

# Embedded Systems Questions and Answers – Processor of Embedded System

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Processor of Embedded System”.

1. Which one of the following offers CPUs as integrated memory or peripheral interfaces?

- a) Microcontroller
- b) Microprocessor
- c) Embedded system
- d) Memory system

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Answer: a

Explanation: Microcontrollers are the CPUs which have integrated memory and peripherals but microprocessor possesses external chips for memory.  
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2. Which of the following offers external chips for memory and peripheral interface circuits?

- a) Microcontroller
- b) Microprocessor
- c) Peripheral system
- d) Embedded system

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Answer: b

Explanation: Microcontrollers are the CPUs which have integrated memory and peripherals whereas microprocessor offers external chips for memory.

3. How many bits does an MC6800 family have?

- a) 16
- b) 32
- c) 4
- d) 8

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Answer: d

Explanation: MC6800 is an 8-bit processor proposed by Motorola.

4. Which of the following is a 4-bit architecture?

- a) MC6800
- b) 8086
- c) 80386
- d) National COP series

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Answer: d

Explanation: National COP series is a 4-bit processor whereas MC6800 is an 8-bit processor, 8086 is a 16-bit processor and 80386 is a 32-bit processor.

5. What is CISC?

- a) Computing instruction set complex
- b) Complex instruction set computing
- c) Complimentary instruction set computing
- d) Complex instruction set complementary

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Answer: b

Explanation: It is complementary to RISC architecture and has complex instruction set compared to RISC architecture.  
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6. How is the protection and security for an embedded system made?

- a) OTP
- b) IPR
- c) Memory disk security
- d) Security chips

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Answer: b

Explanation: Intellectual property right provides security and protection to embedded systems.

7. Which of the following possesses a CISC architecture?

- a) MC68020
- b) ARC
- c) Atmel AVR

d) Blackfin  
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Answer: a

Explanation: MC68020 is having a CISC architecture. CISC architecture is used for code efficiency whereas RISC architecture is used for speeding up the processor. ARC, Atmel AVR, and Blackfin are RISC architectures.

8. Which of the following is a RISC architecture?

- a) 80286
- b) MIPS
- c) Zilog Z80
- d) 80386

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Answer: b

Explanation: MIPS possess a RISC architecture whereas 80386, 80286 and Zilog Z80 are CISC architectures.

9. Which one of the following is board based system?

- a) Data bus
- b) Address bus
- c) VMEbus
- d) DMA bus

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Answer: c

Explanation: VMEbus is Versa Module Europa Bus which is used as a board based system for easy manipulation. VMEbus is a computer bus standard developed for the Motorola MC6800 family and is mainly based on Eurocard sizes.

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10. VME bus stands for

- a) Versa module Europa bus
- b) Versa module embedded bus
- c) Vertical module embedded bus
- d) Vertical module Europa bus

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Answer: a

Explanation: A computer bus standard in Eurocard sizes mainly developed for Motorola MC6800 family and later on used in many applications and approved by IEEE.

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## Embedded Systems Questions and Answers – Memory and Peripherals of Embedded System

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Memory and Peripherals of Embedded System”.

1. It retains its content when power is removed. What type of memory is this?

- a) Volatile memory
- b) Nonvolatile memory
- c) RAM
- d) SRAM

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Answer: b

Explanation: Nonvolatile devices are those which always retains its content even when any abrupt change occurs and nonvolatile memory are a kind of such devices. But RAM is a volatile memory which is primary storage that can only access its data only when the device is powered and SRAM is a type of RAM which is called Static RAM.

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2. Name a volatile memory.

- a) RAM
- b) EPROM
- c) ROM
- d) EEPROM

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Answer: a

Explanation: Volatile memory is those which can access data only when the device is powered.

3. Name a nonvolatile memory.

- a) ROM
- b) RAM
- c) SRAM
- d) DRAM

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Answer: a

Explanation: Non-volatile memory is the one which retains its content even when the power is removed. This is done by an on-chip read only memory (ROM) or an external EPROM. The software that it contains the program which is capable of obtaining the full software from another source within or outside of the system. This initialisation routine is also referred to as a bootstrap program or routine.

4. The initial routine is often referred to as

- a) Initial program
- b) Bootstrap program
- c) Final program
- d) Initial embedded program

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Answer: b

Explanation: ROM contains the program which is capable of obtaining the full software from another source within or outside of the system. This initialisation routine is also referred to as bootstrap program or routine.

5. What kind of socket does an external EPROM to plugged in for prototyping?

- a) Piggyback
- b) Single socket
- c) Multi-socket
- d) Piggyback reset socket

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Answer: a

Explanation: Some controllers use a special package called piggyback socket on the top of the package to allow the EPROM for prototyping.

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6. Which one of the following is UV erasable?

- a) Flash memory
- b) SRAM
- c) EPROM
- d) DRAM

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Answer: c

Explanation: EPROM is an erasable program and it can be erased by ultraviolet radiations. SRAM and DRAM are volatile memories. Flash memory is a volatile memory but it is not UV erasable.

7. What kind of memory does an OTP have?

- a) SRAM
- b) RAM
- c) EPROM
- d) DRAM

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Answer: c

Explanation: OTP is one-time programming so it should possess a nonvolatile memory and EPROM is a nonvolatile memory whereas SRAM, DRAM and RAM are volatile memories.

8. Which type of memory is suitable for low volume production of embedded systems?

- a) ROM
- b) Volatile
- c) Non-volatile
- d) RAM

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Answer: c

Explanation: The devices which use non-volatile memory allow the software to download and return in the device. UV erasable EPROM is favorable but EEPROM is also gaining favor. Therefore, this type of memory is used in low volume production.

9. Which is the single device capable of providing prototyping support for a range of microcontroller?

- a) ROM
- b) Umbrella device
- c) OTP
- d) RAM

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Answer: b

Explanation: Umbrella device is capable of providing prototyping support for a range of microcontrollers.

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10. What type of memory is suitable for high volume production?

- a) RAM
- b) ROM
- c) EPROM
- d) EEPROM

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Answer: b

Explanation: Read Only Memory is suitable for high volume production since it is a nonvolatile memory.

11. What type of memory is suitable for medium volume production?

- a) Umbrella devices
- b) OTP
- c) ROM
- d) RAM

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Answer: b

Explanation: One-time programmable memory is also a nonvolatile memory so it is used for medium volume production.

12. How an embedded system communicate with the outside world?

- a) Peripherals

- b) Memory
  - c) Input
  - d) Output
- [View Answer](#)

Answer: a

Explanation: The system communicates with the outside world through peripherals.

13. How the input terminals are associated with external environments?

- a) Actuators
- b) Sensors
- c) Inputs
- d) Outputs

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Answer: b

Explanation: Sensors measures the physical quantity and convert it into electrical means whereas actuators convert electrical quantity into physical quantity.  
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14. Which of the following are external pins whose logic state can be controlled by the processor to either be a logic zero or logic one is known as

- a) Analogue value
- b) Display values
- c) Binary values
- d) Time derived digital outputs

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Answer: c

Explanation: Binary values possess logic zeros and logic ones.

15. What kind of visual panel is used for seven segmented display?

- a) LED
- b) LCD
- c) Binary output
- d) Analogue output

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Answer: b

Explanation: None.

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# Embedded Systems Questions and Answers – Microcontroller of Embedded System

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Micro-controller of Embedded Systems”.

1. Which one of the following is a microcontroller from Motorola?

- a) MC68HC05
- b) 4004
- c) MIPS
- d) 8080

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Answer: a

Explanation: MC68HC05 is designed by Motorola but 4004 and 8080 are designed by Intel. MIPS is designed by MIPS technology.

2. Which is the first microcontroller?

- a) 8051
- b) Arm
- c) TMS1000
- d) Intel 4004

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Answer: c

Explanation: TMS1000 is the first microcontroller which was done in April 1971 but Intel 4004 was designed in November 1971.

3. How many bits does MC68HC05 possess?

- a) 4
- b) 8
- c) 16
- d) 32

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Answer: b

Explanation: MC68HC05 is a 8 bit controller.

4. What is the bit size of the program counter in MC68HC05?

- a) 7
- b) 9
- c) 13
- d) 17

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Answer: c

Explanation: MC68HC05 have a 13-bit program counter.

5. Which of the following microcontroller is used in engine management system?

- a) MC68HC05
- b) MC68HC11
- c) Intel 80286
- d) Intel 8086

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Answer: b

Explanation: MC68HC11 was originally designed in conjunction with General Motors for use within engine management systems. As a result, its initial versions had built-in EEPROM/OTP ROM, RAM, digital I/O, timers, 8 channel 8 bit A/D converter, PWM generator, and synchronous and asynchronous communications channels (RS232 and SPI).

6. Which is the concatenated register of MC68HC11?

- a) D
- b) X
- c) IP
- d) DI

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Answer: a

Explanation: The MC68HC11 architecture is similar to that of the 6800 and has two 8 bit accumulators referred to as registers A and B. They are concatenated to provide a 16-bit double accumulator called register D.

7. What does CCR stand for?

- a) Condition code register
- b) Computing code register
- c) Complex code register
- d) Code control register

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Answer: a

Explanation: Condition code register is a special register in the MC68HC11.

8. How many bytes of EPROM does MC68HC705A possess?

- a) 176 bytes
- b) 240 bytes
- c) 4144 bytes
- d) 1024 bytes

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Answer: c

Explanation: There are defined memory size for different processors and controllers. The MC68HC705A has 4144 bytes of EPROM.

9. Which of the following is an 8-bit command in MC68HC11?

- a) Add
- b) Shift
- c) Multiply
- d) Subtract

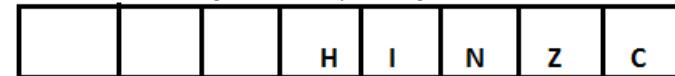
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Answer: c

Explanation: Multiplying two 8 bit requires a 16-bit register.

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10. In the below diagram, identify the register of MC68HC05



- a) CCR
- b) PC
- c) SP
- d) IV

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Answer: a

Explanation: MC68HC05 have different registers such as the accumulator, stack pointer, index register . Condition code register has to carry flag, zero flags, negative flag, interrupt flag, Half carry flag.

11. Which one of the following is an asynchronous communication channel?

- a) SPI
- b) MUDs
- c) MOO
- d) VOIP

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Answer: a

Explanation: MOO, MUDs, and VOIP are apps for the online conference which is synchronous but SPI is an asynchronous communication channel.

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## Embedded Systems Questions and Answers – Microprocessor of Embedded System

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Microprocessor of Embedded System”.

1. Which of the following microprocessor is designed by Zilog?

- a) Z80
- b) Zigbee
- c) 80386
- d) 8087

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Answer: a

Explanation: Designed by Zilog in 1976. 80386 and 8087 are the processors designed by Intel and Zigbee is IEEE based which is used for high-level communication protocol.

2. Z80 is mainly based on

- a) Intel 8080
- b) MIPS
- c) TIMS
- d) 8051

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Answer: a

Explanation: Its architecture is based on Intel 8080 but has an extended instruction set and hardware improvement.

3. Flag register of Z80 is also known as

- a) Program status register
- b) Program status address
- c) Program status word
- d) Program address register

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Answer: c

Explanation: The flag register of Z80 contains status information such as carry, overflow, signed etc.

4. What are the two register sets used in Z80?

- a) C'D' and BC'
- b) CD and BD
- c) IV and MR
- d) Main and alternate

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Answer: d

Explanation: Z80 have two sets of registers which are the main registers and alternate registers.

5. How an alternate set of the register can be identified in Z80?

- a) 'Suffix
- b) 'Prefix
- c) ,suffix
- d) ,prefix

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Answer: a

Explanation: In order to identify the main register and alternate register ‘ is used in the suffix.  
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6. What is the purpose of memory refresh register of Z80?

- a) To control on-chip DRAM
- b) To control on-chip SRAM
- c) To control ROM
- d) To clear cache

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Answer: a

Explanation: In addition to the general purpose registers, a stack pointer, program counter, and two index registers are included in Z80. It was also used in many embedded designs because of its high-quality performance and for its in-built refresh circuitry for DRAMs.

7. What is the clock frequency of Z80?

- a) 6 MHz
- b) 8 MHz
- c) 4 MHz
- d) 2 MHz

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Answer: c

Explanation: It is the maximum clock frequency or runs a time of the processor.

8. Which are the two additional registers of Z80?

- a) Interrupt and NMI
- b) NMI and PSW
- c) Interrupt vector and memory refresh
- d) NMI and memory refresh

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Answer: c

Explanation: The Interrupt vector(IV) register is used in the interrupt handling. Mode 2 is used to point the required software routine to process the interrupt. In mode 1, the interrupt vector is supplied via the external data bus.

9. By which instruction does the switching of registers take place?

- a) Instruction opcodes
- b) AXX instruction
- c) EXX instruction
- d) Register instruction

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Answer: c

Explanation: Only one set of registers can be used at one time and the switching of registers and data transfer is performed by the EXX instruction.  
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10. Which of the following can be a paired set of 16-bit register?

- a) CD
- b) HL
- c) AB
- d) EH

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Answer: b

Explanation: Registers B, C, D, E, H and L are 8-bit general-purpose registers that can be concatenated to produce 16 registers known as BC, DE, and HL.

11. Which signal is used to differentiates the access from a normal memory cycle?

- a) HALT
- b) RESET
- c) MREQ
- d) IORQ

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Answer: d

Explanation: The IORQ signal is used to differentiate the access from a normal memory cycle. These input/output accesses are similar from a hardware perspective to a memory cycle but only occur when an input/output port instruction is executed.

12. What is done in mode1 of Z80?
- a) Interrupt vector is supplied via the external bus
  - b) Interrupt vector is supplied via the peripherals
  - c) NMI gets started
  - d) Interrupt gets acknowledge from peripheral

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Answer: a

Explanation: In mode 1, the interrupt vector is supplied via the external data bus. The memory refresh register is used to control the on-chip DRAM refresh circuitry.

13. What does m1 signal in Z80 describes?

- a) I/O operation status
- b) Memory refresh output
- c) Output pulse on instruction fetch cycle
- d) Interrupt request input

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Answer: c

Explanation: It is a signal which describes output pulse on the instruction fetch cycle. Interrupt request input, input/output operation status, memory refresh output are the other signals in Z80 for various operations.

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# Embedded Systems Questions and Answers – 8 Bit Accumulator Processor of Embedded System

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “8 Bit Accumulator Processor of Embedded System”.

1. Which is the first device which started microprocessor revolution by Intel?

- a) 8080
- b) 8086
- c) 8087
- d) 8088

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Answer: a

Explanation: 8086 was released in 1978 and 8088 was released in 1979 .8087 is a numeric coprocessor which was released in 1977. Furthermore, 8080 is a device designed by Intel in 1974.

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2. Which is the first microprocessor by Motorola?

- a) MC6800
- b) MC68001
- c) MIPS
- d) powerPC

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Answer: a

Explanation: MC6800 is the first microprocessor by Motorola which started a revolution to the embedded systems.

3. Motorola MC6800 is a how many bit processor?

- a) 4
- b) 8
- c) 16
- d) 32

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Answer: b

Explanation: MC6800 is an 8-bit processor and having two 8 bit accumulator registers.

4. How many accumulators does an MC6800 have?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: MC6800 is having 2 accumulators both comprising of 8 bits.

5. How many bits does an accumulator of MC6800 have?

- a) 8
- b) 16
- c) 32
- d) 4

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Answer: a

Explanation: MC6800 possess 8-bit accumulator register since it is an 8-bit processor.

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6. What is the performance of an accumulator?

- a) Storing data and performing logical operation
- b) Storing data and performing arithmetic operation
- c) Storing address
- d) Pointer

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Answer: b

Explanation: Accumulator is used for all the arithmetic operation such as addition, subtraction, multiplication, relational, logical etc. It is also used for storage.

7. Which of the following is the area of memory that is used for storage?

- a) Register
- b) Stack
- c) Accumulator
- d) Memory

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Answer: b

Explanation: Stack can be used at the time of function call or it is a short time large scale storage of data. Therefore, stack is the area within memory for storage.

8. How a stack is accessed?

- a) Stack pointer
- b) Stack address
- c) Stack bus

d) Stack register  
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Answer: a

Explanation: Stack pointer is a special register that indexes into the stack.

9. PUSH-POP mechanism is seen in \_\_\_\_\_

- a) Stack pointer
- b) Register
- c) Memory
- d) Index register

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Answer: a

Explanation: Stack pointer is used to store data like subroutine calls in which a push-pop mechanism is followed. Data is pushed into the stack to store it and popped off to retrieve it.

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10. 8 bits equals \_\_\_\_\_

- a) 128 bytes
- b) 64 bytes
- c) 256 bytes
- d) 32 bytes

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Answer: c

Explanation:  $2^8 = 256$  by which bytes are calculated.

11. What is the address range in 80286?

- a) 1 Mbytes
- b) 2 Mbytes
- c) 16 Mbytes
- d) 32 mbytes

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Answer: c

Explanation: 80286 is a 16 bit processor. So it has an address range of 16 Mbytes.

12. Which is the first 32 bit member of Intel?

- a) 8086
- b) 8088
- c) 80286
- d) 80386

View Answer

Answer: d

Explanation: The new generation of Intel starts with 80386 which have 32 bit registers.

13. What supports multitasking in 80386?

- a) Read mode
- b) External paging memory management unit
- c) Paging and segmentation
- d) On-chip paging memory management unit

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Answer: d

Explanation: Because of the efficient paging mechanism of 80386 in the memory management unit it supports multitasking that is, different tasks can be done at a time, a kind of parallel porting.

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# Embedded Systems Questions and Answers – Architecture of Embedded Systems

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Architecture of Embedded System”.

1. Which one of the following is the successor of 8086 and 8088 processor?

- a) 80286
- b) 80387
- c) 8051
- d) 8087

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Answer: a

Explanation: 80286 is the successor of 8086 and 8088 because it possess a CPU based on 8086 and 8088. 8051 is a microcontroller designed by Intel which is commonly known as Intel MCS-51. 8087 is the first floating point coprocessor of 8086.

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2. Which is the processor behind the IBM PC AT?

- a) 80387
- b) 8088
- c) 80286
- d) 8086

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Answer: c

Explanation: The processor was successful in the PC market and it was a successful processor behind the IBM.

3. Which are the two modes of 80286?

- a) Real mode and protected mode
- b) Mode1 and mode2
- c) Alternate and main
- d) Mode A and mode B

[View Answer](#)

Answer: a

Explanation: It possess two modes which are called real and protected modes. In real modes it adds some additional register in order to access a size greater than 16MB but still preserving its compatibility with 8086 and 8088.

4. Which register set of 80286 form the same register set of 8086 processor?

- a) AH,AL
- b) BX
- c) BX,AX
- d) EL

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Answer: a  
Explanation: The 16 bit register of 80286 can also act as 8 bit register by splitting into a higher register and lower register.

5. Which are the 4 general purposes 16 bit register in Intel 80286?

- a) CS,DS,SS,ES
- b) AX,BX,CX,DX
- c) IP,FL,DI,SI
- d) DI,SI,BP,SP

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Answer: b

Explanation: Intel 80286 possess 4 general purpose registers and these are 16-bit in size. In addition to the general purpose register, there are four segmented registers, two index registers and a base pointer register.

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6. Which are the 4 segmented registers in intel 80286?

- a) AX,BX,CX,DX
- b) AS,BS,CS,DS
- c) SP,DI,SI,BP
- d) IP,FL,SI,DI

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Answer: b

Explanation: Intel 80286 possess 4 general purpose registers, 4 segmented registers, 2 index register and a base pointer register.

7. How is expanded memory accessed in 80286?

- a) Paging
- b) Interleaving
- c) RAM
- d) External storage

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Answer: a

Explanation: The 80286 processor can access beyond 1MB by paging and special hardware to stimulate the missing address lines. This is called expanded memory.

8. When is the register set gets expanded in 80286?

- a) In real mode
- b) In expanded mode
- c) In protected mode
- d) Interrupt mode

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Answer: c

Explanation: In protected mode, two additional register arises which is called index register and base pointer register which helps in expanding the register.

9. Which are the two register available in the protected mode of 80286?

- a) General and segmented
- b) General and pointer
- c) Index and base pointer
- d) Index and segmented

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Answer: c

Explanation: In the protected mode of 80286, two additional register arises which is called index register and base pointer register.

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10. What kind of support does 80286 access in protected mode?

- a) Real mode
- b) Address access
- c) Data access
- d) Virtual memory

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Answer: d

Explanation: In the protected mode of 80286, two additional register arises which is called index register and base pointer register. This allows the 80286 to support virtual memory scheme.

11. Which of the following processor possess memory management?

- a) 8086
- b) 8088
- c) 80286
- d) 8051

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Answer: c

Explanation: Because of the efficient paging mechanism, 80286 is one of the processors which allows the memory management unit. 8086 and 8088 does not

allow paging mechanism. 8051 is a microcontroller which have an in-built memory and does not possess a paging mechanism.

12. What is the size of the address bus in 80286?

- a) 20
- b) 24
- c) 16
- d) 32

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Answer: b

Explanation: The size of the address bus in 80286 is 24 bits and 20 bits in 8088 and 8086.

13. Which is the interrupt vector in 80286 which functions for stack fault?

- a) 11
- b) 12
- c) 14
- d) 16

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Answer: b

Explanation: 12 is the interrupt vector indicating stack fault. It will be different for a different microprocessor.  
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14. Which is the interrupt vector that functions as invalid opcode?

- a) 9
- b) 8
- c) 7
- d) 6

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Answer: d

Explanation: 6 is the interrupt vector indicating invalid opcode. It will be different for a different microprocessor.

15. Which of the following possess the same set of instructions?

- a) 8088 and 80286
- b) 8086 and 80286
- c) 8051 and 8088
- d) 8051 and 8086

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Answer: b

Explanation: 80286 is based on the architecture of 8086. So both the processors have the same set of instructions with slight variations.

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## Embedded Systems Questions and Answers – Coprocessor of Intel

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Coprocessor of Intel”.

1. Which of the following is a coprocessor of 80386?

- a) 80387
- b) 8087
- c) 8089
- d) 8088

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Answer: a

Explanation: 80386 have 80387 as a floating point arithmetic coprocessor which can perform various floating point calculations.

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2. Name the processor which helps in floating point calculations.

- a) microprocessor
- b) microcontroller
- c) coprocessor
- d) controller

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Answer: c

Explanation: The coprocessor can perform signal processing, floating point arithmetics, encryption etc.

3. Which is the coprocessor of 8086?

- a) 8087
- b) 8088
- c) 8086
- d) 8080

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Answer: a

Explanation: 8087 is the coprocessor for both 8086 and 8088. 8089 is also a coprocessor of 8086 and 8088.

4. Which of the following is a coprocessor of Motorola 68000 family?

- a) 68001
- b) 68011
- c) 68881
- d) 68010

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Answer: c

Explanation: The 68881 coprocessor of Motorola provides floating point arithmetics.

5. Which of the following processors can perform exponential, logarithmic and trigonometric functions?

- a) 8086
- b) 8087
- c) 8080
- d) 8088

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Answer: b

Explanation: 8087 is a coprocessor which can perform all the mathematical functions including addition, subtraction, multiplication, division, exponential, logarithmic, trigonometric etc. 8086, 8080 and 8088 are microprocessors which require the help of a coprocessor for floating point arithmetic.

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6. How many stack register does an 8087 have?

- a) 4
- b) 8
- c) 16
- d) 32

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Answer: b  
Explanation: The 8087 coprocessor does not have a main register set but they have an 8-level deep stack register from st0 to st7.

7. Which of the following processor can handle infinity values?

- a) 8080
- b) 8086
- c) 8087
- d) 8088

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Answer: c

Explanation: 8087 is a coprocessor which can handle infinity values with two types of closure known as affine closure and projective closure.

8. Which coprocessor supports affine closure?

- a) 80187
- b) 80287
- c) 80387
- d) 8088

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Answer: b

Explanation: 80287 uses an affine closure for infinity values whereas 80387 and 80187 support projective closure for infinity values.

9. Which one is the floating point coprocessor of 80286?

- a) 8087
- b) 80187
- c) 80287
- d) 80387

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Answer: c

Explanation: 80286 supports 80287 as its floating point coprocessor which helps in floating point calculations.

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10. How many pins does 8087 have?

- a) 40 pin DIP
- b) 20 pin DIP
- c) 40 pins
- d) 20 pins

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Answer: a

Explanation: All 8087 models have a 40 pin DIP which is operated in 5V.

11. What is the clock frequency of 8087?

- a) 10 MHz
- b) 5 MHz
- c) 6 MHz
- d) 4 MHz

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Answer: b

Explanation: 8087 have 5 MHz as its clock frequency because the coprocessor must have the same clock frequency as that of the main processor.

12. How are negative numbers stored in a coprocessor?

- a) 1's complement
- b) 2's complement
- c) decimal
- d) gray

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Answer: b

Explanation: In a coprocessor, negative numbers are stored in 2's complement with its leftmost sign bit of 1 whereas positive numbers are stored in the form of true value with its leftmost sign bit of 0.

13. How many bits are used for storing signed integers?

- a) 2
- b) 4
- c) 8
- d) 16

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Answer: d

Explanation: Signed integers in a coprocessor are stored as a 16-bit word, 32-bit double word or 64-bit quadword.

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14. Which of the processor has an internal coprocessor?

- a) 8087
- b) 80287
- c) 80387
- d) 80486DX

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Answer: d

Explanation: 8087 is an external IC designed to operate with the 8088/8086 processor but 80486DX is an on-chip coprocessor that is, it does not require an extra integrated chip for floating point arithmetics.

15. What are the two major sections in a coprocessor?

- a) control unit and numeric control unit
- b) integer unit and control unit
- c) floating point unit and coprocessor unit
- d) coprocessor unit and numeric control unit

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Answer: a

Explanation: Control unit interfaces the coprocessor with its main microprocessor whereas numeric control unit can execute the coprocessor instructions.

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## Embedded Systems Questions and Answers – Features of Intel

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Features of Intel”.

1. What are the three stages included in pipelining of 80386?

- a) Fetch, decode, execute
- b) Fetch, execute, decode
- c) Execute, fetch, decode

d) Decode, execute, fetch

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Answer: a

Explanation: The instruction can execute in a single cycle which is done by pipelining the instruction flow. The address calculations are performed as the instruction proceeds down the line. Pipelining may take several cycles, an instruction can potentially be started and completed on every clock edge, thus achieving the single cycle performance.

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2. How instructions and data are accessed to pipeline stages of 80486 processor?

- a) Through internal unified cache
- b) Through external unified cache
- c) Through external cache
- d) Through multiple caches

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Answer: a

Explanation: In order to have instruction and data to the pipeline, the 80486 has an internal unified cache to contain both data and instructions. This helps in the independency of the processor on external memory.

3. Which of the following processor possesses a similar instruction of 80486?

- a) 8086
- b) 80286
- c) 80386
- d) 8080

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Answer: c

Explanation: The instruction set is same as that of 80386 but there are some additional instructions available when the processor is in protected mode.

4. What are the two external interrupt signals in 80386?

- a) IV and NMI
- b) NMI and INTR
- c) INTR and IV
- d) PC and NMI

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Answer: b

Explanation: The 80386 has two external interrupt signals which allow external devices to interrupt the processor. The INTR input creates a maskable interrupt while the NMI creates a non-maskable interrupt.

5. How many bit vector number is used in an interrupt cycle of 80386?

- a) 4
- b) 8
- c) 16
- d) 32

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Answer: b

Explanation: While an interrupt cycle is running, the processor possesses two interrupts to acknowledge bus cycles and reads an 8-bit vector number. This vector is then used to locate, within the vector table and it has the address of the corresponding interrupt service routine. NMI is automatically assigned as vector number 2.

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6. In how many modes does 80386 can run?

- a) 2
- b) 4
- c) 3
- d) 5

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Answer: c

Explanation: The 80386 can run in three different modes: the real mode, the protected mode, and a virtual mode. In real mode, the size of each segment is limited to 64 Kbytes and in protected mode, the largest segment size is increased to 4 Gbytes and the virtual mode is a special version of the protected mode.

7. How many bit flag register does 80386 have?

- a) 8
- b) 16
- c) 32
- d) 64

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Answer: c

Explanation: The 32-bit flag register possesses the normal carry zero, auxiliary carry, parity, sign and overflow flags.

8. Which processor is the derivative of 80386DX?

- a) 80387

- b) 80386SX
  - c) 80386 DDX
  - d) 8087
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Answer: b

Explanation: Derivative of the 80386DX called the 80386SX which provides the same architecture and lowers cost. To minimal the cost value, it uses an external 16-bit data bus and a 24-bit memory bus.

9. Which of the following is a portable device of Intel?

- a) 80386DX
- b) 8087
- c) 80386SL
- d) 80386SX

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Answer: c

Explanation: Intel has 80386SL as the portable PCs which helps in controlling power and increases the power efficiency of the processor.  
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10. Which of the processor has a 5 stage pipeline?

- a) 80386
- b) 80486
- c) 80286
- d) 80386DX

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Answer: b

Explanation: 80486 have a five stage pipeline ALU. These include fetch, decode, execute, memory access and write back. This helps in accessing instruction faster and thus makes the processor faster. 80386DX have a three-stage pipelining which only includes fetch, decode and execute.

11. Which of the following processor can execute two instructions per cycle?

- a) 80486
- b) 80386DX
- c) Intel Pentium
- d) 80386

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Answer: c

Explanation: Intel Pentium have many advanced features one of which is, it can execute two instructions per cycle thus improving the speed of the processor whereas 80486, 80386 and 80386DX does not have this feature.

12. Which of the following processors have two five-stage pipelines?

- a) 80486
- b) 80386
- c) Intel Pentium
- d) 80386DX

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Answer: c

Explanation: The intel Pentium possess two five-stage pipelines which allow the execution of two integer instruction jointly.

13. In which processor does the control register and system management mode register first appeared?

- a) 80386
- b) 80386SL
- c) 80386DX
- d) 80486

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Answer: b

Explanation: The control register and system management mode register has first appeared in 80386SL and later on succeeded by other processors. These registers can provide intelligent power control.

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14. Which is the next successor of Intel Pentium?

- a) Pentium pro
- b) P1
- c) P2
- d) P5

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Answer: a

Explanation: Intel Pentium is succeeded by Pentium pro. P1, P2, and P5 are the other processors of Intel.

15. Which of the following processor allows a multiple branch prediction?

- a) 80386
- b) P1

- c) Intel Pentium
- d) Intel Pentium pro

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Answer: d

Explanation: A branch instruction can change the program flow and multiple branch prediction allows the continuous execution of instructions based on assumptions. This can eliminate delay and thus speeds up the execution.

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## Embedded Systems Questions and Answers – RISC Processor

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “RISC Processor”.

1. Which are the processors based on RISC?

- a) SPARC
- b) 80386
- c) MC68030
- d) MC68020

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Answer: a

Explanation: SPARC and MIPS processors are the first generation processors of RISC architecture.

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2. What is 80/20 rule?

- a) 80% instruction is generated and 20% instruction is executed
- b) 80% instruction is executed and 20% instruction is generated
- c) 80%instruction is executed and 20% instruction is not executed
- d) 80% instruction is generated and 20% instructions are not generated

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Answer: a

Explanation: 80% of instructions are generated and only 20% of the instruction set is executed that is, by simplifying the instructions, the performance of the processor can be increased which lead to the formation of RISC that is reduced instruction set computing.

3. Which of the architecture is more complex?

- a) SPARC
- b) MC68030
- c) MC68030
- d) 8086

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Answer: a

Explanation: SPARC have RISC architecture which has a simple instruction set but MC68020, MC68030, 8086 have CISC architecture which is more complex than CISC.

4. Which is the first company who defined RISC architecture?

- a) Intel
- b) IBM
- c) Motorola
- d) MIPS

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Answer: b

Explanation: In 1970s IBM identified RISC architecture.

5. Which of the following processors execute its instruction in a single cycle?

- a) 8086
- b) 8088
- c) 8087
- d) MIPS R2000

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Answer: d

Explanation: MIPS R2000 possess RISC architecture in which the processor executes its instruction in a single clock cycle and also synthesize complex operations from the same reduced instruction set.

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6. How is memory accessed in RISC architecture?

- a) load and store instruction
- b) opcode instruction
- c) memory instruction
- d) bus instruction

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Answer: a

Explanation: The data of memory address is loaded into a register and manipulated, its contents are written out to the main memory.

7. Which of the following has a Harvard architecture?

- a) EDSAC
- b) SSEM
- c) PIC
- d) CSIRAC

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Answer: c

Explanation: PIC follows Harvard architecture in which the external bus architecture consist of separate buses for instruction and data whereas SSEM, EDSAC, CSIRAC are stored program architecture.

8. Which of the following statements are true for von Neumann architecture?

- a) shared bus between the program memory and data memory
- b) separate bus between the program memory and data memory
- c) external bus for program memory and data memory
- d) external bus for data memory only

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Answer: a

Explanation: von Neumann architecture shares bus between program memory and data memory whereas Harvard architecture have a separate bus for program memory and data memory.

9. What is CAM stands for?

- a) content-addressable memory
- b) complex addressable memory
- c) computing addressable memory
- d) concurrently addressable memory

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Answer: a

Explanation: Non-von Neumann architecture is based on content-addressable memory.  
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10. Which of the following processors uses Harvard architecture?

- a) TEXAS TMS320
- b) 80386
- c) 80286
- d) 8086

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Answer: a

Explanation: It is a digital signal processor which have small and highly optimized audio or video processing signals. It possesses multiple parallel data bus.

11. Which company further developed the study of RISC architecture?

- a) Intel
- b) Motorola
- c) university of Berkeley
- d) MIPS

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Answer: c

Explanation: The University of Berkeley and Stanford university provides the basic architecture model of RISC.

12. Princeton architecture is also known as

- a) von Neumann architecture
- b) Harvard
- c) RISC
- d) CISC

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Answer: a

Explanation: The von Neumann architecture is also known as von Neumann model or Princeton architecture.

13. Who coined the term RISC?

- a) David Patterson
- b) von Neumann
- c) Michael J Flynn
- d) Harvard

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Answer: a

Explanation: David Patterson of Berkeley university coined the term RISC whereas Michael J Flynn who first views RISC.  
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14. Which of the following is an 8-bit RISC Harvard architecture?

- a) AVR
- b) Zilog80
- c) 8051
- d) Motorola 6800

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Answer: a

Explanation: AVR is an 8-bit RISC architecture developed by Atmel. Zilog80, 8051, Motorola 6800 are having CISC architectures.

15. Which of the following processors has CISC architecture?

- a) AVR
- b) Atmel
- c) Blackfin
- d) Zilog Z80

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Answer: d

Explanation: Zilog80 have CISC architecture whereas AVR, Atmel and blackfin possess RISC architecture.

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# **Embedded Systems Questions and Answers – Examples of Embedded System Digital Signal Processing**

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This set of Embedded Systems Interview Questions and Answers focuses on “Examples of Embedded System Digital Signal Processing”.

1. What are the factors of filters which are determined by the speed of the operation in a digital signal processor?

- a) attenuation constant
- b) frequency
- c) bandwidth
- d) phase

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Answer: c

Explanation: The bandwidth of any filter depends on the speed of operations held in a digital signal processor.

2. How many tables does an FIR function of a digital signal processor possess?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: Digital signal processor function involves setting up of two tables and one is for sampled data and the other table is for filter coefficients which determine the filter response. It takes values from the table and performs programs.

3. Why is said that branch prediction is not applicable in a digital signal processor?

- a) low bandwidth
- b) high bandwidth
- c) low frequency
- d) high frequency

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Answer: a

Explanation: Loop control timing varies depending on the branch predictions which in turn make bandwidth predictions difficult thereby lowering the bandwidth of the digital signal processor.

4. Which architecture can one overcome the low bandwidth issue in MC6800 family?

- a) RISC

- b) CISC
  - c) von Neumann
  - d) program stored
- [View Answer](#)

Answer: a

Explanation: RISC architecture can offer some improvement in the low bandwidth issue since it has the ability to perform operations in a single cycle.

5. Which architecture in digital signal processor reduces the execution time?

- a) Harvard
- b) CISC
- c) program storage
- d) von Neumann

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Answer: a

Explanation: Harvard architecture in a digital signal processor allows continuous data fetching and performing the corresponding instructions.  
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6. Which of the following processors also can work as a digital signal processor?

- a) 8086
- b) 8088
- c) 8080
- d) ARM9E

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Answer: d

Explanation: ARM9E can also have DSP level of performance without having a digital signal processor by its enhanced DSP instructions.

7. What types of modules are used in the digital signal processor to form the loop structure?

- a) modulo-timer
- b) modulo-counter
- c) timer
- d) external timer

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Answer: b

Explanation: By using hardware multipliers, counters etc the entire hardware can be redesigned to perform some specific functions which are used in digital signal processors. One such is the modulo-counter to form the loop structure.

8. Name a processor which is used in digital audio appliances.

- a) 8086
- b) Motorola DSP56000
- c) 80486
- d) 8087

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Answer: b

Explanation: Motorola DSP56000 is a powerful digital signal processor which is used in digital audio applications which have the capability of noise reduction and multi-band graphics whereas 8087 is a coprocessor and 80486 and 8086 are microprocessors.

9. How many bits does DSP56000 processor have?

- a) 8
- b) 16
- c) 24
- d) 32

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Answer: c

Explanation: In order to increase the resolution, DSP56000 is a 24-bit data word processor.

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10. How many buses did DSP56000 possess?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: b

Explanation: It possess three separate external buses, one is for the program and the remaining two buses are for X and Y memories for data.

11. Which of the following architecture does DSP56000 possess?

- a) Harvard
- b) von Neumann
- c) CISC

d) program-stored  
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Answer: a

Explanation: DSP56000 possess Harvard architecture since this architecture has a separate bus for program memory and data memory.

12. What does AAU stand for?

- a) arithmetic address unit
- b) address arithmetic unit
- c) address access unit
- d) arithmetic access unit

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Answer: b

Explanation: DSP56000 possess two external bus switches in which one is for data and the other is for the address for communicating with the outside world and these two switches are reproduced by the internal data bus and AAU.

13. How many address register does the AAU of a DSP56000 have?

- a) 8
- b) 16
- c) 24
- d) 32

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Answer: c

Explanation: AAU have 24 address registers in three banks of eight.

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14. How many registers does a DSP56000 have?

- a) 4
- b) 5
- c) 7
- d) 6

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Answer: c

Explanation: DSP56000 has six 24-bit registers for controlling the loop counts, operating mode, stack manipulation and condition codes.

15. Which of the following bits are used for sign extension in DSP56000?

- a) upper 8 bits of the stack pointer
- b) lower 8 bits of the stack pointer
- c) lower 8 bits of the program counter
- d) upper 8 bits of the program counter

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Answer: d

Explanation: The DSP56000 have a 24-bit program counter in which the upper 8 bits are only used for sign extension.

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## Embedded Systems Questions and Answers – The Berkeley RISC Model and Digital Signal Processing

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “The Berkeley RISC Model and Digital Signal Processing”.

1. How many bit register set does RISC 1 model used?

- a) 138\*24
- b) 138\*32
- c) 69\*16
- d) 69\*32

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Answer: b

Explanation: RISC 1 model is developed in the 1970s and uses a large register set of 138\*32 bit. These are arranged in eight overlapping windows which have 24 registers each and these windows are split so that six registers can be used during function calls.

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2. Which of the following processor commercializes the Berkeley RISC model?

- a) SPARC
- b) Stanford
- c) RISC-1
- d) RISC

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Answer: a

Explanation: The Berkeley RISC design was developed between the year 1980 and 1984 and later on the RISC design were commercialized as SPARC processor.

3. How many transistors does RISC 1 possess?

- a) 44000
- b) 45000
- c) 44500
- d) 45500

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Answer: c

Explanation: The final design of the RISC concept is called the RISC 1 which was published by ACM ISCA. It possesses 44500 transistors which can implement 31 instruction.

4. How many registers does RISC 1 model have?

- a) 68
- b) 58
- c) 78
- d) 88

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Answer: c

Explanation: The RISC 1 model have 78 registers of size 32 bits.

5. Which of the architectures are made to speed up the processor?

- a) CISC
- b) RISC
- c) program stored
- d) von Neumann

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Answer: b

Explanation: RISC architecture is made for speeding up the processor with limited execution time whereas CISC architecture is mainly for code efficiency.

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6. How did 8086 pass its control to 8087?

- a) BUSY instruction
- b) ESCAPE instruction
- c) CONTROL instruction
- d) fetch 8087

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Answer: b

Explanation: When 8086 comes across any floating point arithmetic operations, it executes ESCAPE instruction code in order to pass the control of bus and instruction op-code to 8087.

7. Which of the following processor supports MMX instructions?

- a) 8080
- b) 80486
- c) Intel Pentium
- d) 80386

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Answer: c

Explanation: MMX instructions or multimedia extensions were introduced in Pentium processors to provide support for multimedia software running on a PC.

8. Which of the following processors has a speculative execution?

- a) 80486
- b) P1
- c) Intel Pentium
- d) Pentium pro

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Answer: d

Explanation: Speculative execution is executed speculatively that is, following the predicted branch paths in the code until the true path is determined. If the processor executes correctly, then the performance is gained, if not, the results are discarded and the processor continues to execute until the correct path is identified.

9. How many bit accumulator does DSP56000 have?

- a) 28
- b) 56
- c) 112
- d) 14

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Answer: b

Explanation: The ALU of DSP56000 have two 56-bit accumulator A and B each of which have a small register with it.

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10. How many additional registers does DSP56000 have?

- a) 2
- b) 4
- c) 6
- d) 8

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Answer: b

Explanation: In addition to the six registers of DSP56000, it has four 24-bit registers X1, X0, Y1, Y0 which can be concatenated to form 48 bit register X and Y.

11. What does MAC instruction of DSP56000 stand for?

- a) multiply accumulator
- b) multiple access
- c) multiple accounting
- d) multiply accumulator counter

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Answer: a

Explanation: When MAC instruction is executed, the two of the 24-bit additional registers are multiplied together and then added or subtracted from A and B. It takes place in a single machine cycle of 75ns at 27MHz.

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# Embedded Systems Questions and Answers – The Sun SPARC RISC Model

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “The Sun SPARC RISC Model”.

1. What does SPARC stand for?  
a) scalable processor architecture  
b) speculating architecture  
c) speculating processor  
d) scaling Pentium architecture

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Answer: a

Explanation: SPARC was designed for optimizing compilers and easily pipelined hardware implementations and it can license by anyone that is, having a nonproprietary architecture which is used to develop various microprocessors.

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2. How many bits does SPARC have?  
a) 8  
b) 16  
c) 32  
d) 64

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Answer: c

Explanation: It is a 32 bit RISC architecture having 32-bit wide register bank.

3. Which company developed SPARC?  
a) intel  
b) IBM  
c) Motorola  
d) sun microsystem

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Answer: d

Explanation: SPARC is developed by Sun Microsystem but different manufacturers from other companies like Intel, Texas worked on it.

4. What improves the context switching and parameter passing?

- a) register windowing
- b) large register
- c) stack register
- d) program counter

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Answer: a

Explanation: SPARC follows Berkeley architecture model and uses register windowing in order to improve the context switching and parameter passing. It also supports superscalar operations.

5. How many external interrupts does SPARC processor support?

- a) 5
- b) 10
- c) 15
- d) 20

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Answer: c

Explanation: SPARC processor provides 15 external interrupts which are generated by the interrupt lines IRL0-IRL3.  
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6. Which level is an in-built nonmaskable interrupt in SPARC processor?

- a) 15
- b) 14
- c) 13
- d) 12

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Answer: a

Explanation: The level 15 of the SPARC processor is assigned to be a nonmaskable interrupt and the remaining 14 levels are unmasks and if necessary they can be made maskable.

7. How many instructions does SPARC processor have?

- a) 16
- b) 32
- c) 64
- d) 128

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Answer: c

Explanation: The instruction set of SPARC processor have 64 instructions which can be accessed by load and store operation with a RISC architecture.

8. What is generated by an external interrupt in SPARC?

- a) internal trap
- b) external trap
- c) memory trap
- d) interfaced trap

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Answer: a

Explanation: In SPARC when an external interrupt is generated, an internal trap is created in the trap base register in which the current and next instructions are saved, the pipeline gets flushed and the processor turns into a supervisor mode.

9. When an external interrupt is generated, what type of mode does the processor supports?

- a) real mode
- b) virtual mode
- c) protected mode
- d) supervisor mode

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Answer: d

Explanation: In SPARC when an external interrupt is called, it creates an internal trap in which the current and next instructions get saved and mode of the processor switches to supervisor mode.

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10. Where is trap vector table located in SPARC processor?

- a) program counter
- b) Y register
- c) status register
- d) trap base register

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Answer: d

Explanation: The trap vector table is located in the trap base register which supplies the address of the service routine. When it is completed REIT instructions are executed.

11. How many bits does SPARC-V9 processor have?

- a) 16
- b) 32
- c) 64
- d) 128

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Answer: c

Explanation: There are three major versions of SPARC which are SPARC-V7, SPARC-V8 and SPARC-V9. The former two are 32 bits processor and the later is a 64-bit processor.

12. What are the three modules in the SPARC processor?

- a) IU, FPU, CU
- b) SP, DI, SI
- c) AX, BX, CX
- d) CU, CH, CL

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Answer: a

Explanation: The SPARC processor has three modules which are Integer unit, Floating point unit, and coprocessor unit. Each module has its own functions and integer unit controls the overall operation of the processor.

13. How many floating point register does the FPU of the SPARC have?

- a) 16 128-bit
- b) 32 128-bit
- c) 64 128-bit
- d) 10 128-bit

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Answer: a

Explanation: It possesses 32 32-bit single precision, 32 64-bit double precision and 16 128-bit quads precise floating registers.

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14. Which module of SPARC contains the general purpose registers?

- a) IU
- b) FPU
- c) CU
- d) control unit

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Answer: a

Explanation: Integer unit contains the general purpose registers and it controls the overall operation and performance of the processor and the memory address is also calculated by the integer unit.

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## Embedded Systems Questions and Answers – Types of Processors

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Types of Processors”.

1. What shows the brightness of the pixel in a digital signal processor?

- a) luminance
- b) transparent
- c) chrominance
- d) opaque

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Answer: a

Explanation: The color image of a digital signal processor have multiple channels. The brightness of the pixel is determined by luminance and the color of the pixel is determined by chrominance.

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2. What is the color format of chrominance in a digital signal processor?

- a) VGBA
- b) VIBGYOR
- c) White
- d) RGBA

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Answer: d

Explanation: RGBA colors have four channels red, green, blue, and alpha, which is transparent.

3. Which of the following processor are designed to perform calculations in graphics rendering?

- a) GPU
- b) digital signal processor
- c) microprocessor
- d) microcontroller

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Answer: a

Explanation: Graphics processing unit is designed to perform calculations in graphics rendering. Intel, NVIDIA, and AMD are dominant providers of GPU.

4. Which of the processor is a good match for applications such as video games?

- a) GPU
- b) VLIW
- c) Coprocessor
- d) Microcontroller

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Answer: a

Explanation: GPU is a graphics processing unit. Therefore, more graphical images can be created by GPU which is necessary for video games. Therefore, GPU is a good match for video games.

5. Which of the following statement is true for concurrency?

- a) different parts of the program executes physically
- b) different parts of the program executes sequentially
- c) different parts of the program executes conceptually
- d) different parts of the program executes sequentially and physically

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Answer: c

Explanation: A concurrent program executes different parts of the program conceptually, a parallel program executes different programs physically and a non-concurrent program executes the program in sequential order.

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6. Which is an imperative language?

- a) C program
- b) SQL
- c) XQuery
- d) Concurrent model of HDL

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Answer: a

Explanation: Imperative language is one which executes the program in sequential order. C program is an example of imperative language, SQL and XQuery are examples of declarative languages or non-imperative language. Concurrent model in HDL is a hardware description language which executes the program concurrently.

7. Which of the following instructions supports parallel execution?

- a) VLIW
- b) TTA
- c) ALU operation
- d) Test-and-set instructions

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Answer: a

Explanation: VLIW is a very long instruction word which receives many instructions and is executed in one instructed word. VLIW is majorly designed for instruction-level parallel (ILP) that is, it can execute codes concurrently or parallel in some time. TTA is a transport triggered architecture which is a type of CPU design which programs controlling the internal buses of the processor. Test-and-set is used to write to a memory location and return its old values. ALU used to perform arithmetic and logic operations.

8. Who invented VLIW architecture?

- a) Josh Fisher
- b) John Ellis
- c) John Ruttenberg
- d) John O'Donnell

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Answer: a

Explanation: Josh Fisher from Yale Universities invented the concept of VLIW architecture. John Ellis described the VLIW compiler. John Ruttenberg develops some important algorithms in scheduling.

9. What is ILP?

- a) instruction-level parallelism
- b) instruction-level panel
- c) instruction-language panel
- d) inter-language parallelism

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Answer: a

Explanation: A processor which supports instruction-level parallelism can perform multiple independent operations in every instruction cycle. Basically, there are four types of instructions. These are CISC instructions, subword parallelism, superscalar, and VLIW.

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10. Which ILP supports the ALU division?

- a) Subword parallelism
- b) CISC
- c) Superscalar
- d) VLIW

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Answer: a

Explanation: In subword parallelism, the wide ALU is divided into smaller slices which enable simultaneous arithmetic and logical operations.

11. Which is a vector processor?

- a) Subword parallelism
- b) CISC
- c) Superscalar
- d) VLIW

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Answer: a

Explanation: Subword parallelism is a form of a vector processing. A vector processor is the one whose instruction set includes operations on multiple data elements simultaneously.

12. Which of the following architecture supports out-of-order execution?

- a) RISC
- b) CISC
- c) Superscalar
- d) Subword parallelism

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Answer: c

Explanation: Superscalar architecture support out-of-order execution in which the instructions later in the stream are executed before earlier instructions.

13. Which is an example of superscalar architecture?

- a) Pentium 4
- b) 8086
- c) 80386
- d) Pentium pro

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Answer: a

Explanation: Pentium 4 is a single core CPU used in desktops, laptops which are proposed by Intel. It has Netburst architecture.  
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14. Which of the following is a combination of several processors on a single chip?

- a) Multicore architecture
- b) RISC architecture
- c) CISC architecture
- d) Subword parallelism

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Answer: a

Explanation: The Multicore machine is a combination of many processors on a single chip. The heterogeneous multicore machine also combines a variety of processor types on a single chip.

15. Which is an example of the multi-core processor which possesses 10 cores?

- a) Intel Xeon E7-2850
- b) AMD Phenom IIx2
- c) Intel core duo
- d) AMD Phenom IIx3

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Answer: a

Explanation: Intel Xeon E7-2850 have ten cores whereas AMD Phenom IIx2 and Intel core duo has two cores and AMD Phenom IIx3 has three cores.

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# Embedded Systems Questions and Answers – Memory Technology of Embedded Systems

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This set of Embedded Systems Assessment Questions and Answers focuses on “Memory Technology of Embedded Systems”.

1. Which is the most basic non-volatile memory?

- a) Flash memory
- b) PROM
- c) EPROM
- d) ROM

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Answer: d

Explanation: The basic non-volatile memory is ROM or mask ROM, and the content of ROM is fixed in the chip which is useful in firmware programs for booting up the system.

2. Who has invented flash memory?

- a) Dr.Fujio Masuoka
- b) John Ellis
- c) Josh Fisher
- d) John Ruttenberg

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Answer: a

Explanation: Flash memory is invented by Dr. Fujio Masuoka at Toshiba in the 1980s which are non-volatile memory.

3. Which of the following is serial access memory?

- a) RAM
- b) Flash memory
- c) Shifters
- d) ROM

[View Answer](#)

Answer: c

Explanation: The memory arrays are basically divided into three which are random access memory, serial access memory, and content address memory. Serial access memory is divided into two, theses are shifters and queues.

4. Which is the early form of non-volatile memory?

- a) magnetic core memory
- b) ferrimagnetic memory
- c) anti-magnetic memory
- d) anti-ferromagnetic

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Answer: a

Explanation: The early form of non-volatile memory is known as magnetic core memory in which the ferromagnetic ring was magnetised to store data.

5. Which of the following memories has more speed in accessing data?

- a) SRAM
- b) DRAM
- c) EPROM
- d) EEPROM

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Answer: a

Explanation: SRAM have more speed than DRAM because it has 4 to 6 transistors arranged as flip-flop logic gates, that is it can be flipped from one binary state to another but DRAM has a small capacitor as its storage element.

6. In which memory, the signals are multiplexed?

- a) DRAM
- b) SRAM
- c) EPROM
- d) EEPROM

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Answer: a

Explanation: The signals in address bus are multiplexed with DRAM non-multiplexed with SRAM.

7. How many main signals are used with memory chips?

- a) 2
- b) 4
- c) 6
- d) 8

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Answer: b

Explanation: The main signals associated with memory chips are four. These are the signals associated with address bus, data bus, chip select signals, and control signals for read and write operations.

8. What is the purpose of the address bus?

- a) to provide data to and from the chip
- b) to select a specified chip
- c) to select a location within the memory chip
- d) to select a read/write cycle

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Answer: c

Explanation: Address bus is used to choose a particular location in the memory chip. Data bus is used to provide data to and from the chip. Chip select signals are used to select a particular chip within the memory.

9. Which are the two main types of processor connection to the motherboard?

- a) sockets and slots
- b) sockets and pins
- c) slots and pins
- d) pins and ports

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Answer: a

Explanation: The type of processor which connects to a socket on the bottom surface of the chip that connects to the motherboard by Zero Insertion Force Socket. Intel 486 is an example of this type of connection. The processor slot is one which is soldered into a card, which connects to a motherboard by a slot. Example for slot connection is Pentium 3.

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10. Which of the following has programmable hardware?

- a) microcontroller
- b) microprocessor
- c) coprocessor
- d) FPGA

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Answer: d

Explanation: Field programmable gate arrays are a type of multi-core architecture whose hardware function can be programmed by using hardware design tools.

11. Who invented TriMedia processor?

- a) Intel
- b) IBM
- c) Apple
- d) NXP Semiconductor

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Answer: d

Explanation: TriMedia is a VLIW processor from NXP Semiconductor in the Netherlands. It possesses a Harvard architecture CPU for video and audio applications.

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# Embedded Systems Questions and Answers – SRAM

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “SRAM”.

1. Why is SRAM more preferably in non-volatile memory?

- a) low-cost
- b) high-cost
- c) low power consumption
- d) transistor as a storage element

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Answer: c

Explanation: SRAM will retain data as long it is powered up and it does not need to be refreshed as DRAM. It is designed for low power consumption and used in preference. DRAM is cheaper than SRAM but it is based on refresh circuitry as it loses charge since the capacitor is the storage element.

2. Which of the following has refresh control mechanism?

- a) DRAM
- b) SRAM
- c) Battery backed-up SRAM
- d) Pseudo-static RAM

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Answer: d

Explanation: Pseudo RAM uses DRAM cells because of its higher memory density and it has refresh control which is an additional function of DRAM and is suitable for low power consumption. It has both the advantages of SRAM and DRAM.

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3. Which storage element is used by MAC and IBM PC?

- a) CMOS
- b) Transistor
- c) Capacitor
- d) Inductor

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Answer: a

Explanation: CMOS is complementary metal oxide semiconductor which is used by MAC and IBM PC as storage element because it contains configuration data of SRAM and is battery back-up to ensure that it is powered up when the computer is switched off.

4. Which type of storage element of SRAM is very fast in accessing data but consumes lots of power?

- a) TTL
- b) CMOS
- c) NAND
- d) NOR

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Answer: a

Explanation: TTL or transistor-transistor logic which is a type of bipolar junction transistor access data very fast but consumes lots of power whereas CMOS

is used in low power consumption.

5. What is approximate data access time of SRAM?

- a) 4ns
- b) 10ns
- c) 2ns
- d) 60ns

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Answer: a

Explanation: SRAM access data in approximately 4ns because of its flip-flop arrangement of transistors whereas the data access time in DRAM is approximately 60ns since it has a single capacitor for one-bit storage.

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6. Who proposed the miniature card format?

- a) Intel
- b) IBM
- c) MIPS
- d) Apple

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Answer: a

Explanation: Miniature Card is an SRAM memory card proposed by Intel in the 1980s but it was no longer manufactured.

7. How many MOSFETs are required for SRAM?

- a) 2
- b) 4
- c) 6
- d) 8

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Answer: c

Explanation: Six MOSFETs are required for a typical SRAM. Each bit of SRAM is stored in four transistors which form two cross-coupled inverters.

8. Which of the following is an SRAM?

- a) 1T-RAM
- b) PROM
- c) EEPROM
- d) EPROM

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Answer: a

Explanation: 1T-RAM is a pseudo-static RAM which is developed by MoSyS, Inc. PROM, EPROM, and EEPROM are non-volatile memories.

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9. Which of the following can access data even when the power supply is lost?

- a) Non-volatile SRAM
- b) DRAM
- c) SRAM
- d) RAM

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Answer: a

Explanation: Random Access Memory is the primary storage which can access data only when it is powered up. But non-volatile SRAM can access data even when the power supply is lost. It is used in many applications like networking, aerospace etc.

10. Which of the following can easily convert to a non-volatile memory?

- a) SRAM
- b) DRAM
- c) DDR SRAM
- d) Asynchronous DRAM

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Answer: a

Explanation: The low power consumption makes SRAM easily convertible to non-volatile memory, by adding a small battery it can retain its data even when the main power is lost.

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## Embedded Systems Questions and Answers – DRAM

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “DRAM”.

1. Which memory storage is widely used in PCs and Embedded Systems?

- a) SRAM
- b) DRAM
- c) Flash memory
- d) EEPROM

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Answer: b

Explanation: DRAM is used in PCs and Embedded systems because of its low cost. SRAM, flash memory and EEPROM are more costly than DRAM.

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2. Which of the following memory technology is highly denser?

- a) DRAM
- b) SRAM
- c) EPROM
- d) Flash memory

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Answer: a

Explanation: DRAM is highly denser and cheaper because it only uses a single capacitor for storing one bit.

3. Which is the storage element in DRAM?

- a) inductor
- b) capacitor
- c) resistor
- d) mosfet

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Answer: b

Explanation: DRAM uses a small capacitor whose voltage represents a binary zero which is used as a storage element in DRAM in which a single transistor cell is used to store each bit of data.

4. Which one of the following is a storage element in SRAM?

- a) capacitor

- b) inductor
  - c) transistor
  - d) resistor
- [View Answer](#)

Answer: c

Explanation: Four to six transistors are used to store a single bit of data and form a flip-flop logic gate and thus SRAM is faster in accessing data.

5. Which of the following is more volatile?

- a) SRAM
- b) DRAM
- c) ROM
- d) RAM

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Answer: b

Explanation: DRAM is said to be more volatile because it has a capacitor as its storage element in which the data disappears when the capacitor loses its charge so even when the device is powered the data can be lost.

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6. What is the size of a trench capacitor in DRAM?

- a) 1 Mb
- b) 4-256 Mb
- c) 8-128 Mb
- d) 64-128 Mb

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Answer: b

Explanation: Trench capacitor can store from 4-256 Mb but planar capacitor can store up to 1 Mb.

7. Which of the following capacitor can store more data in DRAM?

- a) planar capacitor
- b) trench capacitor
- c) stacked-cell
- d) non-polar capacitor

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Answer: c

Explanation: Stacked-cell can store greater than 1 Gb. Planar capacitor can store up to 1 Mb and trench capacitor can store 4-256 Mb.

8. In which of the memories, does the data disappear?

- a) SRAM
- b) DRAM
- c) Flash memory
- d) EPROM

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Answer: b

Explanation: Both SRAM and DRAM are volatile memories and flash memory and EPROM are non-volatile memories. DRAM has a storage element as a capacitor whose charge loses gradually thereby losing data.

9. Which of the following is the main factor which determines the memory capacity?

- a) number of transistors
- b) number of capacitors
- c) size of the transistor
- d) size of the capacitor

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Answer: a

Explanation: The chip capacity is dependent on the number of transistors which can be fabricated on the silicon, and DRAM offers more storage capacity than SRAM.

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10. What does VRAM stand for?

- a) video RAM
- b) verilog RAM
- c) virtual RAM
- d) volatile RAM

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Answer: a

Explanation: Video RAM is a derivative of DRAM. It functions as a DRAM and has additional functions to access data for video hardware for creating the display.

11. What does TCR stand for?

- a) temperature-compensated refresh
- b) temperature-compensated recovery

- c) texas CAS-RAS
- d) temperature CAS-RAS

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Answer: a

Explanation: The temperature-compensated refresh is one of the refreshing techniques used for extending the battery life by reducing the refresh rate.

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## Embedded Systems Questions and Answers – Memory Organisation of Embedded Systems

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This set of Embedded Systems Questions and Answers for Freshers focuses on “Memory Organisation of Embedded Systems”.

1. How many data lines does  $256 \times 4$  have?

- a) 256
- b) 8
- c) 4
- d) 32

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Answer: c

Explanation: There are four data lines in the memory and these different organisations of memory and these different organisations of memory are apparent when upgrading memory and it also determines how many chips are needed.

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2. How is the number of chips required determined?

- a) number of data lines
- b) the minimum number of data

- c) width of the data path from the processor
- d) number of data lines and the width of the data path from the processor

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Answer: d

Explanation: The minimum number of chips is determined by the number of data lines and the width of the data path from the processor. For example, MC6800 family have a 16-bit wide datapath,  $16*1$  devices,  $4*4$  or  $2*8$  devices are needed.

3. Where is memory address stored in a C program?

- a) stack
- b) pointer
- c) register
- d) accumulator

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Answer: b

Explanation: Memory model is defined by a range of memory address which is accessible to the program. For example, in the C program, the memory address is stored in the pointer.

4. Which is the term that is used to refer the order of bytes?

- a) endianness
- b) memory organisation
- c) bit
- d) register

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Answer: a

Explanation: Endianness defines the order of bytes, that is, whether it is big endian or little endian. The former represents the higher order bits and the latter represents the lower order bits.

5. Which of the following processors uses big endian representation?

- a) 8086
- b) ARM
- c) PowerPC
- d) Zilog Z80

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Answer: c

Explanation: The IBM's PowerPC uses big endian representation whereas 8086, ARM and Zilog Z80 use little representation.  
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6. Which statement is true for a cache memory?

- a) memory unit which communicates directly with the CPU
- b) provides backup storage
- c) a very high-speed memory to increase the speed of the processor
- d) secondary storage

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Answer: c

Explanation: The RAM is the primary storage which directly communicates with the CPU. ROM is the secondary storage. Disk drives are capable of providing backup storage and the cache memory is a small high-speed memory which increases the speed of the processor.

7. Which of the following memory organisation have the entire memory available to the processor at all times?

- a) segmented addressing
- b) paging
- c) virtual address
- d) linear address

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Answer: d

Explanation: There are two types of memory organisation, linear addressing in which the entire memory is available to the processor of all times as in Motorola 6800 and the other is segmented addressing where the memory space is divided into several segments and the processor is limited to access the program instructions and data which are located in particular segments.

8. How many memory locations can be accessed by 8086?

- a) 1 M
- b) 2 M
- c) 3 M
- d) 4 M

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Answer: a

Explanation: The 8086 processor has a 20-bit address bus, hence it can access a memory of  $2^{20}$ -1 M locations.

9. Which of them is a memory that is allocated to the program in LIFO pattern?

- a) stack

- b) index
- c) accumulator
- d) base

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Answer: a

Explanation: A stack is a memory which is allocated to the program in last-in, first out pattern. Stack pointer contains the memory address of the stack.

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10. What does SIMM stand for?

- a) single in-line memory module
- b) single interrupt memory module
- c) single information memory module
- d) same-in-line memory module

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Answer: a

Explanation: SIMM is single in-line memory module is a kind of memory module, which contains random access memory used in computers of the early 1980s and 1990s.

11. Which of the memory organisation is widely used in parity bit?

- a) by 1 organisation
- b) by 4 organisation
- c) by 8 organisation
- d) by 9 organisation

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Answer: a

Explanation: The use of By 1 organisation is declined because of the wider data path devices. But it is still used in parity bit and were used in SIMM memory.

12. Which configuration of memory organisation replaces By 1 organisation?

- a) by 4 organisation
- b) by 8 organisation
- c) by 9 organisation
- d) by 16 organisation

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Answer: a

Explanation: By 1 organisation is replaced with By 4 organisation because of its reduced address bus and complexity.

13. Which shifting helps in finding the physical address in 8086?

- a) shifting the segment by 8
- b) shifting the segment by 6
- c) shifting the segment by 4
- d) shifting the segment by 2

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Answer: c

Explanation: The address bus of the 8086 is 20-bit and the data bus is 16-bit in size. So the physical address can be calculated by shifting the segment register by 4 to left and by adding the address bus to it.

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14. Which memory organisation is supported in wider memories?

- a) by 8 organisation
- b) by 16 organisation
- c) by 9 organisation
- d) by 4 organisation

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Answer: b

Explanation: The wider memories support 16-bits because it can integrate more number of the interface logic so that the time consumed by the latches and buffers removes the memory access thus allowing the slower parts to be used in wait state free designs.

15. Which of the following is a plastic package used primarily for DRAM?

- a) SIMM
- b) DIMM
- c) Zig-zag
- d) Dual-in-line

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Answer: c

Explanation: Zig-zag package of memory is a plastic package used for DRAM. The leads of this package are arranged in a zigzag manner.

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# Embedded Systems Questions and Answers – Memory Management

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Memory Management”.

1. Which of the following have a 16 Mbytes addressed range?

- a) PowerPC
- b) M68000
- c) DSP56000
- d) TMS 320

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Answer: b

Explanation: The M68000 family has a 16 Mbyte addressing range. The PowerPC family has a larger 4 Gbyte range and the DSP56000 has a 128-kilo word address space.

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2. Which of the following can destroy the accuracy in the algorithms?

- a) delays
- b) error signal
- c) interrupt
- d) mmu

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Answer: a

Explanation: The delays occurring in the memory management unit can destroy the accuracy in the algorithms and in order to avoid this, the linear addressing range should be increased.

3. How many numbers of ways are possible for allocating the memory to the modular blocks?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: c

Explanation: Most of the systems have a multitasking operating system in which the software consists of modular blocks of codes which run under the control of the operating system. There are three ways for allocating memory to these blocks. The first way distributes the block in a predefined way. The second way for allocating memory includes relocation or position independency in the software and the other way of allocating memory to the block is the address translation in which the logical address is translated to the physical address.

4. Which of the following is replaced with the absolute addressing mode?

- a) relative addressing mode
- b) protective addressing mode
- c) virtual addressing mode
- d) temporary addressing mode

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Answer: a

Explanation: The memory allocation of the modular blocks can be done by writing the software program in relocatable or position independent manner which can execute anywhere in the memory map, but relocatable code must have the same address between its data and code segments. This is used to avoid the use of absolute addressing modes which is replaced by the relative addressing modes.

5. What is the main purpose of the memory management unit?

- a) address translation
- b) large storage
- c) reduce the size
- d) provides address space

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Answer: a

Explanation: The memory management unit handles with physical addresses. Therefore, the virtual or the logical address is first translated to the physical address.

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6. Which of the following provides stability to the multitasking system?

- a) memory
- b) DRAM
- c) SRAM
- d) Memory partitioning

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Answer: d

Explanation: The memory partitioning provides stability to the multitasking system so that the errors within one task will not corrupt the other tasks.

7. Which of the following is used by the M68000 family?

- a) M68000
- b) 80386
- c) 8086
- d) 80286

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Answer: a

Explanation: The M68000 uses memory partitioning by the use of function code or by the combination of superscalar signals and the Harvard architecture.

8. What can be done for the fine grain protection of the processor?

- a) add extra description bit
- b) add error signal
- c) add wait stage
- d) remains unchanged

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Answer: a

Explanation: The finer grain protection of memory management is achieved by the addition of extra description bit to an address to declare its status. The memory management unit can detect an error if the task attempts to access memory that has not been allocated to it or a certain kind of mismatch occurs.

9. Which of the following technique is used by the UNIX operating system?

- a) logical address memory
- b) physical address memory
- c) virtual memory technique
- d) translational address

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Answer: c

Explanation: In the workstation and in the UNIX operating system virtual memory technique is frequently used in which the main memory is divided into different segments and pages. These pages will have a virtual address which can increase the address spacing.

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10. Which of the following consist two lines of legs on both sides of a plastic or ceramic body?

- a) SIMM
- b) DIMM

- c) Zig-zag
- d) Dual in-line

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Answer: d

Explanation: The dual-in-line package consists of two lines of legs on both sides of the plastic or ceramic. Most commonly used are BIOS EPROMs, DRAM and SRAM.

11. Which package has high memory speed and change in the supply?

- a) DIP
- b) SIMM
- c) DIMM
- d) zig-zag

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Answer: c

Explanation: DIMM is a special version of SIMM which is 168-bits wider bus and looks similar to a larger SIMM. The wider bus increases the memory speed and change in supply voltage.

12. Which is a subassembly package?

- a) dual-in-line
- b) zig-zag
- c) simm
- d) ceramic shell

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Answer: c

Explanation: The SIMM is basically a subassembly, not a package. It is a small board which possesses finger connection on the bottom and sufficient memory on the board in order to make up the required configuration.

13. What is the required voltage of DIMM?

- a) 2V
- b) 2.2V
- c) 5V
- d) 3.3V

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Answer: d

Explanation: For increasing the speed and reducing the power consumption, it is necessary to reduce the power supply. Today's CPUs and memories have 3.3V supply or even lower instead of the signal level from 0 to 5V. DIMMs are described by its voltage, speed, and memory type respectively as 3.3V 133MHz SDRAM DIMM.

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14. Which memory package has a single row of pins?

- a) SIMM
- b) DIP
- c) SIP
- d) zig-zag

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Answer: c

Explanation: The Single-in-line package is the same as that of SIMM, in which the finger connections are replaced by a single row of pins. SIP took the popularity of SIMM but nowadays it is rarely seen.

15. What is the access time of MCM51000AP10?

- a) 100ns
- b) 80ns
- c) 60ns
- d) 40ns

[View Answer](#)

Answer: a

Explanation: The access time of memory is defined as the maximum time taken by the chip to read/write data and it is very important to match the access time to the design. For example, MCM51000AP10 have 100ns access time for the memory.

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# **Embedded Systems Questions and Answers – DRAM Refreshing Techniques**

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This set of Embedded Systems Questions and Answers for Aptitude test focuses on “DRAM Refreshing Techniques”.

1. Which is the very basic technique of refreshing DRAM?

- a) refresh cycle
- b) burst refresh
- c) distributive refresh
- d) software refresh

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Answer: a

Explanation: The DRAM needs to be periodically refreshed and the very basic technique is a special refresh cycle, during these cycles no other access is permitted. The whole chip is refreshed within a particular time period otherwise, the data will be lost.

2. How is the refresh rate calculated?

- a) by refresh time
- b) by the refresh cycle
- c) by refresh cycle and refresh time
- d) refresh frequency and refresh cycle

[View Answer](#)

Answer: c

Explanation: The time required for refreshing the whole chip is known as refresh time. The number of access needed to complete refresh is called as the number of cycles. The number of cycles divided by the refresh time gives the refresh rate.

3. Which is the commonly used refresh rate?

- a) 125 microseconds
- b) 120 microseconds
- c) 130 microseconds
- d) 135 microseconds

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Answer: a

Explanation: There are two refresh rates used in common. They are standard refresh rate of 15.6 microseconds and 125 microseconds which is the extended form.

4. How can we calculate the length of the refresh cycle?

- a) twice of normal access

- b) thrice of normal access
- c) five times of normal access
- d) six times of normal access

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Answer: a

Explanation: Each of the refresh cycles is approximately as twice as the length of the normal access, for example, a 70ns DRAM has a refresh cycle time of 130ns.

5. What type of error occurs in the refresh cycle of the DRAM?

- a) errors in data
- b) power loss
- c) timing issues
- d) not accessing data

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Answer: c

Explanation: When the refresh cycle in a DRAM is running, it will not access data, so the processor will have to wait for its data. This arises some timing issues.  
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6. What is the worst case delay of the burst refresh in 4M by 1 DRAM?

- a) 0.4ms
- b) 0.2ms
- c) 170ns
- d) 180ns

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Answer: b

Explanation: A 4M by 1 DRAM have 1024 refresh cycles. Bursting delay will be 0.2ms that are, the worst case delay is 1024 times larger than that of the single refresh cycle. The distributed delay is about 170ns.

7. Which refresh techniques depends on the size of time critical code for calculating the refresh cycle?

- a) burst refresh
- b) distributed refresh
- c) refresh cycle
- d) software refresh

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Answer: b

Explanation: Most of the system uses the distributed method and depending on the size of the time critical code, the number of refresh cycles can be calculated.

8. Which of the following uses a timer for refresh technique?

- a) RAS
- b) CBR
- c) software refresh
- d) CAS

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Answer: c

Explanation: The software refresh performs the action by using a routine to periodically cycle through the memory and refreshes. It uses a timer in the program generating an interrupt. This interrupt performs the refreshing part in the DRAM.

9. What is the main disadvantage in the software refresh of the DRAM?

- a) timer
- b) delay
- c) programming delay
- d) debugging

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Answer: d

Explanation: Debugging in software refresh is very difficult to perform because they may stop the refreshing and if the refreshing is stopped, the contents get lost.

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10. Which refresh technique is useful for low power consumption?

- a) Software refresh
- b) CBR
- c) RAS
- d) Burst refresh

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Answer: b

Explanation: CBR that is, CAS before RAS refresh is the one which is commonly used. It has low power consumption quality because it does not have address bus and the buffers can be switched off. It is worked by using an internal address counter which is stored on the memory chip itself and this can be incremented periodically.

11. Which refreshing techniques generate a recycled address?

- a) RAS
- b) CBR
- c) Distributed refresh
- d) Software refresh

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Answer: a

Explanation: The row address is placed on the address bus and the column address is held off which generates the recycle address. The address generation is done by an external hardware controller.

12. Which of the following uses a software refresh in the DRAM?

- a) 8086
- b) 80386
- c) Pentium
- d) Apple II personal computer

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Answer: d

Explanation: The Apple II personal computer has a particular memory configuration, periodically the DRAM gets blocked and is used for video memory accessing to update the screen which can refresh the DRAM.

13. How do CBR works?

- a) by asserting CAS before RAS
- b) by asserting CAS after RAS
- c) by asserting RAS before CAS
- d) by asserting CAS only

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Answer: a

Explanation: CBR works by an internal address counter which is periodically incremented. The mechanism is based on CAS before RAS. Each time when RAS is asserted, the refresh cycle performs and the counter is incremented.

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14. Which of the refresh circuit is similar to CBR?

- a) software refresh
- b) hidden refresh
- c) burst refresh
- d) distribute refresh

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Answer: b

Explanation: In the hidden refresh, the refresh cycle is added to the end of a normal read cycle. The RAS signal goes high and is then asserted low. At the end of the read cycle, the CAS is still asserted. This is similar to the CBR mechanism, that is, toggling of the RAS signal at the end of the read cycle starts a CBR refresh cycle.

15. Which technology is standardized in DRAM for determining the maximum time interval between the refresh cycle?

- a) IEEE
- b) RAPID
- c) JEDEC
- d) UNESCO

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Answer: c

Explanation: The maximum time interval between refresh cycle is standardized by JEDEC, Joint Electron Device Engineering Council which is an independent semiconductor engineering trade organization. This standardized JEDEC in DRAM is specified in the manufacturer's chip specification.

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## Embedded Systems Questions and Answers – DRAM Interfaces

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “DRAM Interfaces”.

1. In which pin does the data appear in the basic DRAM interfacing?

- a) dout pin
- b) din pin
- c) clock
- d) interrupt pin

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Answer: a

Explanation: In the basic DRAM interfacing, the higher order bits asserts the RAS signal and the lower order bits asserts the CAS signal. When the access got expired, the data appears on the dout pin and is latched by the processor.

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2. What is the duration for memory refresh to remain compatible?

- a) 20 microseconds
- b) 12 microseconds
- c) 15 microseconds
- d) 10 microseconds

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Answer: c

Explanation: The memory refresh is performed every 15 microseconds in order to remain compatible.

3. Which interfacing method lowers the speed of the processor?

- a) basic DRAM interface
- b) page mode interface
- c) page interleaving
- d) burst mode interface

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Answer: a

Explanation: The direct method access limits the wait state-free operation which lowers the processor speed.

4. What is EDO RAM?

- a) extreme data operation
- b) extended direct operation
- c) extended data out
- d) extended DRAM out

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Answer: c

Explanation: EDO RAM is a special kind of random access memory which can improve the time to read from the memory on faster microprocessors. The example of such a microprocessor is Intel Pentium.

5. What is RDRAM?

- a) refresh DRAM
- b) recycle DRAM

- c) Rambus DRAM
  - d) refreshing DRAM
- [View Answer](#)

Answer: c

Explanation: Rambus DRAM is a synchronous memory developed by Rambus. It can replace SDRAM and is useful in high bandwidth applications.

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6. Which of the following can transfer up to 1.6 billion bytes per second?

- a) DRAM
- b) RDRAM
- c) EDO RAM
- d) SDRAM

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Answer: b

Explanation: The Rambus RAM can transfer up to 1.6 billion bytes per second. It possesses RAM controller, a bus which connects the microprocessor and the device, and random access memory.

7. Which of the following cycle is larger than the access time?

- a) write cycle
- b) set up time
- c) read cycle
- d) hold time

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Answer: c

Explanation: The read cycle in the DRAM interfacing is larger than the access time because of the precharge time.

8. Which mode of operation selects an internal page of memory in the DRAM interfacing?

- a) page interleaving
- b) page mode
- c) burst mode
- d) EDO RAM

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Answer: b

Explanation: In the page mode operation, the row address is provided as normal but the RAS signal is left asserted. This, in turn, selects an internal page within the DRAM memory where any bit of data can be accessed by placing the column address and asserting CAS.

9. What is the maximum time that the RAS signal can be asserted in the page mode operation?

- a) 5 microseconds
- b) 10 microseconds
- c) 15 microseconds
- d) 20 microseconds

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Answer: b

Explanation: The maximum time that the RAS signal can be asserted during the page mode operation is about 10 microseconds. But this is a major disadvantage for page mode operation, that is, the standard PCs have a maximum time of 15 microseconds for the refresh cycle.

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10. Which of the following mode of operation in the DRAM interfacing has a page boundary?

- a) burst mode
- b) EDO RAM
- c) page mode
- d) page interleaving

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Answer: c

Explanation: The page mode operation have memory cycles that exhibit some form of locality, that is, stay within the page boundary which causes page missing when there is access outside the page boundary and two or more wait states.

11. Which mode offers the banking of memory in the DRAM interfacing technique?

- a) page mode
- b) basic DRAM interfacing
- c) page interleaving
- d) burst mode

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Answer: c

Explanation: The accessing of data outside the page boundary can cause missing of pages in the page mode operation. So a program has to operate for frequently accessing data thereby, increasing the efficiency in the page selection. One such mode is the page interleaving mode in which the memory is divided into different banks, depending on the number of memories installed.

12. Which of the following has a fast page mode RAM?

- a) burst mode

- b) page interleaving
  - c) EDO memory
  - d) page mode
- [View Answer](#)

Answer: c

Explanation: Extended data out memory is a fast page mode RAM which has a faster cycling process which makes EDO memory a faster page mode access.

13. Which mode reduces the need for fast static RAMs?

- a) page mode
- b) page interleaving
- c) burst mode
- d) EDO memory

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Answer: c

Explanation: The page mode, nibble mode devices can provide data fastly when the new column address is given. In burst mode operation, the processor can fetch more data than it needs and keeps the remaining data in an internal cache for the future use which can reduce the need for fast static RAMs.

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14. Which of the following is also known as hyper page mode enabled DRAM?

- a) page mode
- b) EDO DRAM
- c) burst EDO DRAM
- d) page interleaving

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Answer: b

Explanation: The EDO DRAM is also known as hyper page mode enable DRAM because of the faster page mode operation along with some additional features.

15. What does BEDO DRAM stand for?

- a) burst EDO DRAM
- b) buffer EDO DRAM
- c) BIBO EDO DRAM
- d) bilateral EDO DRAM

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Answer: a

Explanation: The burst EDO DRAM is evolved from the EDO DRAM and it can access four memory addresses in one burst. It also supports pipeline stages which allow the page access cycle into two parts.

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# Embedded Systems Questions and Answers – Cache Memory

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Cache Memory”.

1. Which of the following is more quickly accessed?

- a) RAM
- b) Cache memory
- c) DRAM
- d) SRAM

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Answer: b

Explanation: The cache memory is a small random access memory which is faster than a normal RAM. It has a direct connection with the CPU otherwise, there will be a separate bus for accessing data. The processor will check whether the copy of the required data is present in the cache memory if so it will access the data from the cache memory.

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2. Which factor determines the effectiveness of the cache?

- a) hit rate
- b) refresh cycle
- c) refresh rate
- d) refresh time

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Answer: a

Explanation: The proportion of accesses of data that forms the cache hit, which measures the effectiveness of the cache memory.

3. Which of the following determines a high hit rate of the cache memory?

- a) size of the cache
- b) number of caches
- c) size of the RAM
- d) cache access

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Answer: a

Explanation: The size of the cache increases, a large amount of data can be stored, which can access more data which in turn increases the hit rate of the cache memory.

4. Which of the following is a common cache?

- a) DIMM
- b) SIMM
- c) TLB
- d) Cache

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Answer: c

Explanation: The translation lookaside buffer is common cache memory seen in almost all CPUs and desktops which are a part of the memory management unit. It can improve the virtual address translation speed.

5. Which factor determines the number of cache entries?

- a) set commutativity
- b) set associativity
- c) size of the cache
- d) number of caches

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Answer: b

Explanation: The set associativity is a criterion which describes the number of cache entries which could possibly contain the required data.

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6. What is the size of the cache for an 8086 processor?

- a) 64 Kb
- b) 128 Kb
- c) 32 Kb

d) 16 Kb  
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Answer: a  
Explanation: The 8086 processor have a 64 Kbytes cache, beyond this size, the cost will be extremely high.

7. How many possibilities of mapping does a direct mapped cache have?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: a

Explanation: The direct mapped cache only have one possibility to fetch data whereas a two-way system, there are two possibilities, for a three-way system, there are three possibilities and so on. It is also known as the one-way set associative cache.

8. Which of the following allows speculative execution?

- a) 12-way set associative cache
- b) 8-way set associative cache
- c) direct mapped cache
- d) 4-way set associative cache

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Answer: c

Explanation: The direct mapped cache has the advantage of allowing a simple and fast speculative execution.

9. Which of the following refers to the number of consecutive bytes which are associated with each cache entry?

- a) cache size
- b) associative set
- c) cache line
- d) cache word

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Answer: c

Explanation: The cache line refers to the number of consecutive bytes which are associated with each cache entry. The data is transferred between the memory and the cache in a particular size which is called a cache line.

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10. Which factor determines the cache performance?

- a) software
- b) peripheral
- c) input
- d) output

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Answer: a

Explanation: The cache performance is completely dependent on the system and software. In software, the processor checks out each loop and if a duplicate is found in the cache memory, immediately it is accessed.

11. What are the basic elements required for cache operation?

- a) memory array, multivibrator, counter
- b) memory array, comparator, counter
- c) memory array, trigger circuit, a comparator
- d) memory array, comparator, CPU

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Answer: b

Explanation: The cache memory operation is based on the address tag, that is, the processor generates the address which is provided to the cache and this cache stores its data with an address tag. The tag is compared with the address, if they did not match, the next tag is checked. If they match, a cache hit occurs, the data is passed to the processor. So the basic elements required is a memory array, comparator, and a counter.

12. How many divisions are possible in the cache memory based on the tag or index address?

- a) 3
- b) 2
- c) 4
- d) 5

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Answer: c

Explanation: There is four classification based on the tag or index address corresponds to a virtual or physical address. They are PIPT, VIVT, PIVT, VIPT that is, physically indexed physically tagged, virtually indexed virtually tagged, physically indexed virtually tagged, virtually indexed physically tagged respectively.

13. What does DMA stand for?

- a) direct memory access
- b) direct main access

- c) data main access
- d) data memory address

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Answer: a

Explanation: The DMA is direct memory access which can modify the memory without the help of the processor. If any kind of memory access by DMA to be done, it will pass a request to the processor bus and the processor provides an acknowledgment and gives the control of the bus to the DMA.

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## Embedded Systems Questions and Answers – Size of Cache

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Size of Cache”.

1. Which of the following cache has a separate comparator for each entry?
  - a) direct mapped cache
  - b) fully associative cache
  - c) 2-way associative cache
  - d) 16-way associative cache

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Answer: b

Explanation: A fully associative cache have a comparator for each entry so that all the entries can be tested simultaneously.

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2. What is the disadvantage of a fully associative cache?

- a) hardware
- b) software
- c) memory

d) peripherals  
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Answer: a

Explanation: The major disadvantage of the fully associative cache is the amount of hardware needed for the comparison increases in proportion to the cache size and hence, limits the fully associative cache.

3. How many comparators present in the direct mapping cache?

- a) 3
- b) 2
- c) 1
- d) 4

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Answer: c

Explanation: The direct mapping cache have only one comparator so that only one location possibly have all the data irrespective of the cache size.

4. Which mapping of cache is inefficient in software viewpoint?

- a) fully associative
- b) 2 way associative
- c) 16 way associative
- d) direct mapping

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Answer: d

Explanation: The direct mapping cache organization is simple from the hardware design aspects but it is inefficient in the software viewpoint.

5. Which mechanism splits the external memory storage into memory pages?

- a) index mechanism
- b) burst mode
- c) distributive mode
- d) a software mechanism

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Answer: a

Explanation: The index mechanism splits the external memory storage into a series of memory pages in which each page is the same size as the cache. Each page is mapped to the cache so that each page can have its own location in the cache.

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6. Which of the following cache mapping can prevent bus thrashing?

- a) fully associative
- b) direct mapping
- c) n way set associative
- d) 2 way associative

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Answer: c

Explanation: Only one data can be accessed in direct mapping that is, if one word is accessed at a time, all other words are discarded at the same time. This is known as bus thrashing which can be solved by splitting up the caches so there are  $2, 4, \dots, n$  possible entries available. The major advantage of the set associative cache is its capability to prevent the bus thrashing at the expense of hardware.

7. Which cache mapping have a sequential execution?

- a) direct mapping
- b) fully associative
- c) n way set associative
- d) burst fill

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Answer: d

Explanation: The burst fill mode of cache mapping have a sequential nature of executing instructions and data access. The instruction fetches and execution accesses to sequential memory locations until it has a jump instruction or a branch instruction. This kind of cache mapping is seen in the MC68030 processor.

8. Which address is used for a tag?

- a) memory address
- b) logical address
- c) cache address
- d) location address

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Answer: b

Explanation: The cache memory uses either a physical address or logical address for its tag data. For a logical cache, the tag refers to a logical address and for a physical cache, the tag refers to the physical address.

9. In which of the following the data is preserved within the cache?

- a) logical cache
- b) physical cache

- c) unified cache
  - d) harvard cache
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Answer: b

Explanation: In the physical cache, the data is preserved within the cache because it does not flush out during the context switching but on the other hand, the logical cache flushes out the data and clear it during a context switching.

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10. What is the disadvantage of the physical address?

- a) debugging
- b) delay
- c) data preservation
- d) data cleared

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Answer: b

Explanation: The physical address access the data through the memory management unit which causes a delay.

11. Which cache memory solve the cache coherency problem?

- a) physical cache
- b) logical cache
- c) unified cache
- d) harvard cache

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Answer: a

Explanation: The physical cache is more efficient and can provide the cache coherency problem solved and MMU delay is kept to a minimum. PowerPC is an example for this advantage.

12. What type of cache is used in the Intel 80486DX?

- a) logical
- b) physical
- c) harvard
- d) unified

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Answer: d

Explanation: The Intel 80486DX processor has a unified cache. Similarly, Motorola MPC601PC also uses the unified cache. The unified cache has the same mechanism to store both data and instructions.

13. Which of the following has a separate cache for the data and instructions?

- a) unified
- b) harvard
- c) logical
- d) physical

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Answer: b

Explanation: The Harvard cache have a separate cache for the data and the instruction whereas the unified cache has a same cache for the data and instructions.

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14. Which type of cache is used the SPARC architecture?

- a) unified
- b) harvard
- c) logical
- d) physical

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Answer: c

Explanation: The SPARC architecture uses logical cache whereas most of the internal cache designed now, uses physical cache because data is not flushed out in this cache.

15. Which of the following approach uses more silicon area?

- a) unified
- b) harvard
- c) logical
- d) physical

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Answer: b

Explanation: The Harvard architecture have a separate bus for data and instruction, therefore, it requires more area. It also uses more silicon area for the second set of tags and the comparators.

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# Embedded Systems Questions and Answers – Writing Scheme of Cache Memory

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This set of Embedded Systems Interview Questions and Answers for freshers focuses on “Writing Scheme of Cache Memory”.

1. Which of the following is the biggest challenge in the cache memory design?

- a) delay
- b) size
- c) coherency
- d) memory access

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Answer: c

Explanation: The coherency is a major challenge in designing the cache memory. The cache has to be designed by solving the problem of data coherency while remaining hardware and software compatible.

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2. What arises when a copy of data is held both in the cache and in the main memory?

- a) stall data
- b) stale data
- c) stop data
- d) wait for the state

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Answer: b

Explanation: The stale data arises when the copy is held both in the cache memory and in the main memory. If either copy is modified, the other data become stale and the system coherency can be destroyed.

3. In which writing scheme does all the data writes go through to main memory and update the system and cache?

- a) write-through
- b) write-back
- c) write buffering

d) no caching of writing cycle

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Answer: a

Explanation: There are different writing scheme in the cache memory which increases the cache efficiency and one such is the write-through in which all the data go to the main memory and can update the system as well as the cache.

4. In which writing scheme does the cache is updated but the main memory is not updated?

- a) write-through
- b) write-back
- c) no caching of writing cycle
- d) write buffering

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Answer: b

Explanation: The cache write-back mechanism needs a bus snooping system for the coherency. In this write-back scheme, the cache is updated first and the main memory is not updated.

5. In which writing scheme does the cache is not updated?

- a) write-through
- b) write-back
- c) write buffering
- d) no caching of writing cycle

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Answer: d

Explanation: The no caching write cycle does not update the cache but the data is written to the cache. If the previous data had cached, that entry is invalid and will not use. This makes the processor fetch data directly from the main memory.

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6. Which writing mechanism forms the backbone of the bus snooping mechanism?

- a) write-back
- b) write-through
- c) no caching of write cycles
- d) write buffer

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Answer: c

Explanation: The no caching of write cycle seems to be wasteful because it does not update the cache, and if any previous data is cached, that entry might be an error and is not used. So the processor access data from the main memory but this writing scheme forms the backbone of the bus snooping system for the coherency issue.

7. What is the main idea of the writing scheme in the cache memory?

- a) debugging
- b) accessing data
- c) bus snooping
- d) write-allocate

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Answer: c

Explanation: There are four main writing scheme in the cache memory which is, write-through, write-back, no caching of the write cycle and write buffer. All these writing schemes are designed for bus snooping which can reduce the coherency.

8. In which scheme does the data write via a buffer to the main memory?

- a) write buffer
- b) write-back
- c) write-through
- d) no caching of the write cycle

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Answer: a

Explanation: The write-buffer is slightly similar to the write-through mechanism in which data is written to the main memory but in write buffer mechanism data writes to the main memory via a buffer.

9. Which of the following can allocate entries in the cache for any data that is written out?

- a) write-allocate cache
- b) read-allocate cache
- c) memory-allocate cache
- d) write cache

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Answer: a

Explanation: A write-allocate cache allocates the entries in the cache for any data that is written out. If the data is transferred to the external memory so that, when it is accessed again, the data is already waiting in the cache. It works efficiently if the size of the cache is large and it does not overwrite even though it is advantageous.

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10. Which of the following uses a bus snooping mechanism?

- a) MC88100
- b) 8086
- c) 8051
- d) 80286

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Answer: a

Explanation: The bus snooping mechanism uses a combination of cache tag status, write policies and bus monitoring to ensure coherency. MC88100 or MC88200 uses bus snooping mechanism.

11. What leads to the development of MESI and MEI protocol?

- a) cache size
- b) cache coherency
- c) bus snooping
- d) number of caches

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Answer: b

Explanation: The problem of cache coherency lead to the formation of two standard mechanisms called MESI and MEI protocol. MC88100 have MESI protocol and MC68040 uses an MEI protocol.

12. Which of the following is also known as Illinois protocol?

- a) MESI protocol
- b) MEI protocol
- c) Bus snooping
- d) Modified exclusive invalid

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Answer: a

Explanation: The MESI protocol is also known as Illinois protocol because of its formation at the University of Illinois.

13. What does MESI stand for?

- a) modified exclusive stale invalid
- b) modified exclusive shared invalid
- c) modified exclusive system input
- d) modifies embedded shared invalid

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Answer: b

Explanation: The MESI protocol supports a shared state which is a formal mechanism for controlling the cache coherency by using the bus snooping techniques. MESI refers to the states that cached data can access. In MESI protocol, multiple processors can cache shared data.

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14. What does MEI stand for?

- a) modified embedded invalid
- b) modified embedded input
- c) modified exclusive invalid
- d) modified exclusive input

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Answer: c

Explanation: MEI protocol is less complex and is easy to implement. It does not allow shared state for the cache.

15. Which protocol does MPC601 use?

- a) MESI protocol
- b) MEI protocol
- c) MOSI protocol
- d) MESIF protocol

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Answer: a

Explanation: MPC601 uses a MESI protocol, that is they have a shared state for data accessing in the cache. It can reduce the cache coherency but the cache coherency is processor specific. So different processors have different cache coherency implementations.

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## **Embedded Systems Questions and Answers – Burst Interfaces**

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Burst Interfaces”.

1. Which of the following include special address generation and data latches?

- a) burst interface
- b) peripheral interface
- c) dma
- d) input-output interfacing

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Answer: a

Explanation: The burst interfacing has special memory interfaces which include special address generation and data latches that help in the high performance of the processors. It takes the advantages of both the nibble mode memories and paging.

2. Which of the following makes use of the burst fill technique?

- a) burst interfaces
- b) dma
- c) peripheral interfaces
- d) input-output interfaces

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Answer: a

Explanation: The burst interfaces use the burst fill technique in which the processor will access four words in succession, which fetches the complete cache line or written out to the memory.

3. How did burst interfaces access faster memory?

- a) segmentation
- b) dma
- c) static column memory
- d) memory

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Answer: c

Explanation: The speed of the memory can be improved by the page mode or the static column memory which offer a faster access in a single cycle.

4. Which of the following memory access can reduce the clock cycles?

- a) bus interfacing
- b) burst interfacing
- c) dma

d) dram  
View Answer

Answer: b

Explanation: The burst interfaces reduces the clock cycles. For fetching four words with a three clock memory, it will take 12 clock cycle but in the burst interface, it will only take five clocks to access the data.

5. How many clocks are required for the first access in the burst interface?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: In the burst interface, the first access of the memory address requires two clock cycles and a single cycle for the remaining memory address.  
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6. In which of the following access, the address is supplied?

- a) the first access
- b) the second access
- c) third access
- d) fourth access

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Answer: a

Explanation: In the burst interface, the address is supplied only for the first access and not for the remaining accesses. An external logic is required for the additional addresses for the memory interface.

7. What type of timing is required for the burst interfaces?

- a) synchronous
- b) equal
- c) unequal
- d) symmetrical

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Answer: c

Explanation: The burst interfacing uses an unequal timing. It takes two clocks for the first access and only one for the remaining accesses which make it an unequal timing.

8. How can gate delays be reduced?

- a) synchronous memory
- b) asynchronous memory
- c) pseudo asynchronous memory
- d) symmetrical memory

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Answer: a

Explanation: The burst interfaced is associated with the SRAM and for the efficiency of the SRAM, it uses a synchronous memory on-chip latches to reduce the gate delays.

9. In which memory does the burst interfaces act as a part of the cache?

- a) DRAM
- b) ROM
- c) SRAM
- d) Flash memory

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Answer: c

Explanation: The burst interface is associated with the static RAM.

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10. Which of the following uses a wrap around burst interfacing?

- a) MC68030
- b) MC68040
- c) HyperBus
- d) US 5729504 A

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Answer: b

Explanation: MC68040 is developed by the Motorola which uses a wrap around burst interfacing. MC68030 is also developed by Motorola but it uses a linear line fill burst. HyperBus can switch to both linear and wrap around burst. US 5729504 A uses a linear burst fill.

11. Which of the following is a Motorola's protocol product?

- a) MCM62940
- b) Avalon
- c) Slave interfaces

d) AXI slave interfaces

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Answer: a

Explanation: MCM62940 protocol is developed by Motorola, whereas Slave interfaces, AXI slave interfaces are for ARM. Avalon is developed by Altera.

12. Which of the following uses a linear line fill interfacing?

- a) MC68040
- b) MC68030
- c) US 74707 B2
- d) Hyper Bus

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Answer: b

Explanation: MC68030 uses a linear burst fill whereas MC68040, US 74707 B2 uses to wrap around burst interfacing. HyperBus can switch to both linear and wrap around interfacing.

13. Which of the following protocol matches the Intel 80486?

- a) MCM62940
- b) MCM62486
- c) US 74707 B2
- d) Hyper Bus

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Answer: b

Explanation: The MCM62486 has an on-chip counter that matches the Intel 80486 and is developed by the Motorola.

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14. Which of the following protocol matches the MC68040?

- a) MCM62486
- b) US 5729504 A
- c) HyperBus
- d) MCM62940

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Answer: d

Explanation: The MCM62940 and MCM62486 are the specific protocols developed by Motorola, in which the MCM62940 has an on-chip counter which matches the wrap-around burst interfacing of the MC68040.

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# Embedded Systems Questions and Answers – Segmentation and Paging

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This set of Embedded Systems Problems focuses on “Segmentation and Paging”.

1. The modified bit is also known as

- a) dead bit
- b) neat bit
- c) dirty bit
- d) invalid bit

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Answer:

Explanation: The dirty bit is said to be set if the processor modifies its memory. This bit indicates that the associative set of blocks regarding the memory is modified and has not yet saved to the storage.

2. Which of the following have an 8 KB page?

- a) DEC Alpha
- b) ARM
- c) VAX
- d) PowerPC

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Answer:

Explanation: DEC Alpha divides its memory into 8KB pages whereas VAX is a small page which is only 512 bytes in size. PowerPC pages are normally 4 KB and ARM is having 4 KB and 64 KB pages.

3. Which of the following address is seen by the memory unit?

- a) logical address
- b) physical address
- c) virtual address
- d) memory address

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Answer: b

Explanation: The logical address is the address generated by the CPU. It is also known as virtual address. The physical address is the address which is seen by the memory unit.

4. Which of the following modes offers segmentation in the memory?

- a) virtual mode
- b) real mode
- c) protected mode
- d) memory mode

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Answer: c

Explanation: The main memory can split into small blocks by the method of paging and segmentation and these mechanisms are possible only in protected mode.

5. Which of the following is necessary for the address translation in the protected mode?

- a) descriptor
- b) paging
- c) segmentation
- d) memory

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Answer: a

Explanation: The address translation from the logical address to physical address partitions the main memory into different blocks which is called segmentation. Each of these blocks have a descriptor which possesses a descriptor table. So the size of every block is very important for the descriptor.

6. What does “G” in the descriptor entry describe?

- a) gain
- b) granularity
- c) gate voltage
- d) global descriptor

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Answer: b

Explanation: The granularity bit controls the resolution of the segmented memory. When it is set to logic one, the resolution is 4 KB. When the granularity bit is set to logic zero, the resolution is 1 byte.

7. How many types of tables are used by the processor in the protected mode?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: There are two types of descriptor table used by the processor in the protected mode which are GDT and LDT, that is global descriptor table and local descriptor table respectively.

8. What does the table indicator indicate when it is set to one?

- a) GDT
- b) LDT
- c) remains unchanged
- d) toggles with GDT and LTD

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Answer: b

Explanation: The table indicator is a part of selector that selects which table is to be used. If the table indicator is set to logic one, it will use the local descriptor table and if the table indicator is set to logic zero, it will use the global descriptor table.

9. What does GDTR stand for?

- a) global descriptor table register
- b) granularity descriptor table register
- c) gate register
- d) global direct table register

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Answer: a

Explanation: The global descriptor table register is a special register which have the linear address and the size of its own GDT. Both the global descriptor table register and local descriptor table register are located in the global descriptor table.

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10. What does PMMU stands for?

- a) protection mode memory management unit
- b) paged memory management unit
- c) physical memory management unit
- d) paged multiple management unit

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Answer: b

Explanation: The paged memory management unit is used to decrease the amount of storage needed in the page tables, that is, a multi-level tree structure is used. MC68030, PowerPC, ARM 920 uses a paged memory management unit.

11. Which of the following support virtual memory?

- a) segmentation
- b) descriptor
- c) selector
- d) paging

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Answer: d

Explanation: The paging mechanism supports the virtual memory. Paging helps in creating virtual address space which has a major role in memory management.

12. What does DPL in the descriptor describes?

- a) descriptor page level
- b) descriptor privilege level
- c) direct page level
- d) direct page latch

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Answer: b

Explanation: The descriptor privilege level is used to restrict access to the segment which helps in protection mechanism. It acquires two bit of the descriptor.

13. What does "S" bit describe in a descriptor?

- a) descriptor type
- b) small type
- c) page type
- d) segmented type

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Answer: a

Explanation: The S bit determines whether it is a system segment or a normal segment. When the S bit is set, it might be a code segment or a data segment. If the S bit clears, it is a system segment.

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# Embedded Systems Questions and Answers – Memory Protection Unit

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Memory Protection Unit”.

1. How many regions are created by the memory range in the ARM architecture?

- a) 4
- b) 8
- c) 16
- d) 32

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Answer: b

Explanation: The memory protection unit in the ARM architecture divides the memory into eight separate regions. Each region can be small as well as big ranging from 4 Kbytes to 4 Gbytes.

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2. How many bits does the memory region in the ARM memory protection unit have?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: c

Explanation: The memory region possesses three bits which are the cacheable bit, bufferable bit and access permission bit.

3. Which of the following uses a priority level for permitting data?

- a) ARM memory management unit
- b) ARM protection memory management unit
- c) Bus interface unit
- d) Execution unit

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Answer: b

Explanation: In the ARM protection architecture, the memory is divided into some regions of size 4 Kbytes to 4 Gbytes. These regions possess bits called the cacheable bit, buffer bit, and access permitted bits. The regions are numbered as per priority level for which the permission bits takes the precedence if any of the regions gets overlapped.

4. What type of bit in the ARM memory mimics to that of the protection unit of ARM management unit?

- a) permission bit
- b) buffer bit
- c) cacheable bit
- d) access permission bit

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Answer: a

Explanation: The ARM architecture memory protection unit divides the memory range into different regions of size ranging from 4 Kbytes to 4 Gbytes. Each region is associated with certain bits called the cacheable bit, buffer bit, and access permitted bit. These bits are similar to the permission bit in the ARM memory management unit architecture which is stored in the control register.

5. Which of the following bits are used to control the cache behaviour?

- a) cacheable bit
- b) buffer bit
- c) cacheable bit and buffer bit
- d) cacheable bit, buffer bit and permission access bit

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Answer: c

Explanation: The cacheable bit and the buffer bit are used to control the behaviour of cache. Depending on the cacheable bit and the buffer bit, the memory access will complete successfully.

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6. Which of the following unit provides security to the processor?

- a) bus interface unit
- b) execution unit
- c) peripheral unit
- d) memory protection unit

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Answer: d

Explanation: The memory management unit and the memory protection unit provides security to the processor by trapping the invalid memory accesses before they corrupt other data.

7. Which of the following includes a tripped down memory management unit?

- a) memory protection unit
- b) memory real mode
- c) memory management unit
- d) bus interface unit

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Answer: a

Explanation: The memory protection unit allows a tripped memory down memory management unit in which the memories are partitioned and protected without any address translation. This can remove the time consumption in the address translation thereby increases the speed.

8. Which of the following can reduce the chip size?

- a) memory management unit
- b) execution unit
- c) memory protection unit
- d) bus interface unit

[View Answer](#)

Answer: c

Explanation: The memory protection unit have many advantages over the other units. It can reduce the chip size, cost and power consumption.

9. How does the memory management unit provide the protection?

- a) disables the address translation
- b) enables the address translation
- c) wait for the address translation

d) remains unchanged  
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Answer: a

Explanation: The memory management unit can be used as a protection unit by disabling the address translation that is, the physical address and the logical address are the same.

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10. Which of the following is used to start a supervisor level?

- a) error signal
- b) default signal
- c) wait for the signal
- d) interrupt signal

View Answer

Answer: a

Explanation: If memory access from the software does not access the correct data, an error signal is generated which will start a supervisor level software for the decision.

11. What happens when a task attempts to access memory outside its own address space?

- a) paging fault
- b) segmentation fault
- c) wait
- d) remains unchanged

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Answer: b

Explanation: Different tasks assign their own address space and whenever a task access memory outside its own address space, a segmentation fault result and which in turn results in the termination of the offending application.

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# Embedded Systems Questions and Answers – Parallel Ports

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Parallel Ports”.

1. Which of the following can transfer multiple bits of data simultaneously?

- a) serial port
- b) sequential port
- c) concurrent unit
- d) parallel port

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Answer: d

Explanation: The parallel port can transfer multiple bits of data simultaneously. It provides the input or output binary data with a single bit allocated to each pin within the port.

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2. Which of the following are interfaced as inputs to the parallel ports?

- a) LEDs
- b) switch
- c) alphanumeric display
- d) seven segmented display

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Answer: b

Explanation: The LEDs, alphanumeric displays, seven segment displays are interfaced for the output whereas the switch is an input port.

3. Which of the following are interfaced as the outputs to the parallel ports?

- a) keyboards
- b) switches
- c) LEDs
- d) knobs

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Answer: c

Explanation: The keyboards, switches, and knobs are used as output whereas the LEDs are used as the input port.

4. How many registers are there to control the parallel port in the basic form?

- a) 1
- b) 3
- c) 2
- d) 5

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Answer: c

Explanation: The basic operation of the parallel port dealt with two types of registers which are called data direction register and the data register.

5. Which of the following is also known as tri-state?

- a) output port
- b) input port
- c) parallel port
- d) output-input port

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Answer: a

Explanation: The progression in the parallel ports provides a third register or an individual control bit which can make the pin in a high impedance state. An output port which can do this is also known as tri-state, that is, logic high, logic low and a high impedance state.

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6. How buffers are enabled in the parallel ports?

- a) by the data register
- b) by data direction register
- c) by individual control register
- d) by data and individual control register

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Answer: b

Explanation: The implementation of parallel port uses a couple of buffers which are enabled by the data direction register by setting the corresponding bit of the register.

7. Which of the following registers offers high impedance?

- a) data register
- b) data direction register
- c) individual control bit

d) data register and data direction register

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Answer: c

Explanation: The register which offers high impedance is the individual control bit or the third register which can be implemented by switching off both the buffers and putting their connections to the pin which offers high impedance.

8. Which of the following can be used as a chip select?

- a) multifunction I/O port
- b) parallel port
- c) DMA port
- d) memory port

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Answer: a

Explanation: The multifunction I/O port can also be used a chip select for the memory design. The function that the pin performs is set up internally through the use of a function register which internally configures how the external pins are connected internally.

9. Which of the following is necessary for the parallel input-output port?

- a) inductor
- b) pull-up resistor
- c) push-up resistor
- d) capacitor

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Answer: b

Explanation: The I/O port needs an external pull-up resistor. In some devices, it offers internally. If it is not provided, it can cause incorrect data on reading the port and it prevents the port from turning off an external device.

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10. Which of the following can be described as general-purpose?

- a) multifunction I/O port
- b) input port
- c) dma port
- d) output port

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Answer: a

Explanation: The multifunction I/O ports can be described as the general-purpose and it can be shared with other peripherals.

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# Embedded Systems Questions and Answers – Timer

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Timer”.

1. Which of the following helps in the generation of waveforms?

- a) timer
- b) inputs
- c) outputs
- d) memory

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Answer: a

Explanation: The embedded systems have a timing component called timer or counter which helps in the timing reference for control sequence, provides system tick for the operating system and also helps in the generation of waveforms for the serial port baud rate generation.

2. Which bit size determines the slowest frequency?

- a) counter size
- b) pre-scalar value
- c) counter
- d) timer

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Answer: b

Explanation: The pre-scalar value determines the slowest frequency that can be generated from a given clock input. Actually the bit size are determined by the pre-scalar value and the counter size.

3. Which bit size determines the maximum value of the counter-derived period?

- a) counter size
- b) pre-scalar value
- c) bit size
- d) byte size

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Answer: a

Explanation: The bit size are basically determined by its fundamental properties, that is, the pre-scalar value and the counter size. The counter size determines the maximum value of the counter derived period.

4. Which of the following timer is suitable for IBM PC?

- a) IA-32
- b) Intel 8253
- c) Intel 64
- d) 8051 timer

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Answer: b

Explanation: The Intel 8253 timer is suitable for the IBM PC. IA-32 and Intel 64 are the offload timers used only for Intel. The 8051 timer is used for the timing program in 8051.

5. Which of the following is mode 0 in 8253?

- a) interrupt on start count
- b) interrupt for wait statement
- c) interrupt on terminal count
- d) no interrupt

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Answer: c

Explanation: The interrupt on the terminal count is known as mode 0 for the 8253. An initial value is loaded into the count register and then starts to count down at the frequency which is determined by the clock input. When the count reaches zero, an interrupt is generated.

6. Which determines the mode 1 in the Intel 8253?

- a) interrupt on terminal count
- b) programmable one-shot
- c) rate generator

d) square wave rate generator

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Answer: b

Explanation: Programmable one-shot is also known as mode 1 in the Intel 8253. In mode 1, a single pulse with a programmable duration is created first and then the pulse length is loaded into the counter and when the external gate signal is high, the rising edge starts the counter to count down to zero and the counter output signal goes high to start the external pulse. When the counter reaches to zero, the counter output goes low and thus the ending of the pulse.

7. Which mode of 8253 can provide pulse width modulation?

- a) programmable one-shot
- b) square wave rate generator
- c) software triggered strobe
- d) hardware triggered strobe

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Answer: a

Explanation: Mode 1 of the Intel 8253 can provide pulse width modulation for the power control where the gate is connected to a zero crossing detector or a clock source.

8. Which of the following is the mode 3 in the Intel timer 8253?

- a) rate generator
- b) hardware triggered strobe
- c) square wave rate generator
- d) software triggered strobe

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Answer: a

Explanation: The rate generator is the mode 3 in Intel 8253 timer. The square wave generator is the mode 4 and the hardware triggered strobe is the mode 5 in the Intel 8253 timer.

9. Which of the following determines the rate generation?

- a) divide by N
- b) multiply by N
- c) addition by N
- d) subtraction by N

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Answer: a

Explanation: The rate generator mode is determined by the mode 3 with the Intel 8253. It is a simple divide by N mode where N is the initial value loaded into the counter.

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10. Which mode of the Intel 8253 timer can generate a square wave?

- a) mode 1
- b) mode 2
- c) mode 3
- d) mode 4

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Answer: d

Explanation: The mode 4 is the square wave generator. This mode is similar to mode 3 except that the waveform is a square wave.

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## Embedded Systems Questions and Answers – Timer-II

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This set of Embedded Systems Questions and Answers for Campus interviews focuses on “Timer-2”.

1. Which mode of the Intel timer 8253 provides a software watchdog timer?

- a) rate generator
- b) hardware triggered strobe
- c) square wave rate generator
- d) software triggered strobe

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Answer: d

Explanation: The software triggered strobe can be used as a software-based watchdog timer in which the output is connected to a non maskable interrupt.  
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2. Which of the following mode is similar to the mode 4 of the 8253 timer?

- a) mode 5
- b) mode 6
- c) mode 0
- d) mode 1

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Answer: a

Explanation: The mode 5 or the hardware triggered strobe is similar to the mode 4 or the square wave rate generator expect that the retriggering is done by the external gate pin.

3. Which pin of 8253 is used for the generation of an external interrupt signal?

- a) OUT pin
- b) IN pin
- c) Interrupt pin
- d) Ready pin

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Answer: a

Explanation: The Intel 8253 timer has no interrupt pins. Therefore, the timer OUT pin is used to generate an external interrupt signal.

4. Which timer architecture can provide a higher resolution than Intel 8253?

- a) Intel 8253
- b) Intel 8254
- c) 8051 timer
- d) MC68230

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Answer: d

Explanation: The Intel 8253 and 8254 have same pin configuration and functions. 8051 timer is a programmable timer in the 8051 microcontroller. The MC68230 timer developed by Motorola can provide a powerful timer architecture which can provide higher resolution than the Intel 8253.

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5. How many bit architecture does MC68230 have?

- a) 16
- b) 24
- c) 32
- d) 40

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Answer: b

Explanation: The MC68230 timer have a 24-bit architecture which is split into three 8-bit components because of the 8-bit bus in the MC68000 CPU.

6. How many bit bus does MC68230 have?

- a) 2
- b) 4
- c) 8
- d) 16

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Answer: c

Explanation: The MC68230 timer have a 24-bit architecture which is split into three 8-bit components because of the 8-bit bus which is used for the communication with the host processor like MC68000 CPU which have an 8-bit architecture.

7. Which of the following is a timer processor?

- a) Intel 8253
- b) MC146818
- c) MC68332
- d) Intel 8259

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Answer: c

Explanation: Intel 8253 and 8259 are timers or counters which supports the processors. MC146818 is a real-time clock. MC68332 which is developed by Motorola is a 32 bit timer processor which can support MC68020.

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8. What is the running frequency of MC68332?

- a) 12 MHz
- b) 14 MHz
- c) 16 MHz
- d) 18 MHz

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Answer: c

Explanation: The running frequency of the MC68332 is 16 MHz.

9. Which of the following is a real time clock?

- a) MC146818
- b) 8253
- c) 8259
- d) 8254

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Answer: a

Explanation: The 8253, 8254 and 8259 are timers or counters developed by Intel whereas MC146818 is a real-time clock.

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## Embedded Systems Questions and Answers – Serial Port and Serial Peripheral Interface

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Serial Port and Serial Port Interface”.

1. Which of the following is the pin efficient method of communicating between other devices?

- a) serial port
- b) parallel port
- c) peripheral port
- d) memory port

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Answer: a

Explanation: The serial ports are considered to be the pin efficient method of communication between other devices within an embedded system.

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2. Which of the following depends the number of bits that are transferred?

- a) wait statement
- b) ready statement
- c) time
- d) counter

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Answer: c

Explanation: The time taken for the data transmission within the system depends on the clock frequency and the number of bits that are transferred.

3. Which of the following is the most commonly used buffer in the serial porting?

- a) LIFO
- b) FIFO
- c) FILO
- d) LILO

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Answer: b

Explanation: Most of the serial ports uses a FIFO buffer so that the data is not lost. The FIFO buffer is read to receive the data, that is, first in first out.

4. What does SPI stand for?

- a) serial parallel interface
- b) serial peripheral interface
- c) sequential peripheral interface
- d) sequential port interface

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Answer: b

Explanation: The serial parallel interface bus is a commonly used interface which involves master slave mechanism. The shift registers are worked as master and the slave devices are driven by a common clock.

5. Which allows the full duplex synchronous communication between the master and the slave?

- a) SPI
- b) serial port
- c) I2C
- d) parallel port

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Answer: a

Explanation: The serial peripheral interface allows the full duplex synchronous communication between the master and the slave devices. MC68HC05

6. Which of the following processor uses SPI for interfacing?

- a) 8086
- b) 8253
- c) 8254
- d) MC68HC11

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Answer: d

Explanation: The MC68HC05 and MC68HC11 microcontrollers use the serial peripheral interface for the peripheral interfacing.

7. In which register does the data is written in the master device?

- a) index register
- b) accumulator
- c) SPDR
- d) status register

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Answer: c

Explanation: The serial peripheral interface follows a master slave mechanism in which the data is written to the SPDR register in the master device and clocked out into the slave device SPDR by using a common clock signal called SCK.

8. What happens when 8 bits are transferred in the SPI?

- a) wait statement
- b) ready statement
- c) interrupt
- d) remains unchanged

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Answer: c

Explanation: The interrupts are locally generated when 8-bits are transferred so that the data can be read before the next byte is clocked through.

9. Which signal is used to select the slave in the serial peripheral interfacing?

- a) slave select
- b) master select
- c) interrupt
- d) clock signal

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Answer: a

Explanation: The slave select signal selects which slave is to receive data from the master.

10. How much time period is necessary for the slave to receive the interrupt and transfer the data?

- a) 4 clock time period
- b) 8 clock time period
- c) 16 clock time period
- d) 24 clock time period

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Answer: b

Explanation: The SPI uses an eight clock time period for the slave to receive the interrupt and transfer the data which determines the maximum data rate.

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## Embedded Systems Questions and Answers – I2C-I

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “I2C-I”.

1. What does I2C stand for?

- a) inter-IC
- b) intra-IC
- c) individual integrated chip
- d) intel IC

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Answer: a

Explanation: The I2C is known as inter-IC, which is developed by Philips for interfacing with the peripheral devices.

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2. Which company developed I2C?

- a) Intel
- b) Motorola
- c) Phillips
- d) IBM

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Answer: c

Explanation: The I2C is developed by Philips for use within the television sets.

3. Which of the following is the most known simple interface?

- a) I2C
- b) Serial port
- c) Parallel port
- d) SPI

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Answer: a

Explanation: The I2C is the most known simple interface which is used currently. It can combine both the hardware and the software protocols to provide a bus interface which helps in the communication with many peripherals.

4. Which are the two lines used in the I2C?

- a) SDA and SPDR
- b) SPDR and SCL
- c) SDA and SCL
- d) SCL and status line

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Answer: c

Explanation: The I2C bus consists of two lines which are called SDA and SCL. The master and slave devices are attached to these lines.

5. Which of the following developed P82B715?

- a) Philips
- b) Intel
- c) IBM

d) Motorola  
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Answer: a

Explanation: The special buffer chip, P82B715 for increasing the current drive is developed by Philips.  
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6. Which pin provides the reference clock for the transfer of data?

- a) SDA
- b) SCL
- c) SPDR
- d) Interrupt pin

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Answer: b

Explanation: The SCL pin can provide the reference clock for the transmission of data but it is not a free running clock.

7. Which of the following are the three hardware signals?

- a) START, STOP, ACKNOWLEDGE
- b) STOP, TERMINATE, END
- c) START, SCL, SDA
- d) STOP, SCL, SDA

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Answer: a

Explanation: The three hardware signals are START, STOP and ACKNOWLEDGE. These signals help in the transmission of data between the slave and the masters.

8. Which of the following performs the START signal?

- a) master
- b) slave
- c) CPU
- d) memory

View Answer

Answer: a

Explanation: The START signal is performed by the master by making the SCL and SDA pin high.

9. Which of the following are handshake signals?

- a) START
- b) STOP
- c) ACKNOWLEDGE
- d) START and STOP

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Answer: c

Explanation: The START signal and ACKNOWLEDGE signals are almost similar but there exhibits a small change. The START signal is initiated by the master only but the ACKNOWLEDGE signal is a handshake between both the master and slave.

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10. A packet is also referred to as

- a) postcard
- b) telegram
- c) letter
- d) data

View Answer

Answer: b

Explanation: The data is transmitted in packets with a having one or more bytes. These packets of data are also known as a telegram.

11. Which of the following byte performs the slave selection?

- a) first byte
- b) second byte
- c) terminal byte
- d) eighth byte

View Answer

Answer: a

Explanation: The slave selection is performed by using the first byte as an address byte. When the address byte is sent out all the slave devices compares the address by its own value. If there is a match, the ACKNOWLEDGE signal will be sent by the slave.

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# Embedded Systems Questions and Answers – I2C-II

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This set of Embedded Systems Questions and Answers for Experienced people focuses on “I2C-II”.

1. Which of the following indicates the type of operation that the master requests?

- a) address value
- b) initial value
- c) terminal count
- d) first byte

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Answer: a

Explanation: The address value helps the master to select the device and indicates what operation should be taken. If the 8th bit is logic one, read operation takes out and if it is logic zero, write operation takes out.

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2. How can both single byte and the double byte address slave use the same bus?

- a) extended memory
- b) extended address
- c) peripheral count
- d) slave bus

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Answer: b

Explanation: For providing more addressing, an extended address is developed which possesses two bytes in which the first byte uses a special code to distinguish it from a single byte address so that the single byte and double byte address slaves can use a shared bus.

3. Which counter selects the next register in the I2C?

- a) auto-incrementing counter
- b) decrementing counter
- c) auto-decrementing counter
- d) terminal counter

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Answer: a

Explanation: The peripheral having a small number of locations can use auto-incrementing counter for accessing the next register. But this will not be applicable in bigger memory devices.

4. Which is an efficient method for the EEPROM?

- a) combined format
- b) auto-incrementing counter
- c) register set
- d) single format

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Answer: a

Explanation: Combined format is an efficient method for the EEPROM because it is having a large number of registers.

5. Which of the following uses two data transfers?

- a) auto-incrementing counter
- b) auto-decrementing counter
- c) combined format
- d) single format

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Answer: c

Explanation: The EEPROM is having a large number of registers, so auto incrementing counter will not be applicable. So there is an alternative method which uses index value that is written to the chip, prior to accessing the data. This is called combined format and this combined format uses two data transfer. One is to write the data and the other is to read.

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6. Which of the following is efficient for the small number of registers?

- a) auto-incrementing counter
- b) auto-decrementing counter
- c) combined format
- d) single format

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Answer: a

Explanation: The peripherals which have a small number of locations can use auto-increment counter within the peripheral in which each access selects the next register.

7. Which can determine the timeout value?

- a) polling
- b) timer
- c) combined format
- d) watchdog timer

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Answer: a

Explanation: The polling can be used along with the counter to determine the timeout value.

8. How is bus lockup avoided?

- a) timer and polling
- b) combined format
- c) terminal counter
- d) counter

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Answer: a

Explanation: The timeout value can be changed by the peripheral devices, so for a sophisticated system a combination of polling and timer is used to check for the signal n times within a predefined interval. This can avoid the bus lock.

9. Which of the following can determine if two masters start to use the bus at the same time?

- a) counter detect
- b) collision detect
- c) combined format
- d) auto-incremental counter

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Answer: b

Explanation: The collision detects technique helps to determine whether two or more masters are using the same bus in a multi-master device.

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10. Which ports are used in the multi-master system to avoid errors?

- a) unidirectional port
- b) bidirectional port
- c) multi directional port
- d) tridirectional port

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Answer: b

Explanation: By using the bidirectional ports, each master can monitor the line and confirm its expected state and if it is not matched, a mismatch or collision had occurred which will discontinue the transmission by the master.

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## Embedded Systems Questions and Answers – RS232

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “RS232”.

1. Which of the following can be used for long distance communication?

- a) I2C
- b) Parallel port
- c) SPI
- d) RS232

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Answer: d

Explanation: A slightly different serial port called RS232 is used for long distance communication, otherwise the clock may get skewed. The low voltage signal also affects the long distance communication.

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2. Which of the following can affect the long distance communication?

- a) clock
- b) resistor
- c) inductor
- d) capacitor

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Answer: a

Explanation: For small distance communication, the clock signal which allows a synchronous transmission of data is more than enough, and the low voltage

signal of TTL or CMOS is sufficient for the operation. But for long distance communication, the clock signal may get skewed and the low voltage can be affected by the cable capacitance. So for long distance communication RS232 can be used.

3. Which are the serial ports of the IBM PC?

- a) COM1
- b) COM4 and COM1
- c) COM1 and COM2
- d) COM3

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Answer: c

Explanation: The IBM PC has one or two serial ports called the COM1 and the COM2, which are used for the data transmission between the PC and many other peripheral units like a printer, modem etc.

4. Which of the following can provide hardware handshaking?

- a) RS232
- b) Parallel port
- c) Counter
- d) Timer

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Answer: a

Explanation: In RS232, several lines are used for transmitting and receiving data and these also provide control for the hardware handshaking.

5. Which of the following have an asynchronous data transmission?

- a) SPI
- b) RS232
- c) Parallel port
- d) I2C

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Answer: b

Explanation: The data is transmitted asynchronously in RS232 which enhance long distance communication, whereas SPI, I2C offers short distance communication, and therefore, they are using synchronous data transmission.

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6. How many areas does the serial interface have?

- a) 1
- b) 3
- c) 2
- d) 4

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Answer: c

Explanation: The serial interface is divided into two, physical interface and the electrical interface.

7. The RS232 is also known as

- a) UART
- b) SPI
- c) Physical interface
- d) Electrical interface

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Answer: d

Explanation: The RS232 is also known as the physical interface and it is also known as EIA232.

8. How much voltage does the MC1489 can take?

- a) 12V
- b) 5V
- c) 3.3V
- d) 2.2V

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Answer: b

Explanation: The MC1489 is an interface chip which can take a 5V and generate internally the other voltages which are needed to meet the interface specification.

9. Which of the following is not a serial protocol?

- a) SPI
- b) I2C
- c) Serial port
- d) RS232

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Answer: d

Explanation: The RS232 is a physical interface. It does not follow the serial protocol.

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10. Which of the following is an ideal interface for LCD controllers?

- a) SPI
- b) parallel port
- c) Serial port
- d) M-Bus

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Answer: d

Explanation: M-Bus or Motorola Bus is an ideal interface for LCD controllers, A/D converters, EEPROMs and many other components which can benefit faster transmission.

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## Embedded Systems Questions and Answers – UART

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “UART”.

1. What does UART stand for?

- a) universal asynchronous receiver transmitter
- b) unique asynchronous receiver transmitter
- c) universal address receiver transmitter
- d) unique address receiver transmitter

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Answer: a

Explanation: The UART or universal asynchronous receiver transmitter is used for the data transmission at a predefined speed or baud rate.

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2. How is data detected in a UART?

- a) counter
- b) timer

- c) clock
- d) first bit

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Answer: c

Explanation: The data can be detected by the local clock reference which is generated from the baud rate generator.

3. Which of the signal is set to one, if no data is transmitted?

- a) READY
- b) START
- c) STOP
- d) TXD

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Answer: d

Explanation: The TXD signal goes to logic one when no data is transmitted. When data transmit, it sets to logic zero.

4. What rate can define the timing in the UART?

- a) bit rate
- b) baud rate
- c) speed rate
- d) voltage rate

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Answer: b

Explanation: The timing is defined by the baud rate in which both the transmitter and receiver are used. The baud rate is supplied by the counter or an external timer called baud rate generator which generates a clock signal.

5. How is the baud rate supplied?

- a) baud rate voltage
- b) external timer
- c) peripheral
- d) internal timer

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Answer: b

Explanation: The baud rate is supplied by the counter or an external timer called baud rate generator which generates a clock signal.

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6. Which is the most commonly used UART?

- a) 8253
- b) 8254
- c) 8259
- d) 8250

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Answer: d

Explanation: The Intel 8253, 8254 and 8259 are timers whereas Intel 8250 is a UART which is commonly used.

7. Which company developed 16450?

- a) Philips
- b) Intel
- c) National semiconductor
- d) IBM

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Answer: c

Explanation: The Intel 8250 is replaced by the 16450 and 16550 which are developed by the National Semiconductors. 16450 is a chip which can combine all the PC's input output devices into a single piece of silicon.

8. What does ADS indicate in 8250 UART?

- a) address signal
- b) address terminal signal
- c) address strobe signal
- d) address generating signal

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Answer: c

Explanation: The ADS is address strobe signal and is working as active low in 8250 UART. The ADS signal is used to latch the address and chip select signals while processor access.

9. Which of the following signals are active low in the 8250 UART?

- a) BAUDOUT
- b) DDIS
- c) INTR

d) MR

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Answer: a

Explanation: The BAUDOUT signal is active low whereas DDIS, INTR and MR are active high in the 8250 UART. BAUDOUT is the clock signal from the transmitter part of the UART. DDIS signal goes low when the CPU is reading data from the UART. INTR is the interrupt pin. MR is the master reset pin.

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10. Which of the signal can control bus arbitration logic in 8250?

- a) MR
- b) DDIS
- c) INTR
- d) RCLK

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Answer: b

Explanation: DDIS signal goes low when the CPU is reading data from the UART and it also controls the bus arbitration logic.

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## Embedded Systems Questions and Answers – UART-2

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This set of Embedded Systems Questions and Answers for Entrance exams focuses on “UART-2”.

1. Which of the following is used to reset the device in 8250?

- a) MR
- b) DDIS
- c) INTR
- d) RCLK

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Answer: a

Explanation: MR is the master reset pin which helps to reset the device and restore the internal registers.  
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2. Which provides an input clock for the receiver part of the UART 8250?

- a) RD
- b) RCLK
- c) MR
- d) DDIS

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Answer: b

Explanation: RCLK provides an input clock for the receiver part of the UART. RD is the read signal. MR is the master reset pin and DDIS is used to control bus arbitration logic.

3. Which of the following is a general purpose I/O pin?

- a) OUT1
- b) RD
- c) ADS
- d) MR

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Answer: a

Explanation: There are two general purposes I/O pin OUT1 and OUT2. OUT1 is set by the programming bit 2 of the MCR to a '1' whereas OUT2 is set by the programming bit 3 of the MCR to '1'. These are active low pins in 8250.

4. Which of the following indicate the type of access that the CPU needs to perform?

- a) MR
- b) RD
- c) ADS
- d) RCLK

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Answer: b

Explanation: RD and WR signals are indicating the type of access that the CPU needs to perform, that is, whether it is a read cycle or write cycle.

5. Which pins are used for additional DMA control?

- a) RXRDY
- b) RD
- c) MR
- d) INR

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Answer: a

Explanation: The RXRDY and TXRDY are two active low pins which are used for additional DMA control. It can be used for DMA transfers to and from the read and write buffers.

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6. Which of the following are not used within the IBM PC?

- a) TXRDY
- b) BAUDOUT
- c) ADS
- d) OUT2

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Answer: a

Explanation: The CPU is responsible for moving data to and from the UART in the IBM PC, therefore it does not have TXRDY and RXRDY pins which are used for DMA accessing.

7. Which pins are used to connect an external crystal?

- a) INR
- b) ADS
- c) XIN
- d) SIN

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Answer: c

Explanation: The XIN and XOUT pins are used to connect an external crystal. These pins can also connect an external clock.

8. Which UART is used in MC680 by 0 design?

- a) Intel 8250
- b) 16450
- c) 16550
- d) MC68681

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Answer: d  
Explanation: The MC68681 is a standard UART developed by Motorola. It has been used in many MC680 by 0 designs.

9. Which of the following have large FIFO buffer?

- a) 8253
- b) 8250
- c) 16550
- d) 16450

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Answer: c

Explanation: The largest buffer of 16 bytes is available on 16550 UART which is used for high speed data communications.

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10. Which of the following has a quadruple buffered receiver and a double buffered transmitter?

- a) Intel 8250
- b) 16450
- c) 16550
- d) MC68681

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Answer: d

Explanation: The MC68681 is a standard UART developed by Motorola. It possess a quadruple buffered receiver and a double buffered transmitter.

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# Embedded Systems Questions and Answers – Asynchronous Flow Control

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Asynchronous Flow Control”.

1. Which can prevent the terminal of data transmission?

- a) flow control
- b) increasing flow
- c) increasing count
- d) terminal count

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Answer: a

Explanation: The flow control can prevent data transmission. It can also prevent the computer from sending more data than the other can cope with.

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2. Which of the following is the first flow control method?

- a) software handshaking
- b) hardware handshaking
- c) UART
- d) SPI

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Answer: b

Explanation: The first flow control method is the hardware handshaking in which the hardware in the UART detects the potential overrun and it will assert a handshake line to tell the other UART to stop the transmission.

3. Which one of the following is the second method for flow controlling?

- a) hardware
- b) peripheral
- c) software
- d) memory

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Answer: c

Explanation: In the first method of flow control, there is a chance of data loss. So the second method of the flow control is adopted in which it uses software to send characters XON and XOFF. XOFF can stop the data transfer and XON can restart the data transfer.

4. Which can restart the data transmission?

- a) XON
- b) XOFF
- c) XRST
- d) restart button

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Answer: a

Explanation: The second method of flow control is called software which is based on certain characters called XON and XOFF. XOFF can stop the data transfer and XON can restart the data transfer.

5. Which of the following is a common connector?

- a) UART
- b) SPI
- c) I2C
- d) DB-25

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Answer: d

Explanation: There are two connectors which are used very commonly. They are DB-25 and DB-9 which has 25 pins and 9 pins respectively.

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6. What does pin 22 in DB-25 indicate?

- a) transmit data
- b) receive data
- c) ring indicator
- d) signal ground

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Answer: c

Explanation: The 22nd pin in DB-25 and the 9th pin in the DB-9 indicates a ring indicator which is asserted when a connected modem has detected an incoming call.

7. Which pin indicates the DSR in DB-25?

- a) 1
- b) 2
- c) 4
- d) 6

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Answer: d

Explanation: The 6th pin in DB-25 indicates DSR, that is, data set ready which indicates that each side is powered on and is ready to access data.

8. Which of the following connections are one to one?

- a) Modem cables
- b) SPI
- c) UART
- d) I2C

[View Answer](#)

Answer: a

Explanation: The modem cables are straight cables which allow one to one connections without crossover.

9. Which of the following are used to link PCs?

- a) modem cable
- b) null modem cable
- c) serial port
- d) parallel port

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Answer: b

Explanation: The modem cables are used to link PC with other peripherals like printers, plotters, modems etc. But it cannot link with other PCs. So an alternative method is adopted to link PCs which is called null modem cable.

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10. Which of the following method is used by Apple Macintosh?

- a) hardware handshaking
- b) software handshaking
- c) no handshaking
- d) null modem cable

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Answer: b

Explanation: The Apple Macintosh and UNIX use software handshaking for the data transmission where the characters are sent to control the flow of characters between two systems.

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# Embedded Systems Questions and Answers – DMA

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “DMA”.

1. Which of the following provides an efficient method for transferring data from a peripheral to memory?

- a) dma controller
- b) serial port
- c) parallel port
- d) dual port

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Answer: a

Explanation: The DMA controllers or direct memory access controller provides an efficient method for transferring data from the peripheral to the memory.  
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2. Which of the following can be adopted for the systems which does not contain DMA controller for data transmission?

- a) counter
- b) timer
- c) polling
- d) memory

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Answer: c

Explanation: The polling and interrupt helps for data transmission for the systems which do not have DMA controller.

3. Which of the following have low-level buffer filling?

- a) output
- b) peripheral
- c) dma controller
- d) input

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Answer: c

Explanation: The DMA controller can initiate and control the bus access between I/O devices and memory, and also between two different memory areas. Therefore, the DMA controller can act as a hardware implementation of low-level buffer filling or emptying the interrupt.

4. How many classifications of DMA controllers are made based on the addressing capability?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: b

Explanation: There are three classifications for the DMA controllers based on the address capability. These are 1D, 2D and 3D.

5. How many address register are there for the 1D type DMA controller?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: a

Explanation: The 1D controller only have a single address register whereas 2D controller have two address register and 3D controller have three or more address register.

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6. Which of the following of a generic DMA controller contain a base address register and an auto-incrementing counter?

- a) address bus
- b) data bus
- c) bus requester
- d) address generator

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Answer: d

Explanation: The generic controller have several components associated with it for controlling the operation and one such is the address generator. It consists of the base address register and an auto-incrementing counter which increment the address after every transfer.

7. Which of the following is used to transfer the data from the DMA controller to the destination?

- a) data bus
- b) address bus
- c) request bus

d) interrupt signal  
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Answer: a

Explanation: The data bus is used for the transmission of data from the DMA controller to the destinal. The DMA controller can directly select the peripheral in some cases in which the data transfer is made from the peripheral to the memory.

8. Which of the following is used to request the bus from the main CPU?

- a) data bus
- b) address bus
- c) bus requester
- d) interrupt signal

View Answer

Answer: c

Explanation: The bus requester requests the bus from the main CPU. In earlier design, the processor bus does not support the multi master system and there were no bus request signals. In such cases, the processor clock was extended.

9. Which signal can identify the error?

- a) data bus
- b) address bus
- c) bus requester
- d) interrupt signal

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Answer: d

Explanation: The interrupt signal can identify the error occurred in the DMA controller. This makes the processor to reprogram the DMA controller for a different transfer.

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10. Which signal allows the DMA controller to select the peripheral?

- a) local peripheral control
- b) global peripheral control
- c) address bus
- d) data bus

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Answer: a

Explanation: The local peripheral control allows the DMA controller to select the peripheral.

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## Embedded Systems Questions and Answers – DMA-II

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This set of Embedded Systems Interview Questions and Answers for Experienced people focuses on " DMA-II".

1. Which of the following is also known as implicit address?

- a) dual address model
- b) single address model
- c) 1D model
- d) 2D model

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Answer: b

Explanation: The single address model is also known as implicit model because the second address is implied and is not directly given, that is, the source address is not supplied.

2. Which address mode uses two addresses and two accesses to transfer the data between the peripheral and the memory?

- a) dual address model
- b) 1D model
- c) 2D model
- d) 3D model

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Answer: a

Explanation: The dual address mode supports two addresses and two accesses for transferring data between a peripheral or memory and another memory location.

3. Which of the following address mode uses a buffer to hold data temporarily?

- a) 1D model
- b) 2D model
- c) dual address model
- d) 3D model

[View Answer](#)

Answer: c

Explanation: The dual address mode supports two addresses and two accesses for transferring data between a peripheral or memory and another memory location, which also consumes two bus cycles and a buffer within the DMA controller to hold data temporarily.

4. Which of the following model can implement a circular buffer?

- a) dual address mode
- b) 1D model
- c) 2D model
- d) 3D model

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Answer: b

Explanation: The 1D model can implement a circular buffer which makes an automatic reset to bring the address back to the beginning.

5. Which of the following uses an address and a counter to define the sequence of addresses?

- a) dual address mode
- b) 2D model
- c) 1D model
- d) 3D model

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Answer: c

Explanation: The 1D model of the DMA controller uses an address location and a counter to define the address sequence which is used during the DMA cycles.

6. Which of the following is used to calculate an offset to base address?

- a) single address mode
- b) dual address mode
- c) 1D model
- d) 2D model

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Answer: d

Explanation: An address stride is specified which can be used for calculating the offset to the base address at the terminal of count. This address stride is used in the 2D model of the DMA controller.

7. Which can provide an address stride?

- a) single address mode
- b) dual address mode
- c) 1D model
- d) 2D model

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Answer: d

Explanation: In the 2D model of the DMA controller, an address stride is specified which can be used for calculating the offset to the base address at the terminal of count.

8. How is the count register can be splitted?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: a

Explanation: In the 2D model of the DMA controller, in addition to the address stride there is a count register which can be split into two, in which one register is used to specify the count for the block and the second register is used to define the total number of blocks or the bytes to be transferred.

9. Which of the following has the ability to change the stride automatically?

- a) 1D model
- b) 2D model
- c) 3D model
- d) dual address mode

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Answer: c

Explanation: In the 3D model of the DMA controller, it have the ability to change the address stride automatically so that blocks of different sizes and stride can be created.

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10. Which is used to prioritise multiple requests?

- a) dual address mode
- b) single address mode
- c) arbitration
- d) chaining

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Answer: c

Explanation: The arbitration is used to provide priority for multiple access. This uses a priority scheme which may offer fair priority to the one channel, or a high priority to the other channel and so on. Such condition is otherwise known as round-robin condition in which the priority is equally divided.

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## Embedded Systems Questions and Answers – Implementation of DMA

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Implementation of DMA”.

1. Which of the following DMA is used in the IBM PC?

- a) Intel 8253
- b) Intel 8254
- c) Intel 8237
- d) Intel 8259

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Answer: c

Explanation: The Intel 8237 is the DMA used in the IBM PC. 8253, 8254 and 8259 are timers developed by Intel.

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2. Which of the following have four transfer modes?

- a) Intel 8253
- b) Intel 8254
- c) Intel 8259
- d) Intel 8237

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Answer: d

Explanation: The Intel 8237 have four transfer modes. These are single mode, block transfer mode, demand mode and cascade mode.

3. Identify the additional transfer mode in the Intel 8237?

- a) single transfer mode
- b) demand transfer mode
- c) verify transfer mode
- d) block transfer mode

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Answer: c

Explanation: In addition to the four main transfer mode, there is a verify transfer mode which is used within the PC to create dummy addresses which are used for refreshing the DRAM.

4. Which of the following transfer mode can refresh the DRAM memory?

- a) verify transfer mode
- b) block transfer mode
- c) demand transfer mode
- d) cascade mode

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Answer: a

Explanation: The verify address transfer mode can generate dummy addresses which are used for the DRAM refreshing.

5. Which of the following is used for supporting the priority scheme?

- a) address transfer mode
- b) arbitration
- c) counter
- d) timer

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Answer: b

Explanation: The arbitration is used for providing priority to the DMA requests. The DMA request is simultaneously generating, so in order to avoid the errors,

6. Which of the following consist of a fully programmable DMA controller of two channels?

- a) MC68300
- b) Intel 8237
- c) Intel 8253
- d) Intel 8254

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Answer: a

Explanation: The MC68300 is developed by Motorola, which consists of a two channel fully programmable DMA controller which can support high speed data transfer.

7. Which cycle can support the burst and single transfer mode?

- a) internal
- b) external
- c) both internal and external
- d) address cycle

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Answer: b

Explanation: The internal cycles can be programmed to occupy the partial or complete fulfillment of the available internal bus bandwidth while the external cycles provides support to the single transfer modes and burst mode.

8. Which of the following requires its own local memory and program?

- a) DMA controller
- b) DMA address
- c) DMA CPU
- d) DMA peripheral

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Answer: c

Explanation: The DMA CPU has its own address local memory and program so that it will not harm main memory bus and it is completely isolated.

9. Which DMA is programmed with higher level software?

- a) DMA controller
- b) DMA address
- c) DMA peripheral
- d) DMA CPU

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Answer: d

Explanation: The DMA CPU is programmed with higher level software which is used to transfer the data and for processing it.

10. Which of the following combine an MC68000/MC68020 type of processor with peripheral and DMA controllers?

- a) Intel 8237
- b) Intel 8253
- c) MC68300
- d) MC68000

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Answer: c

Explanation: The MC68300 combines the processors along with the DMA controllers. The processors which support the MC68300 series are MC68000 or MC68020.

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## Embedded Systems Questions and Answers – Errors of ADC Technique

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Errors of ADC technique”.

1. Which signal is sampled at regular intervals for the purpose of ADC?
  - a) analog signal
  - b) digital signal
  - c) quantised signal
  - d) sampled signal

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Answer: a

Explanation: The analog signal is sampled at regular intervals for the analog to digital conversion. Each sample is then quantised to divided by a given value in order to identify the number of approximate analogue value.

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2. Which factor depends on the quantisation error?
  - a) number of error
  - b) number of bits
  - c) size of error
  - d) conversion process

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Answer: b

Explanation: The quantisation error depends on the number of bits which is used to represent the analogue vale.

3. Which is the first type of error caused during the conversion process?
  - a) sampling error
  - b) interrupt signal
  - c) counter error
  - d) quantisation error

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Answer: d

Explanation: The quantisation error is the first type of error caused in the conversion process. This error is caused because the samples are converted to a slightly higher value instead of zero.

4. Which of the following defines the number of samples that are taken in the time period?
  - a) sample size
  - b) sample nature
  - c) sample rate
  - d) sample frequency

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Answer: c

Explanation: The sample rate is defined by the number of samples that are taken in a time period. The sample rate is usually measured in Hertz. It can determine the speed of the conversion device itself.

5. Which of the following can determine the speed of conversion device itself?
  - a) sample rate

- b) sampled data
- c) sample size
- d) sample nature

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**Answer:** a

**Explanation:** The sample rate determines the various aspect of the conversion process and one such is the conversion speed.

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6. Which of the following can determine the maximum frequency that can be converted?

- a) sample frequency
- b) sample rate
- c) sample size
- d) sample nature

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**Answer:** b

**Explanation:** The sample rate can determine the maximum frequency that can be converted as per the Nyquist theorem. The theorem states that the minimum sampling rate frequency should be twice the maximum frequency of the analog signal.

7. Which term determines the random timing error?

- a) jitter
- b) quantisation error
- c) sample error
- d) delay

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**Answer:** a

**Explanation:** Jitter is a random timing error. Jitter can cause irregular sampling errors.

8. Which of the following introduce a phase error?

- a) conversion time
- b) sampling rate
- c) sample size
- d) sample nature

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**Answer:** a

**Explanation:** The conversion time always introduces a phase error. The conversion time will delay the digital output and hence introduce a phase error.

9. Which of the following can generate an interrupt?

- a) timer
- b) trigger
- c) delay
- d) counter

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**Answer:** a

**Explanation:** The timer can generate an interrupt to the processor at the rate of sampling frequency.

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10. Which filter is used for filtering out the high frequency components?

- a) bandpass filter
- b) band reject filter
- c) analogue filter
- d) digital filter

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**Answer:** c

**Explanation:** The higher frequency components can be filtered out by using an analog filter after sampling.

11. Which theorem describes the sampling rate with the frequency of the analogue signal?

- a) Nyquist theorem
- b) Bayes theorem
- c) Sampling theorem
- d) Parseval's theorem

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**Answer:** a

**Explanation:** The Nyquist theorem states that the minimum sampling rate frequency should be twice the maximum frequency of the analog signal.

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# Embedded Systems Questions and Answers – Codecs

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Codecs”.

1. From which of the following words does codecs is derived?

- a) coder
- b) decoder
- c) coder-decoder
- d) coder-encoder

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Answer: c

Explanation: The codec is derived coder-decoder and is coupled to perform the coding. It can support both analogue to digital conversion and digital to analogue conversion.

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2. Which codec is used in digital audio?

- a) A-law
- b)  $\mu$ -law
- c) linear
- d) PCM

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Answer: c

Explanation: In the linear codec, the relationship between the analogue and digital values are linear. This method is commonly used in digital audio communication.

3. Which of the following have the same quantisation step throughout the range?

- a) linear
- b) PCM
- c) DPCM
- d) ADPCM

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Answer: a

Explanation: The quantisation step is same throughout the dynamic range in the linear codec and thus any increase in the analogue value increases the digital value, that is, the overall performance is linear.

4. Which is used in the telecommunication applications which has a limited bandwidth of 300 to 3100 HZ?

- a) linear codec
- b) logarithmic codec
- c) PCM
- d) DPCM

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Answer: b

Explanation: The logarithmic codec is frequently used in the telecommunication system which have a limited bandwidth of 300 to 3100 Hz. this can provide an 8-bit sample at 8 KHz, which are used in the telephones. The commonly used are A-law and  $\mu$ -law.

5. Which codec is used in the UK?

- a) a-law
- b)  $\mu$ -law
- c) linear codec
- d) PCM

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Answer: a

Explanation: The a-law is a logarithmic codec which is commonly used in the UK whereas  $\mu$ -law is used in the US.  
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6. What does PCM stand for?

- a) pulse codec machine
- b) pulse code modulation
- c) peripheral code machine
- d) peculiar code modulation

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Answer: b

Explanation: The linear codec is also known as pulse code modulation which is commonly used in the telecommunications industry.

7. Which of the following conversion is performed by using a lookup table?

- a) DPCM
- b) ADPCM
- c) Between DPCM and ADPCM
- d) Linear cdec and a-law

[View Answer](#)

Answer: d

Explanation: The conversion between a-law/ $\mu$ -law and a linear digital signal or between  $\mu$ -law and a-law is performed by a lookup table.

8. What does DPCM stand for?

- a) differential pulse code modulation
- b) data pulse code modulation
- c) dynamic pulse code machine
- d) dynamic pulse code modulation

[View Answer](#)

Answer: a

Explanation: The differential pulse code modulation is similar to pulse code modulation, but DPCM uses an encoded value which is the difference between the current and the previous sample.

9. Which of the following have a 16-bit digital dynamic range?

- a) PCM
- b) DPCM
- c) linear codec
- d) logarithmic codec

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Answer: b

Explanation: The differential pulse code modulation can improve the accuracy and resolution by having a 16-bit dynamic range. It works by the increasing dynamic range.

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10. How many types of logarithmic codecs are used commonly?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: a

Explanation: There are two types of logarithmic codec which are commonly used. They are a-law which is used in UK and  $\mu$ -law codec which is used in the US.

11. What does ADPCM stand for?

- a) address differential pulse code modulation
- b) adaptive differential pulse code modulation
- c) address dynamic pulse code machine
- d) adaptive dynamic pulse code modulation

[View Answer](#)

Answer: b

Explanation: The adaptive differential pulse code modulation is used in telecommunications and is based on non-linear quantisation values.

12. Which of the following uses a non-linear quantisation value?

- a) PCM
- b) DPCM
- c) ADPCM
- d) linear codec

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Answer: c

Explanation: The adaptive differential pulse code modulation is based on non-linear quantisation values. In the ADPCM, instead of using all bit for encoding, only a few bits are used for encoding which makes it non linear.

13. Which of the following works by increasing the dynamic range?

- a) logarithmic codec
- b) linear codec
- c) DPCM
- d) PCM

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Answer: c

Explanation: The differential pulse code modulation can improve the accuracy and resolution by having a 16-bit dynamic range. It works by the increasing dynamic range.

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14. Which device can make the PWM operation easier?

- a) timer
- b) software
- c) hardware
- d) transistor

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Answer: a

Explanation: The timer can be used for making up the PWM waveform far more easier and faster and it will free the processor to do other things without affecting the timing.

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## Embedded Systems Questions and Answers – Power Controls

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1. Which of the following can be used for providing high gain?

- a) transistor
- b) darlington transistor pair
- c) resistor
- d) capacitor

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Answer: b

Explanation: The darlington pair of transistors can provide high gain than a single transistor. This is one of the method used to avoid voltage mismatches that the system produces. By using high gain transistors the voltage mismatches can be reduced upto a limit.

2. Which devices have high drive capability?

- a) transistor
- b) fet
- c) buffer pack
- d) darlington amplifier

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Answer: c

Explanation: The buffer pack is used to avoid the voltage mismatches which possesses a high drive capacity and it can also provide high drive currents than the normal logic outputs.

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3. Which of the following is used to switch heavy loads?

- a) fet
- b) transistor
- c) buffer pack
- d) darlington pair

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Answer: a

Explanation: The field effect transistor can be used to provide a very high effective gain and hence they can be used to switch heavy loads easily from a logic device. These are also voltage controlled transistors.

4. Which allows the switching of DC motor by using two outputs and four FETs?

- a) transistor
- b) H bridge
- c) darlington pair
- d) buffer pack

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Answer: b

Explanation: The H bridge can be created by using several switches which allows a DC motor to be switched on and reversed in the direction. The switching can be done by using two outputs and four FETs.

5. Which of the following is used to create H bridge?

- a) switches
- b) led
- c) capacitor
- d) inductor

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Answer: a

Explanation: The H bridge can be created by using several switches. This allows a DC motor to be switched on and reversed in the direction and the switching

of DC motor can be done by using two outputs and four FETs.

6. Which of the following allows voltage reversing?

- a) H bridge
- b) Relays
- c) LEDs
- d) LCDs

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Answer: a

Explanation: The H bridge is used in controlling DC motors or any other loads which need voltage reversing.

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7. Which devices are used as indicators in a digital system?

- a) LCD
- b) LED
- c) Varactor diode
- d) Gunn diode

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Answer: b

Explanation: The light emitting diodes are used as indicators in the digital system and can be directly driven from a logic output.

8. How is the biasing done in LEDs?

- a) forward bias
- b) no bias
- c) supply voltage
- d) reverse bias

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Answer: d

Explanation: The LEDs will light up only when the diode reverse breakdown is achieved. It is usually about 2 to 2.2V.

9. Which of the following determines the brightness of LEDs?

- a) current
- b) voltage
- c) resistance
- d) conductance

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Answer: a

Explanation: The current drive determines the brightness of the LEDs and it is usually associated with a current limiting resistor in series with the LED to prevent the overheating.

10. Which of the following is a current limiting device?

- a) voltage
- b) current
- c) buffer
- d) inductor

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Answer: c

Explanation: A buffer can be used as a current limiting device. Similarly, a transistor can also be used as a current limiting device.

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11. Which of the following can switch the current by a make or break contact?

- a) transistor
- b) relay
- c) buffer
- d) fet

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Answer: b

Explanation: The relays are a kind of switching power in which the logic signal is used to energise the relay. The relay contacts are break or make accordingly and helps in switching the current.

12. Which of the following generates a back EMF?

- a) relay
- b) buffer
- c) transistor
- d) FET

[View Answer](#)

Answer: a

Explanation: The relay generates a back voltage across its terminals when the logic output switches from a high to low state.

13. Which of the following is used to avoid the back EMF in the relay?

- a) resistor
- b) capacitor
- c) inductor
- d) diode

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Answer:

Explanation: In order to get rid of the back EMF which is generated by the relay a diode is connected across the terminals which operate in the reverse bias so that nothing can harm the relay.

14. Which of the following can provide a speed control technique in the DC motor interfacing?

- a) PCM
- b) DPCM
- c) ADPCM
- d) PWM

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Answer: d

Explanation: The pulse width modulation can provide a speed control technique in the DC motor interfacing by changing its mark/space ratio.

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15. Which of the following possesses some loops for providing timing functions?

- a) hardware
- b) software
- c) timer
- d) counter

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Answer: b

Explanation: In the software system, certain loops perform the timing functions. A program is created to switch the motor on and it will start counting through a delay loop. When the count is finished, the motor is switched off. In the second delay loop, it can determine the motor-off period.

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# Embedded Systems Questions and Answers – Introduction of Interrupts

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Introduction of Interrupts”.

1. The time taken to respond to an interrupt is known as

- a) interrupt delay
- b) interrupt time
- c) interrupt latency
- d) interrupt function

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Answer: c

Explanation: The interrupts are the most important function of the embedded system and are responsible for many problems while debugging the system. The time taken to respond to an interrupt is called the interrupt latency.

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2. Into how many parts does the interrupt can split the software?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: a

Explanation: The software interrupt can split into two parts. These are foreground work and background work.

3. Which of the following allows the splitting of the software?

- a) wait statement
- b) ready
- c) interrupt
- d) acknowledgement

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Answer: c

Explanation: The interrupt can make the software into two main parts and these are foreground work and background work.

4. Which part of the software is transparent to the interrupt mechanism?

- a) background
- b) foreground
- c) both background and foreground
- d) lateral ground

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Answer: a

Explanation: The interrupt mechanism is transparent to the background software, that is, the background software is not aware of the existence of the foreground software.

5. Which part of the software performs tasks in response to the interrupts?

- a) background
- b) foreground
- c) lateral ground
- d) both foreground and background

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Answer: b

Explanation: In the foreground work, the tasks are performed in response to the interrupts but in the background work, the tasks are performed while waiting for an interrupt.

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6. In which of the following method does the code is written in a straight sequence?

- a) method 1
- b) timing method
- c) sequence method
- d) spaghetti method

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Answer: d

Explanation: In the spaghetti method, the code is written in a straight sequence in which the analysis software goes and polls the port to see if there is data.

7. Which factor depends on the number of times of polling the port while executing the task?

- a) data
- b) data transfer rate
- c) data size

d) number of bits  
View Answer

Answer: b

Explanation: The data transfer rate can determine the number of times the port is polled while executing the task.

8. Which of the following can improve the quality and the structure of a code?

- a) polling
- b) subroutine
- c) sequential code
- d) concurrent code

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Answer: b

Explanation: The subroutine can improve the quality and the structure of the code. By using the polling method, as the complexity increases the software structure rapidly fall and it will become inefficient. So the subroutine method is adopted.

9. Which of the following are asynchronous to the operation?

- a) interrupts
- b) software
- c) DMA
- d) memory

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Answer: a

Explanation: The interrupts are asynchronous to the operation and therefore can be used with systems that are the event as opposed to the time driven.  
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10. Which of the following can be used to create time-driven systems?

- a) memory
- b) input
- c) output
- d) interrupts

View Answer

Answer: d

Explanation: The interrupts which are asynchronous can be used with systems that are the event as opposed to the time driven.

11. What does ISR stand for?

- a) interrupt standard routine
- b) interrupt service routine
- c) interrupt software routine
- d) interrupt synchronous routine

View Answer

Answer: b

Explanation: The data transfer codes are written as part of the interrupt service routine which is associated with the interrupt generation by the hardware.

12. Which can activate the ISR?

- a) interrupt
- b) function
- c) procedure
- d) structure

View Answer

Answer: a

Explanation: When the port receives the data, it will generate an interrupt which in turn activates the ISR.

13. Which code is written as part of the ISR?

- a) data receive code
- b) sequential code
- c) data transfer code
- d) concurrent code

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Answer: c

Explanation: The data transfer codes are written as part of the interrupt service routine which is associated with the interrupt generation by the hardware.  
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## Embedded Systems Questions and Answers – Sources of Interrupts

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Sources of Interrupts”.

1. Which interrupts are generated by the on-chip peripherals?

- a) internal
- b) external
- c) software
- d) hardware

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Answer: a

Explanation: The internal interrupts are generated by the serial and parallel ports which are on-chip peripherals.

2. Which of the following is the common method for connecting the peripheral to the processor?

- a) internal interrupts
- b) external interrupts
- c) software
- d) exception

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Answer: b

Explanation: The common method for connecting the peripheral to the processor is the external interrupts. The external interrupts are provided through the external pins which are connected to the peripherals.

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3. Which interrupt can make a change in the processor’s mode?

- a) internal interrupt
- b) external interrupts
- c) exceptions
- d) software mode

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Answer: c

Explanation: An exception is an event which changes the software flow to process the event. It includes both internal and external interrupts which cause the processor to change to a service routine.

4. How many exceptions does an MC68000 have?

- a) 256
- b) 128
- c) 90
- d) 70

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Answer: c

Explanation: The MC68000 have 256 table entries which describe 90 exceptions.

5. Which interrupts allows a protected state?

- a) internal interrupt
- b) external interrupt
- c) software interrupt
- d) both internal and external interrupts

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Answer: c

Explanation: The software interrupt can change the processor into a protected state by changing the program flow.

6. How a software interrupt is created?

- a) instruction set
- b) sequential code
- c) concurrent code
- d) porting

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Answer: a

Explanation: The software interrupts includes a set of instructions for handling interrupts. The instruction set allows a currently executing program to change its flow.

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7. What does SWI stand for?

- a) standard interrupt instruction
- b) sequential interrupt instruction
- c) software interrupt instruction
- d) system interrupt instruction

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Answer: c

Explanation: The instruction set of software interrupts are provided by the special instruction set. One such is the SWI which is commonly used in Z80.

8. Which of the following use SWI as interrupt mechanism?

- a) PowerPC
- b) MC68000
- c) Z80
- d) IBM PC

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Answer: c

Explanation: The PowerPC and MC68000 use TRAP instruction set for accessing software interrupt. IBM PC uses 8086 NMI. Z80 uses SWI for accessing software interrupts.

9. Which of the following supplies additional data to the software interrupt?

- a) internal interrupt
- b) external interrupt
- c) software interrupt
- d) nmi

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Answer: c

Explanation: For using the software interrupt more effectively, the additional data are used, which specifies the type of the request and data parameters are passed to the specific ISR. This additional data are offered by certain registers.

10. Which software interrupt is used in MC68000?

- a) Internal interrupt
- b) TRAP
- c) SWI
- d) NMI

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Answer: b

Explanation: The MC68000 uses a software interrupt mechanism for accessing interrupts from the peripheral in which the instruction are created using the TRAP mechanism.

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11. Which of the following are accessible by the ISR in software interrupt mechanism?

- a) register
- b) interrupt
- c) nmi
- d) memory

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Answer: a

Explanation: The additional data are offered by certain registers and these additional data are used to specify the type of the data parameter and the request with the specific ISR when running in the software interrupt mode.

12. What allows the data protection in the software interrupt mechanism?

- a) Different mode
- b) Same mode
- c) SWI
- d) TRAP

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Answer: a

Explanation: The switching between user mode and supervisor mode provides protection for the processor, that is, the different modes in the software interrupt allows the memory and the associated code and data to be protected from each other.

13. What does NMI stand for?

- a) non-machine interrupt
- b) non-maskable interrupt
- c) non-massive interrupt
- d) non-memory interrupt

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Answer: b

Explanation: The NMI stand for the non-maskable interrupt in which the external interrupts cannot be masked out.

14. Which NMI is used in the IBM PC?

- a) SWI
- b) TRAP
- c) 80×86 NMI
- d) Maskable interrupt

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Answer: c

Explanation: The most commonly used non-maskable interrupt is the 80×86 NMI, which is implemented in the IBM PC.

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15. Which can be used to pass the status information to the calling software in the software interrupt mechanism?

- a) register
- b) memory
- c) flag
- d) nmi

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Answer: a

Explanation: In order to use the software interrupt more effectively, the additional data are used to specify the type of the request and data parameters are passed to the specific ISR. This additional data are offered by certain registers. These registers are accessible by the ISR and it can also be used to pass the status information back to the calling software.

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## Embedded Systems Questions and Answers – The mechanism of Interrupts

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “The Mechanism of Interrupts”.

1. Which of the following uses clock edge to generate an interrupt?  
a) edge triggered  
b) level-triggered  
c) software interrupt  
d) nmi

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Answer: a

Explanation: In the edge-triggered interrupt, the clock edge is used to generate an interrupt. The transition is from a logical low to high or vice versa.

2. In which interrupt, the trigger is dependent on the logic level?

- a) edge triggered
- b) level-triggered
- c) software interrupt
- d) nmi

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Answer: b

Explanation: In the level-triggered interrupt, the trigger is completely dependent on the logic level. The processors may require the level to be in a certain clock width so that the shorter pulses which are shorter than the minimum pulse width are ignored.

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3. At which point the processor will start to internally process the interrupt?

- a) interrupt pointer
- b) instruction pointer
- c) instruction boundary
- d) interrupt boundary

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Answer: c

Explanation: After the recognition of the interrupt, and finds that it is not an error condition with the currently executing interrupt, then the interrupt will not be internally executed until the current execution has completed. This point is known as the instruction boundary. At this point, the processor will start to internally process the interrupt.

4. What does 80×86 use to hold essential data?

- a) stack frame
- b) register
- c) internal register
- d) flag register

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Answer: a

Explanation: The MC68000 and 80×86 family use stack frame for holding the data whereas RISC processors use special internal registers.

5. What does the RISC processor use to hold the data?

- a) flag register

- b) accumulator
  - c) internal register
  - d) stack register
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Answer: c

Explanation: The RISC processors uses special internal registers to hold data whereas the 80×86 and MC68000 family uses stack register to hold the data.

6. Which of the following is a stack-based processor?

- a) MC68000
- b) PowerPC
- c) ARM
- d) DEC Alpha

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Answer: a

Explanation: The MC68000, Intel 80×86 and most of the b-bit controllers are based on the stack-based processors whereas PowerPC, DEC alpha, and ARM are RISC families which have a special internal register for holding the data.

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7. Which of the following is used to reduce the external memory cycle?

- a) internal hardware stack
- b) internal software stack
- c) external software stack
- d) internal register

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Answer: a

Explanation: Some of the processors use internal hardware stack which helps in reducing the external memory cycle necessary to store the stack frame.

8. How many interrupt levels are supported in the MC68000?

- a) 2
- b) 3
- c) 4
- d) 7

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Answer: d

Explanation: The MC68000 has an external stack for holding the data. The MC68000 family supports a seven interrupt level which are encoded into three interrupt pins.

9. How many interrupt pins are used in MC68000?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: b

Explanation: The MC68000 family supports a seven interrupt level which are encoded into three interrupt pins. These interrupt pins are IP0, IP1, and IP2.

10. Which priority encoder is used in MC68000?

- a) 4-to-2 priority encoder
- b) LS148 7-to-3
- c) 2-to-4 priority encoder
- d) LS148 3-to-7

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Answer: b

Explanation: The LS148 7-to-3 priority encoder is used in MC68000. This converts the seven external pins into a three-bit binary code.

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11. Which of the following converts the seven external pins into a 3-bit binary code?

- a) priority encoder
- b) 4-to-2 priority encoder
- c) LS148 7-to-3
- d) 2-to-4 priority encoder

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Answer: c

Explanation: The LS148 7-to-3 priority encoder can convert the seven external pins into a three-bit binary code.

12. Which of the following ensures the recognition of the interrupt?

- a) interrupt ready
- b) interrupt acknowledge

- c) interrupt terminal
- d) interrupt start

[View Answer](#)

Answer: b

Explanation: The interrupt level remains asserted until its interrupt acknowledgment cycle ensures the recognition of the interrupt.

13. Which of the following is raised to the interrupt level to prevent the multiple interrupt request?

- a) internal interrupt mask
- b) external interrupt mask
- c) non-maskable interrupt
- d) software interrupt

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Answer: a

Explanation: The internal interrupt mask is raised to the interrupt level, in order to prevent the multiple interrupt acknowledgments.

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## Embedded Systems Questions and Answers – RISC Exceptions

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “RISC Exceptions”.

1. What does MSR stand for?
  - a) machine state register
  - b) machine software register
  - c) minimum state register
  - d) maximum state register

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Answer: a

Explanation: The MSR is a machine state register. When the exception is recognised, the address of the instruction and the MSR are stored in the supervisor registers while handling an exception.

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2. How many supervisor registers are associated with the exception mode?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: a

Explanation: When the exception is recognised, the address of the instruction and the machine state register(MSR) are stored in the supervisor registers in the exception mode. There are two supervisor registers SRR0 and SRR1.

3. What happens when an exception is completed?

- a) TRAP instruction executes
- b) SWI instruction executes
- c) RFI instruction executes
- d) terminal count increases

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Answer: c

Explanation: When an exception is recognised, the address of the instruction and the MSR are stored in the supervisor registers and the processor moves to the supervisor mode and starts to execute the handler which is associated with the vector table. The handler examines the DSISR and FPSCR registers and carries out the required function. When it gets completed the RFI or return-from-interrupt instruction is executed.

4. How many general types of exceptions are there?

- a) 2
- b) 3
- c) 6
- d) 4

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Answer: d

Explanation: There are four general types of exceptions. They are synchronous precise, asynchronous precise, synchronous imprecise and asynchronous imprecise.

5. In which of the exceptions does the external event causes the exception?

- a) synchronous exception
- b) asynchronous exception
- c) precise
- d) imprecise

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Answer: b

Explanation: The asynchronous exception is the one in which an external event causes an exception and is independent of the instruction flow. On the other hand, the synchronous exceptions are synchronised, that is, it is caused by the instruction flow.

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6. Which of the exceptions are usually a catastrophic failure?

- a) imprecise exception
- b) precise exception
- c) synchronous exception
- d) asynchronous exception

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Answer: a

Explanation: An imprecise exception is a catastrophic failure in which the processor cannot continue processing or allow a particular task or program to continue.

7. Which of the exceptions allows the system reset or memory fault?

- a) imprecise exception
- b) precise exception
- c) synchronous exception
- d) asynchronous exception

[View Answer](#)

Answer: a

Explanation: The system reset or memory fault falls into the category of imprecise exceptions while accessing the vector table.

8. Which registers are used to determine the completion status?

- a) MSR
- b) flag register
- c) DSISR

d) index register  
View Answer

Answer: c

Explanation: The completion status can be determined by the information bits in the DSISR and FPSCR registers.

9. Which of the following does not support PowerPC architecture?

- a) synchronous precise
- b) asynchronous precise
- c) synchronous imprecise
- d) asynchronous imprecise

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Answer: c

Explanation: The synchronous imprecise is usually not supported on the PowerPC architecture and also in the MPC601, MPC603 etc.  
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10. Which exceptions are used in the PowerPC for floating point?

- a) synchronous imprecise
- b) asynchronous imprecise
- c) synchronous precise
- d) synchronous imprecise

View Answer

Answer: a

Explanation: The PowerPC can handle the floating point exception by making use of the synchronous imprecise mode.

11. Which exception is used in the external interrupts and decrementer-caused exceptions?

- a) synchronous precise
- b) asynchronous precise
- c) synchronous imprecise
- d) asynchronous imprecise

View Answer

Answer: b

Explanation: The asynchronous precise type exception is used to handle the external interrupts and decrementer-caused exceptions. Both these can occur at any time within the instruction flow.

12. Which exception can be masked by clearing the EE bit to zero in the MSR?

- a) synchronous imprecise
- b) synchronous precise
- c) asynchronous imprecise
- d) asynchronous precise

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Answer: d

Explanation: The asynchronous precise type exceptions can be masked by clearing the EE bits in the MSR. This bit is automatically cleared to zero in the MSR in order to prevent this interrupt causing an exception while other exceptions are being processed.

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## Embedded Systems Questions and Answers – RISC Exceptions-II

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This set of Embedded Systems test focuses on “RISC Exceptions-II”.

1. Which of the following can be done to ensure that all interrupts are recognised?

- a) reset pin
- b) external ready pin
- c) handshaking
- d) acknowledgment

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Answer: c

Explanation: The exception handler performs some kind of handshaking to ensure that all the interrupts are recognised.

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2. How many types of exceptions are associated with the asynchronous imprecise?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: Two types of exceptions are associated with the asynchronous imprecise. These are system reset and machine checks.

3. How is the internal registers and memories are reset?

- a) system reset
- b) memory reset
- c) peripheral reset
- d) software reset

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Answer: a

Explanation: By doing the system reset, all the current processing are stopped and the internal registers and the memories are reset.

4. How is the machine check exception is taken in an asynchronous imprecise?

- a) ME bit
- b) EE bit
- c) FE0
- d) FE1

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Answer: a

Explanation: The machine check exception is taken only if the ME bit of the MSR is set. If it is cleared, the processor will enter into a check stop state.

5. Which of the following are the exceptions associated with the asynchronous imprecise?

- a) decrementer interrupt
- b) machine check
- c) instruction dependent
- d) external interrupt

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Answer: b

Explanation: The machine check and the system reset are two types of exceptions which are associated with the asynchronous imprecise.

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6. Which of the following possesses an additional priority?

- a) asynchronous precise
- b) asynchronous imprecise
- c) synchronous precise
- d) synchronous imprecise

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Answer: c

Explanation: The synchronous precise exceptions provide additional priority because it is possible for an instruction to generate more than one exception.

7. Which of the following has more priority?

- a) system reset
- b) machine check
- c) external interrupt
- d) decrementer interrupt

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Answer: a

Explanation: The system reset has the first priority then comes the machine reset, next priority moves for the instruction dependent, and the next priority is an external interrupt, and last priority level goes for the decrementer interrupt.

8. Which bit controls the external interrupts and the decrementer exceptions?

- a) FE1
- b) FE0
- c) EE
- d) ME

[View Answer](#)

Answer: c

Explanation: The EE bit in the MSR controls the external interrupts and the decrementer exceptions.

9. Which bit controls the machine check exceptions?

- a) ME
- b) FE0
- c) FE1
- d) EE

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Answer: a

Explanation: The ME bit in the MSR controls the machine check interrupts.

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10. Which bits control the floating point exceptions?

- a) EE
- b) FE0
- c) FE1
- d) both FE1 and FE2

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Answer: d

Explanation: The FE0 and FE1 control the floating point exceptions.

11. Which of the following is a 16 kbyte block?

- a) register
- b) vector table
- c) buffer
- d) lookaside buffer

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Answer: b

Explanation: The vector table is a 16 kbyte block which is divided into 256 byte divisions in which each division is allocated for particular exceptions and it also contains the handler routine associated with the exceptions.

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# Embedded Systems Questions and Answers – Fast Interrupts

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Fast Interrupts”.

1. Which processors use fast interrupts?

- a) DSP processor
- b) RISC processor
- c) CISC processor
- d) Harvard processor

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Answer: a

Explanation: The fast interrupts are used in the DSP processors or in microcontrollers in which a small routine is executed without saving the context of the processor.

2. Which interrupts generate fast interrupt exception?

- a) internal interrupt
- b) external interrupt
- c) software interrupt
- d) hardware interrupt

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Answer: b

Explanation: The external interrupts generates the fast interrupt routine exception in which the external interrupt is synchronised with the processor clock.

3. What is the disadvantage of the fast interrupts?

- a) stack frame
- b) delay
- c) size of routine
- d) low speed

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Answer: c

Explanation: The disadvantages associated with the fast interrupt is the size of routine which can be executed and the resources allocated. In this technique, it allocates a couple of address registers for the fast interrupt routine.

4. Which of the following does not have a stack frame building?

- a) hardware interrupt
- b) software interrupt
- c) non-maskable interrupt

d) fast interrupt  
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Answer: d

Explanation: The fast interrupt does not have stack frame building and it does not possess any such delays. This can be considered as the advantage of the fast interrupts.

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5. What is programmed to generate a two instruction fast interrupt?

- a) software
- b) application
- c) timer
- d) sensor

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Answer: c

Explanation: The SCI timer generates the two instruction fast interrupt. This increments the register R1.

6. Which of the following can auto increment the register R1?

- a) SCI timer
- b) interrupt
- c) software interrupt
- d) non-maskable interrupt

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Answer: a

Explanation: The SCI timer is used to generate the two instruction fast interrupt that can increment the register R1 which acts as a simple counter.

7. Which of the following forces a standard service routine?

- a) READY interrupt
- b) IRQA interrupt
- c) NMI
- d) software interrupt

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Answer: b

Explanation: The SCI timer is used to generate the two instruction fast interrupt which increments the register R1 that acts as a simple counter which times the period between the events. The events themselves generate an IRQA interrupt, that forces the service routine.

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8. Which of the following can be used as a reset button?

- a) NMI
- b) internal interrupt
- c) external interrupt
- d) software interrupt

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Answer: a

Explanation: The non-maskable interrupt is used to generate an interrupt to try and recover control and therefore, the NMI can be used as a reset button.

9. Which of the following is connected to a fault detection circuit?

- a) internal interrupt
- b) external interrupt
- c) NMI
- d) software interrupt

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Answer: c

Explanation: The non-maskable interrupt is used to generate an interrupt which can be connected to a fault detection circuit like watchdog timer or parity checker.

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## Embedded Systems Questions and Answers – Operating Systems

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Operating Systems”.

1. Which of the following provides a buffer between the user and the low-level interfaces to the hardware?

- a) operating system
- b) kernel
- c) software
- d) hardware

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Answer: a

Explanation: The operating system is software which provides a buffer between the low-level interfaces to the hardware within the system and the user.

2. Which of the following enables the user to utilise the system efficiently?

- a) kernel
- b) operating system
- c) software
- d) hardware

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Answer: b

Explanation: The operating system is software that enables the users to utilise the system effectively.

3. Which of the following can make the application program hardware independent?

- a) software
- b) application manager
- c) operating system
- d) kernel

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Answer: c

Explanation: The operating system allows the software to be moved from one system to another and therefore, it can make the application program hardware independent.

4. Which of the following speed up the testing process?

- a) kernel
- b) software
- c) application manager
- d) program debugging tools

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Answer: d

Explanation: The program debugging tools can speed up the testing process which can make the processor faster.

5. Which of the following includes its own I/O routine?

- a) hardware
- b) kernel
- c) operating system
- d) application manager

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Answer: c

Explanation: An operating system is a software which includes its own I/o routine in order to drive the serial ports and the parallel ports.  
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6. Which forms the heart of the operating system?

- a) kernel
- b) applications
- c) hardware
- d) operating system

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Answer: a

Explanation: The kernel is the heart of the operating system. This can control the hardware and can deal with the interrupts, I/O systems, memory etc.

7. Which of the following locates a parameter block by using an address pointer?

- a) OS
- b) kernel
- c) system
- d) memory

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Answer: b

Explanation: The kernel is the heart of the operating system which can control the hardware and can deal with the interrupts, I/O systems, memory etc. It can also locate the parameter block by using an address pointer which is stored in the predetermined address register.

8. Which of the following are not dependent on the actual hardware performing the physical task?

- a) applications
- b) hardware
- c) registers
- d) parameter block

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Answer: d

Explanation: The kernel can locate the parameter block by using an address pointer which is stored in the predetermined address register. These parameter blocks are standard throughout the operating system, that is, they are not dependent on the actual hardware performing the physical task.

9. Which of the following bus can easily upgrade the system hardware?

- a) control bus
- b) data bus
- c) VMEbus
- d) bus interface unit

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Answer: c

Explanation: The software can be easily moved from one system to another which is more important for designing embedded systems, especially for those which use an industry standard bus such as VMEbus, in which the system hardware can be expanded or upgraded.  
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10. Which of the following is the first widely used operating system?

- a) MS-DOS
- b) windows XP
- c) android
- d) CP/M

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Answer:

Explanation: The first widely used operating system is the CP/M which is developed for Intel 8080 and the 8"floppy disk system.

11. Which of the following is an example of a single task operating system?

- a) android
- b) windows
- c) IOS
- d) CP/M

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Answer: d

Explanation: The CP/M is a single task operating system, that is, only one task or an application can be executed at a time.

12. Which of the following becomes a limiting factor while an application program has to be complete?

- a) memory
- b) peripheral
- c) input
- d) output

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Answer: a

Explanation: The application program has to complete and the memory becomes a limiting factor, which can be solved by using program overlays.

13. Which of the following cannot carry implicit information?

- a) semaphore
- b) message passing
- c) threads
- d) process

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Answer: a

Explanation: The kernel in the real-time operating system which deals with the flag but cannot carry implicit information are called semaphores or events.

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# Embedded Systems Questions and Answers – Multitasking Operating Systems

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Multitasking Operating Systems”.

1. Which of the following works by dividing the processor's time?

- a) single task operating system

b) multitask operating system

c) kernel

d) applications

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Answer: b

Explanation: The multitasking operating system works by dividing the processor's time into different discrete time slots, that is, each application requires a defined number of time slots to complete its execution.

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2. Which of the following decides which task can have the next time slot?

a) single task operating system

b) applications

c) kernel

d) software

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Answer: c

Explanation: The operating system kernel decides which task can have the next time slot. So instead of the task executing continuously until completion, the execution of the processor is interleaved with the other tasks.

3. Which of the following controls the time slicing mechanism in a multitasking operating system?

a) kernel

b) single tasking kernel

c) multitasking kernel

d) application manager

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Answer: c

Explanation: The multitasking operating systems are associated with the multitasking kernel which controls the time slicing mechanism.

4. Which of the following provides a time period for the context switch?

a) timer

b) counter

c) time slice

d) time machine

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Answer: c

Explanation: The time period required for each task for execution before it is stopped and replaced during a context switch is known as the time slice.

5. Which of the following can periodically trigger the context switch?

a) software interrupt

b) hardware interrupt

c) peripheral

d) memory

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Answer: b

Explanation: The multitasking operating systems are associated with the multitasking kernel which controls the time slicing mechanism. The time period required for each task for execution before it is stopped and replaced during a context switch is known as the time slice. These are periodically triggered by a hardware interrupt from the system timer.

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6. Which interrupt provides system clock in the context switching?

a) software interrupt

b) hardware interrupt

c) peripheral

d) memory

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Answer: b

Explanation: The multitasking operating systems deals with the multitasking kernel which controls the time slicing mechanism and the time period required for each task for execution before it is stopped and replaced during a context switch is known as the time slice which are periodically triggered by a hardware interrupt from the system timer. This hardware interrupt provides the system clock in which several interrupts are executed and counted before a context switch is performed.

7. The special table in the multitasking operating system is also known as

a) task control block

b) task access block

c) task address block

d) task allocating block

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Answer: a

Explanation: When a context switch is performed, the current program or task is interrupted, so the processor's registers are saved in a special table which is

known as task control block.

8. Which of the following stores all the task information that the system requires?

- a) task access block
- b) register
- c) accumulator
- d) task control block

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Answer: d

Explanation: The task control block stores all the task information that the system requires and this is done when the context switch is performed so that the currently running program is interrupted.

9. Which of the following contains all the task and their status?

- a) register
- b) ready list
- c) access list
- d) task list

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Answer: b

Explanation: The ‘ready’ list possesses all the information regarding a task, that is, all the task and its corresponding status which is used by the scheduler to decide which task should execute in the next time slice.

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10. Which determines the sequence and the associated task’s priority?

- a) scheduling algorithm
- b) ready list
- c) task control block
- d) application register

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Answer: a

Explanation: The scheduling algorithm determines the sequence and an associated task’s priority. It also determines the present status of the task.

11. Which can control memory usage?

- a) operating system
- b) applications
- c) hardware
- d) kernel

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Answer: d

Explanation: The kernel can control the memory usage and it can also prevent the tasks from corrupting each other.

12. Which can control the memory sharing between the tasks?

- a) kernel
- b) application
- c) software
- d) OS

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Answer: a

Explanation: The kernel can control memory sharing between tasks which allow sharing common program modules.

13. Which of the following can implement the message passing and control?

- a) application software
- b) operating system
- c) software
- d) kernel

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Answer: d

Explanation: The kernel can implement the message passing and control which acts as a message passer and controller between the tasks.

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14. How many types of messages are associated with the real-time operating system?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: a

Explanation: There are two basic types of messages associated with the real-time operating system. These are semaphores and messages.

15. Which of the following can carry information and control task?

- a) semaphore
- b) messages
- c) flags
- d) address message

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Answer: b

Explanation: The messages can carry information and it can also control the task regarding the real-time operating systems. These are also known as events.

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# Embedded Systems Questions and Answers – Task Swapping Methods

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Task Swapping Methods”.

1. Which task swapping method does not require the time critical operations?

- a) time slice
- b) pre-emption
- c) cooperative multitasking
- d) schedule algorithm

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Answer: a

Explanation: Time-critical operations are not essential in the time slice mechanism. Time slice mechanism describes the task switching in a particular time slot.

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2. Which task swap method works in a regular periodic point?

- a) pre-emption
- b) time slice
- c) schedule algorithm

d) cooperative multitasking

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Answer: b

Explanation: The time slicing works by switching task in regular periodic points in time, that is, any task that needs to run next will have to wait until the current time slice is completed.

3. Which of the following determines the next task in the time slice method of task swapping?

- a) scheduling program
- b) scheduling application
- c) scheduling algorithm
- d) scheduling task

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Answer: c

Explanation: The time slice mechanism can also be used as a scheduling method in which the task to run next is determined by the scheduling algorithm.

4. Which of the following can be used to distribute the time slice across all the task?

- a) timer
- b) counter
- c) round-robin
- d) task slicing

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Answer: c

Explanation: The time slice based system uses fairness scheduler or round robin to distribute the time slices across all the tasks that need to run in a particular time slot.

5. What do a time slice period plus a context switch time of the processor determines?

- a) scheduling task
- b) scheduling algorithm
- c) context task
- d) context switch time

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Answer: d

Explanation: The context switch time of the processor along with the time slice period determines the context switch time of the system which is an important factor in system response, that is, the time period can be reduced to improve the context switching of the system which will increase the number of task switches.

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6. Which can increase the number of task switches?

- a) time period
- b) frequency
- c) time rate
- d) number of cycles

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Answer: a

Explanation: The time period can be reduced to improve the context switching of the system which will increase the number of task switches.

7. Which mechanism is used behind the Windows 3.1?

- a) time slice
- b) pre-emption
- c) cooperative multitasking
- d) scheduling algorithm

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Answer: c

Explanation: The cooperative multitasking mechanism is used the Windows 3.1 but it is not applicable to the real-time operating systems.

8. Which of the following provides an illusion of multitasking?

- a) single task operating system
- b) multitasking operating system
- c) cooperative multitasking
- d) pre-emption

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Answer: c

Explanation: The cooperative multitasking co-operates between them which provides the illusion of multitasking. This is done by periodically executing the tasks.

9. Which task method follows a currently running task to be stopped by a higher priority task?

- a) scheduling algorithm
- b) time slice
- c) cooperative multitasking

d) pre-emption  
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Answer: d

Explanation: The pre-emption is an alternative method of the time slice where the currently running task can be stopped or preempted or switched out by a higher priority active task.

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10. Which of the following requires programming within the application?

- a) time slice
- b) scheduling algorithm
- c) pre-emption
- d) cooperative multitasking

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Answer: d

Explanation: The cooperative multitasking requires programming within the application and the system can be destroyed by a single program which hogs all the processing power. Therefore, it is not applicable in the real-time operating system.

11. What does RMS stand for?

- a) rate monotonic scheduling
- b) rate machine scheduling
- c) rate monotonic software
- d) rate machine software

View Answer

Answer: a

Explanation: The rate monotonic scheduling is a method that is used to assign priority for a pre-emptive system such that the correct execution can be guaranteed.

12. Which of the following task swapping method is a better choice in the embedded systems design?

- a) RMS
- b) pre-emptive
- c) cooperative multitasking
- d) time slice

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Answer: b

Explanation: The pre-emptive method of task swapping is the first choice for embedded system design because of its better system response.

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## Embedded Systems Questions and Answers – Priority Inversion

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Priority Inversion”.

1. Which of the following allows a lower priority task to run despite the higher priority task is active and waiting to preempt?

- a) message queue
- b) message passing
- c) semaphore
- d) priority inversion

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Answer: d

Explanation: The priority inversion mechanism where the lower priority task can continue to run despite there being a higher priority task active and waiting to preempt.

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2. What happens to the interrupts in an interrupt service routine?

- a) disable interrupt
- b) enable interrupts
- c) remains unchanged
- d) ready state

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Answer: a

Explanation: In the interrupt service routine, all the other interrupts are disabled till the routine completes which can cause a problem if another interrupt is received and held pending. This can result in priority inversion.

3. Which of the following is a part of RTOS kernel?

- a) memory
- b) input
- c) ISR
- d) register

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Answer: c

Explanation: The ISR can send the message for the tasks and it is a part of RTOS kernel.

4. Which of the following is an industrial interconnection bus?

- a) bus interface unit
- b) data bus
- c) address bus
- d) VMEbus

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Answer: d

Explanation: The VMEbus is an interconnection bus which is used in the industrial control and many other real-time applications.

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5. Which of the following supports seven interrupt priority level?

- a) kernel
- b) operating system
- c) VMEbus
- d) data bus

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Answer: c

Explanation: The VMEbus supports seven interrupt priority level which allows the prioritisation of the resources.

6. What type of interrupt handling is seen in multiprocessor applications?

- a) centralised interrupt
- b) handled by one MASTER
- c) distributed handling

d) shared handling  
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Answer: c

Explanation: The multiprocessor applications allows distributed handling in which the direct communication with the individual masters is possible.

7. Which of the following is an asynchronous bus?

- a) VMEbus
- b) timer
- c) data bus
- d) address bus

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Answer: a

Explanation: The VMEbus is based on Eurocard sizes and is asynchronous which is similar to the MC68000.

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8. Which of the following is not a priority based?

- a) priority inversion
- b) message passing
- c) fairness system
- d) message queuing

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Answer: c

Explanation: The fairness system allows the system which requires different characteristics from those originally provided and the system response that is not a priority based. The fairness system is not a priority based on where the bus access is distributed across the requesting processors.

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# Embedded Systems Questions and Answers – Tasks,Threads and Process

This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Tasks, Threads and Process”.

1. Which of the following can be used to refer to entities within the RTOS?

- a) threads
- b) kernels
- c) system
- d) applications

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Answer: a

Explanation: The threads and processes can be used to refer to entities within the RTOS. They provide an interchangeable replacement for the task. They have a slight difference in their function. A process is a program in execution and it has its own address space whereas threads have a shared address space. The task can be defined as a set of instructions which can be loaded into the memory.

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2. Which of the following defines the set of instructions loaded into the memory?

- a) process
- b) task
- c) thread
- d) system hardware

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Answer: b

Explanation: The task can be defined by the set of instructions which is loaded into the memory and it can split into two or more tasks.

3. Which of the following uses its own address space?

- a) thread
- b) process
- c) task
- d) kernel

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Answer: a

Explanation: Threads uses shared memory space and it uses the memory space of the process.

4. Which of the following does not uses a shared memory?

- a) process
- b) thread
- c) task
- d) kernel

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Answer: a

Explanation: The program in execution is known as the process. The process does not share the memory space but the threads have a shared memory address. When the CPU switches from process to another, the current information is stored in the process descriptor.

5. Which of the following can own and control the resources?

- a) thread
- b) task
- c) system
- d) peripheral

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Answer: b

Explanation: The task and process have several characteristics and one such is that the task or process can own or control resources and it has threads of execution which are the paths through the code.

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6. Which can be supported if the task or process maintains a separate data area for each thread?

- a) single thread system
- b) mono thread system
- c) multiple threads
- d) dual threads

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Answer: c

Explanation: The multiple threads can be supported only if the process or task can maintain separate data areas for each thread.

7. Which of the following possesses threads of execution?

- a) process
- b) thread
- c) kernel
- d) operating system

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Answer: a

Explanation: The process has threads of execution which are the paths through the code.

8. Which of the following is inherited from the parent task?

- a) task
- b) process
- c) thread
- d) kernel

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Answer: c

Explanation: The threads are a part of the process, that is, it uses a shared memory of the process and therefore said that its resources are inherited from the parent process or task.

9. Which term is used to encompass more than a simple context switch?

- a) process
- b) single thread system
- c) thread
- d) multithread

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Answer: a

Explanation: The process includes the additional information which is used to encompass more than a simple context switch. This is similar to the task switching, that is why it is said that process and task are interchangeable.

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10. Which can be considered as the lower level in the multitasking operating system?

- a) process
- b) task
- c) threads
- d) multi threads

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Answer: c

Explanation: In the multitasking operating system, the process and tasks form the higher level whereas the thread is the lower level. But in a simple operating system, there is no difference between the context switch of thread and the process.

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# Embedded Systems Questions and Answers – Commercial Operating Systems

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Commercial Operating Systems”.

1. Which of the following kernel supports the MC68000 family?

- a) pSOS+
- b) pSOS+kernel
- c) pNA+ network manager
- d) pSOS multiprocessor kernel

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Answer: a

Explanation: The pSOS+ kernel supports many processor families like Intel 80×86, M88000, MC68000 and i960 processors. The kernel is small in size and has a 15-20 Kbytes RAM.

2. What is the worst case figure for interrupt latency for an MC68020 running at 25MHz?

- a) 19 microseconds
- b) 6 microseconds
- c) 20 microseconds
- d) 8 microseconds

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Answer: b

Explanation: The worst case figure for the interrupt latency for an MC68020 which runs at 25MHz is 6 microseconds and the context switch for the same is 19 microseconds.

3. Which of the following is the multiprocessing version of the kernel?

- a) pSOS+
- b) pSOS+ kernel
- c) pSOS multiprocessor kernel
- d) pSOS

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Answer: c

Explanation: The pSOS+ is a multitasking real-time kernel of the operating system and pSOS+m or the pSOS+ multiprocessor kernel is the multiprocessing version of the kernel. It is virtually same as the single processor version except the ability to send and receiving system objects from the processors within the system.

4. Which of the following is a compiler independent run-time environment for C applications?

- a) pSOS multiprocessor kernel
- b) pSOS
- c) pSOS+
- d) pREC+ runtime support

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Answer: d

Explanation: The pREC+ is a compiler independent runtime environment for the C program applications.

5. Which kernel provides 88 functions that can be called from the C programs?

- a) pSOS multiprocessor kernel
- b) pSOS
- c) pSOS+
- d) pREC+ runtime support

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Answer: d

Explanation: The pREC+ is compatible with the ANSI X3J11 and can provide the 88 functions that can be called from the C programs.

6. Which of the following is not a standalone product?

- a) pREC+ runtime support
- b) pSOS+m
- c) pSOS+
- d) pSOS+ kernel

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Answer: a

Explanation: The pREC+ is not a standalone product it uses pSOS+m or pSOS+ for the input/output devices and task functions and calls the PHILE+ for the file and disk I/O.

7. Which kernel allows the multiple tasks which use the same routine?

- a) pREC+ runtime support
- b) pSOS+m
- c) pSOS+

d) pSOS+ kernel

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Answer: a

Explanation: The pREC+ runtime support kernel's routines are reentrant that allows the multiple tasks to use the same routine simultaneously.  
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8. Which provides the TCP/IP communication over the ethernet and FDDI?

- a) pSOS+m
- b) pSOS+ kernel
- c) pNA+ network manager
- d) pSOS+

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Answer: c

Explanation: A pNA+ network manager is a networking option which can provide the TCP/IP communication over a large variety of media such as the FDDI and the ethernet.

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# Embedded Systems Questions and Answers – Commercial Operating Systems-II

This set of Embedded Systems Quiz focuses on “Commercial Operating Systems-II”.

1. Which can provide efficient downloading and debugging communication between the host and target system?

- a) pSOS+
- b) pSOS+ kernel
- c) pFILE+ file system
- d) pNA+ network manager

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Answer: d

Explanation: The pNA+ network manager can provide efficient downloading and debugging communication between the host and target system.  
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2. Which of the following is a system level debugger which provides the low-level debugging facilities and the system debugging?

- a) pROBE+ system level debugger
- b) pNA+ network manager
- c) pFILE+ file system
- d) pNA+ network manager

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Answer: a

Explanation: The pROBE+ system level debugger which can provide the system debugging and the low level debugging.

3. How is the pROBE+ system level debugger communicate with the outside world?

- a) peripheral output
- b) serial port
- c) LCD display
- d) LED

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Answer: b

Explanation: The pROBE+ system level debugger can communicate with the outside world through the serial port or by installing pNA+, a TCP/IP link can be used instead.

4. Which of the following is a complementary product to pROBE+ system level debugger?

- a) pSOS+ kernel
- b) pSOS+
- c) XRAY+ source level debugger
- d) pSOS+m

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Answer: c

Explanation: The XRAY+ source level debugger is a complementary product to pROBE+ system level debugger as it can use the debugger information and combine with the C source and other functions on the host that can provide an integrated debugging.

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5. Which of the following supports the MS-DOS file?

- a) pNA+ network manager
- b) pSOS+ kernel
- c) pSOS+ m
- d) pFILE+ file system

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Answer: d

Explanation: The pFILE+ file system supports the MS-DOS file structure and the product can provide input and output file.

6. Who developed the OS-9?

- a) Microwave
- b) Microwave and Motorola
- c) Motorola and IBM
- d) Microwave and IBM

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Answer: b

Explanation: The OS-9 is developed by Motorola and Microwave as a real-time operating system. The operating system is developed for MC6809 which is an 8-bit processor.

7. Who had developed VRTX-32?

- a) Microtec Research
- b) Microwave
- c) Motorola
- d) IBM

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Answer: a  
Explanation: The VRTX-32 is developed by Microtec Research which is a high-performance real-time kernel.

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8. Which provides the library interface to allow C programs to call standard I/O functions?

- a) RTL
- b) TNX
- c) IFX
- d) MPV

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Answer: a

Explanation: The RTL is run-time library support for Microtec and the Sun compilers and can provide the library interface to allow the C programs to call the standard I/O functions.

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## Embedded Systems Questions and Answers – Resource Protection

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Resource Protection”.

1. Which of the following unit protects the memory?

- a) bus interface unit
- b) execution unit
- c) memory management unit
- d) peripheral unit

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Answer: c

Explanation: The resources have to be protected in an embedded system and the most important resource to be protected is the memory which is protected by the memory management unit through different programming.

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2. Which unit protects the hardware?

- a) MMU
- b) hardware unit
- c) bus interface unit
- d) execution unit

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Answer: a

Explanation: The hardware part is protected by the memory management unit. The memory part is also protected by the memory management unit. The hardware such as the input-output devices are protected and is prevented from the direct access.

3. Which mechanism can control the access?

- a) in-situ
- b) spin-lock
- c) ex-situ
- d) both in-situ and ex-situ

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Answer: b

Explanation: Both the memory and the hardware part are protected by the memory management unit and the hardware such as the input-output devices are protected. These are prevented from the direct access. These accesses are made through a device driver and this device driver can control the serial port. Such a mechanism is called spin-lock mechanism which provides the control access.

4. Which of the following is very resilient to the system crashes?

- a) Windows 3.1
- b) MS-DOS
- c) Windows NT
- d) kernel

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Answer: c

Explanation: The Windows NT is very resilient to the system crashes and the system will continue while the processes can crash. This is because of the user mode and the kernel mode which is coupled with the resource protection. This resilience is a big advantage over the MS-DOS and Windows 3.1.

5. Which of the following are coupled in the Windows NT for the resource protection?

- a) kernel mode and user mode
- b) user mode and protected mode
- c) protected mode and real mode
- d) virtual mode and kernel mode

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Answer: a

Explanation: The user mode and the kernel mode are coupled with the resource protection and this resilience in Windows NT is a big advantage over the MS-DOS and the Windows 3.1.

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6. Which of the following support multi-threaded software?

- a) Windows NT
- b) thread
- c) process
- d) task

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Answer: a

Explanation: The Windows NT supports multi-threaded software in which the processes can support several independent paths or threads.

7. Which provides a 4 Gbyte virtual address space?

- a) Windows 3.1
- b) MS-DOS
- c) pSOS+
- d) Windows NT

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Answer: d

Explanation: The virtual address spacing in the Windows NT is somewhat different from the MS-DOS and the Windows 3.1. The Windows NT provides 4 Gbytes virtual address space for each process and that is linearly addressed using 32-bit address values.

8. Which applications can be used with the Windows NT?

- a) WIN16
- b) WIN32
- c) WIN4

d) WIN24  
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Answer: b

Explanation: The WIN32 is also known as 32-bit or even native. It is used for the Windows NT applications which uses the same instruction set as that of the Windows NT and therefore do not need to emulate a different architecture.

9. Which of the following has the same instruction set as that of the Windows NT?

- a) WIN32
- b) WIN4
- c) WIN24
- d) WIN16

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Answer: a

Explanation: WIN32 is used for the Windows NT applications and is also known as even native which uses the same instruction set as that of the Windows NT and therefore do not need to emulate a different architecture.

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10. Which can provide more memory than physical memory?

- a) real memory
- b) physical address
- c) virtual memory
- d) segmented address

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Answer: c

Explanation: The physical memory can provide more memory than the physical memory within the system. Such memories are divided into segments and pages.

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# Embedded Systems Questions and Answers – Resource Protection-II

This set of Embedded Systems online quiz focuses on “Resource Protection-II”.

1. Which of the following uses a swap file to provide the virtual memory?

- a) windows NT
- b) kernel
- c) memory
- d) memory management unit

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Answer: a

Explanation: The Windows NT use a swap file for providing a virtual memory environment. This file is dynamic and varies with the amount of memory that all the software including the device driver, operating systems and so on.

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2. What is the size of the swap file in Windows 3.1?

- a) 25 Mbytes
- b) 30 Mbytes
- c) 50 Mbytes
- d) 100 Mbytes

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Answer: b

Explanation: The Windows 3.1 have a swap file of size 25 Mbytes.

3. What is the nature of the swap file in the Windows NT?

- a) static
- b) dynamic
- c) linear
- d) non-linear

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Answer: b

Explanation: The swap file used in the Windows NT is dynamic and it varies with the amount of memory that all the software including the device driver, operating systems and so on.

4. What limits the amount of virtual memory in Windows 3.1?

- a) size of the swap file
- b) nature of swap file
- c) static file
- d) dynamic file

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Answer: a

Explanation: The swap file of Windows 3.1 have a size of 25 Mbytes and thus limits the amount of virtual memory that it can support.

5. Which of the following control and supervises the memory requirements of an operating system?

- a) processor
- b) physical memory manager
- c) virtual memory manager
- d) ram

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Answer: c

Explanation: The virtual memory manager can control and supervises the memory requirements of the operating system.

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6. What is the size of the linear address in the virtual memory manager?

- a) 2 Gbytes
- b) 12 Gbytes
- c) 4 Gbytes
- d) 16 Gbytes

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Answer: c

Explanation: The virtual memory manager can allocate a linear address space of size 4 Gbytes to each process which is unique and cannot be accessed by the other processes.

7. How many modes are used to isolate the kernel and the other components of the operating system?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: a

Explanation: There are two modes that are used for isolating the kernel and the other components of the operating system from any process and user applications that are running. These are kernel mode and the user mode.

8. Which are the two modes used in the isolation of the kernel and the user?

- a) real mode and virtual mode
- b) real mode and user mode
- c) user mode and kernel mode
- d) kernel mode and real mode

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Answer: c

Explanation: The two modes are kernel mode and the user mode which are used for isolating the kernel and the other components of the operating system from any process and user applications that are running.

9. Which of the following must be used to isolate the access in the user mode?

- a) device driver
- b) software driver
- c) on-chip memory
- d) peripherals

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Answer: a

Explanation: The device driver is used to control and isolate the access when it is in user mode. This is used to ensure that no conflict is caused.

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10. Which mode uses 16 higher real-time class priority levels?

- a) real mode
- b) user mode
- c) kernel mode
- d) protected mode

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Answer: c

Explanation: The kernel mode processes use the 16 higher real-time class priority levels and the operating system processes will take the preference over the user applications.

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# Embedded Systems Questions and Answers – Characteristics of Windows NT

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Characteristics of Windows NT”.

1. Which filesystem is used in the Windows 95?

- a) FAT
- b) HPFS
- c) VFAT
- d) NTFS

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Answer: c

Explanation: The VFAT is used in the Windows 95 and it also supports long file names.

2. What does HPFS stand for?

- a) high performance file system
- b) high periodic file system
- c) high peripheral file system
- d) horse power file system

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Answer: a

Explanation: The high performance file system is an alternative file system which possess 254 characters. It is used by the OS/2 and also writes caching to disk technique that stores data temporarily and write it to the disk.

3. Which filing system is used by the Windows NT?

- a) FAT
- b) VFAT
- c) HPFS
- d) NTFS

[View Answer](#)

Answer: d

Explanation: The NT filing system or NTFS is used by the Windows NT, that is its own filing system which conforms to various security operations and allows system administrators to restrict access to files.

4. Which filesystem is used by the OS/2?

- a) FAT
- b) VFAT
- c) HPFS
- d) NTFS

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Answer: c

Explanation: The high performance file system is an alternative file system which possess 254 characters. It is used by the OS/2 and also writes caching to disk technique that stores data temporarily and write it to the disk.

5. What do HAL stand for?

- a) hardware abstraction layer
- b) hardware address layer
- c) hardware access layer
- d) hardware address lead

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Answer: a

Explanation: The HAL is the hardware abstraction layer. This provides the portability across the multiprocessor and different platforms.

6. Which of the following can provide portability across different processor-based platforms?

- a) File system
- b) HAL
- c) NTFS
- d) FAT

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Answer: b

Explanation: The HAL or hardware abstraction layer is designed to provide portability across the different platform and different multiprocessor or single processor.

7. Which of the following defines the virtual hardware that the kernel uses?

- a) HAL
- b) NTFS
- c) FAT
- d) VFAT

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Answer: a

Explanation: The HAL or hardware abstraction layer defines virtual hardware which the kernel uses when it needs to access the processor or hardware resources.

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8. Which of the following provides a link between the user processes and threads and the hardware?

- a) I/O driver
- b) File system
- c) Memory
- d) LPC

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Answer: a

Explanation: The I/O driver is also a part of the kernel. These can provide a link between the threads and the processes and the hardware. The Windows NT driver is not compatible with the MS-DOS and Windows 3.1 drivers.

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## Embedded Systems Questions and Answers – Characteristics of Windows NT-II

This set of Embedded Systems Question Bank focuses on “Characteristics of Windows NT-II”.

1. What does LPC stand for?

- a) local procedure call
- b) local program call
- c) local program code
- d) local procedure code

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Answer: a

Explanation: The LPC is defined as the local procedure call which is responsible for coordinating the system calls from the WIN32 subsystem and an application.

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2. Which of the following is responsible for coordinating the system call within an application and the WIN32 subsystem?

- a) kernel
- b) file system
- c) LPC
- d) network support

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Answer: c

Explanation: The local procedure call is responsible for coordinating the system calls from the WIN32 subsystem and an application. Depending upon the type of the system call, the application will be routed directly with the LPC without going through the WIN32 subsystem.

3. Which of the following is responsible for ensuring correct operation of all processes which are running within the system?

- a) kernel
- b) file system
- c) lpc
- d) user mode

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Answer: a

Explanation: The kernel is responsible for ensuring the correct operation of all process which are running within the system. It also provides the synchronisation and the scheduling that the system needs.

4. How many level priority scheme does the scheduling used in the kernel?

- a) 8
- b) 16
- c) 32
- d) 64

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Answer: c

Explanation: The scheduling support in the kernel support 32 level priority scheme and it can be used to schedule threads rather than processes.

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5. Which procedure in the kernel allows the thread to wait until a specific resource is available?

- a) synchronisation
- b) scheduling
- c) scheduling and synchronisation
- d) lpc

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Answer: a

Explanation: The synchronisation procedure will allow the thread to wait until a specific resource such as semaphore, object etc are available.

6. Which of the following can preempt the current thread and reschedule the high priority thread in the kernel?

- a) interrupt
- b) lpc
- c) file system
- d) memory

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Answer: a

Explanation: The interrupts and the similar events such as exceptions can pass through the kernel which can preempt the current thread and the can reschedule the high priority thread to process.

7. How many file system does the Windows NT support?

- a) 4
- b) 5
- c) 3
- d) 2

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Answer: c

Explanation: The Windows NT support three file system and these coexist with each other even though there are some restrictions.  
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8. What does FAT stand for?

- a) file address table
- b) file access table
- c) file arbitrary table
- d) file allocation table

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Answer: d

Explanation: The FAT or file allocation table is a kind of file system which is used by the Windows 3.1 and the MS-DOS.

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## Embedded Systems Questions and Answers – Linux

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Linux”.

1. Who started Linux first as a personal project?

- a) Linus Torvalds
- b) Ken Thompson
- c) Dennis Ritchie
- d) John Dell

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Answer: a

Explanation: The Linux was taken as a personal project by Linus Torvalds at the University of Helsinki in Finland that is similar to UNIX as an operating system.

2. Which of the following is similar to UNIX OS?

- a) Windows NT
- b) MS-DOS
- c) Linux
- d) Windows 3.1

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Answer: c

Explanation: The Linux is similar to UNIX operating system but it is entirely different for the Windows NT, MS-DOS and the Windows 3.1

3. Who had first described UNIX in an article?

- a) Ken Thompson
- b) Dennis Ritchie and Ken Thompson
- c) Dennis Ritchie
- d) Linus Torvalds

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Answer: b

Explanation: The UNIX was first described by Dennis Ritchie and Ken Thompson of Bell Research Labs in 1974 through an article.

4. What does MULTICS stand for?

- a) multiplexed information and computing service
- b) multiplexed information and code service
- c) multiplexed inter-access code service
- d) multiplexed inter-code sensor

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Answer: a

Explanation: MULTICS is a multiplexed information and computing service which generate software that would allow a large number of users for accessing the computer simultaneously.

5. Which of the following is the first version of the UNIX operating system?

- a) PDP-2
- b) Linux
- c) MS-DOS
- d) PDP-7

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Answer: d

Explanation: The PDP-7 processor is the first version of the UNIX which has a new filing system and new utilities.

6. Which of the following is a UNIX clone?

- a) XENIX
- b) Windows 3.1
- c) Windows NT
- d) Linux

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Answer: a

Explanation: The XENIX is a UNIX clone developed by the Motorola in the year 1979 and is ported to many processors.

7. Which of the following is an alternate source of UNIX?

- a) MS-DOS
- b) Windows 3.1
- c) Windows NT
- d) Linux

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Answer: a

Explanation: With the many disadvantages of the UNIX operating system, Linux was used as an alternative source. The UNIX operating system was more expensive operating system and most of the hardware was specific to the manufacturer, which restricted the use of UNIX and developed for an alternative one, the Linux.

8. Which of the following are grouped into directories and subdirectories?

- a) register
- b) memory
- c) files
- d) routines

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Answer: c

Explanation: The files are grouped into directories and subdirectories. This file system contains all the data files, commands, programs and special files which allow the access to the physical computer system. The file system of the Linux operating system is similar to the UNIX operating system.

9. Which character is known as a root directory?

- a) ^
- b) &
- c) &&
- d) /

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Answer: d

Explanation: The character / is used at the beginning of the file name or the path name which is used as the starting point and is known as the root directory or root.

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10. How many types of Linux files are typically used?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: c

Explanation: There are four types of Linux files. These are regular, special, directories and named pipes.

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## Embedded Systems Questions and Answers – Linux-II

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This set of Basic Embedded Systems Questions and Answers focuses on “Linux-II”.

1. Which filesystem of Linux has mass storage devices?

- a) physical file system
- b) temporary file system
- c) ram

d) register  
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Answer: a

Explanation: The physical file system has mass storage devices such as hard disks and floppy which are allocated to parts of the logical file system.  
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2. Which file type of Linux has no restriction on size and can have any kind of data?

- a) special
- b) regular
- c) directories
- d) named pipes

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Answer: b

Explanation: There are four types of Linux files. These are regular, special, directories and named pipes in which the regular file type can have any kind of data and does not have restrictions in size, the special file type represent certain terminals such as physical I/O device, the directories can hold lists of files, and the named pipes are similar to regular files but restricted in size.

3. Which file type of Linux is similar to the regular file type?

- a) named pipe
- b) directories
- c) regular file
- d) special file

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Answer: a

Explanation: Among the Linux files, the regular file type is similar to the named pipe but these are restricted in size. On the other hand, the regular file does not have restrictions.

4. Which file type of the Linux hold lists of files rather than the actual data?

- a) regular
- b) special
- c) directories
- d) named pipes

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Answer: c

Explanation: The directories can hold lists of files other than the actual data, but the other file type does not have this characteristic.  
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5. Which filesystem of the Linux can be implemented on a system with two hard disks?

- a) logical file system
- b) physical file system
- c) special file type system
- d) regular file type system

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Answer: a

Explanation: The physical file system is allocated to the parts of the logical file system. The logical file system can be implemented on a system with two hard disks by the allocation of the bin directory under the hard disk 1 and the file subsystem under the hard disk 2.

6. Which directory is allocated on the hard disk 1 of the physical storage in a Linux operating system?

- a) term
- b) dev
- c) etc
- d) bin

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Answer: d

Explanation: The bin directory is on the hard disk 1 of the physical storage whereas the term, dev, etc is on the hard disk 1 of the physical logical file system.

7. Which process defines the allocation of the mass storage to the logical file system?

- a) mounting
- b) de-allocation
- c) demounting
- d) unmounting

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Answer: a

Explanation: The allocation of the mass storage to the logical file system is known as the mounting and its reverse operation, deallocation of the mass storage is known as unmounting.

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8. Which commands can be used to access the removable media?

- a) system calls

- b) loop instruction
  - c) mount and unmount command
  - d) procedure commands
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Answer: c

Explanation: The commands such as mount and unmount commands are used to access the removable media like the floppy disks, through the logical file system.

9. Which target directory is used in the file system of the Linux operating system?

- a) /mnt
- b) /etc
- c) /term
- d) /bin

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Answer: a

Explanation: The /mnt is the target directory used in the file system of the Linux operating system but the special file names can vary from system to system.

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# Embedded Systems Questions and Answers – Prediction of Execution Times

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Prediction of Execution Times”.

1. Identify the standard software components that can be reused?

- a) application manager
- b) operating system

c) application software  
d) memory

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Answer: b

Explanation: There are certain software components that can be reused in an embedded system design. These are the operating systems, real-time databases and some other forms of middleware.

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2. What does WCET stand for?

- a) wait case execution time
- b) wait case encoder time
- c) worst case execution time
- d) worst code execution time

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Answer: c

Explanation: The WCET is the worst case execution time which is an upper bound on the execution times of task. It can be computed for certain programs like while loops, programs without recursion, iteration count etc.

3. For which of the following WCET can be computed?

- a) C program
- b) assembly language
- c) VHDL
- d) program without recursion

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Answer: d

Explanation: The WCET computing is a difficult task for assembly language and for computing WCET for any high-level language without the knowledge of the generated assembly code is impossible.

4. The WCET of which component can be computed if the task is mapped to hardware?

- a) hardware
- b) task
- c) both task and hardware
- d) application manager

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Answer: a

Explanation: The worst case execution time of the hardware can be computed if the task is mapped to the hardware which in turn requires the synthesis of the hardware.

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5. Which estimation approach is used by Jha and Dutt for hardware?

- a) accurate cost and performance value
- b) estimated cost and performance value
- c) performance value
- d) accurate cost

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Answer: b

Explanation: There are different estimation techniques used. One such is the estimated cost and performance value which is proposed by Jha and Dutt for hardware. The accurate cost and performance value is proposed by Jain et al for software.

6. Which estimate approach is more precise?

- a) estimated cost and performance value
- b) accurate cost and performance value
- c) performance value and execution time
- d) estimated cost

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Answer: b

Explanation: The accurate cost and performance value is possible if interfaces to software synthesis tools and hardware synthesis tools exist and is more precise than any other methods.

7. Which estimate approach takes more time to consume?

- a) accurate value
- b) estimated value
- c) accurate cost and performance value
- d) estimated cost and performance value

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Answer: c

Explanation: The accurate cost and the performance value method is time-consuming but the other estimating approaches are less time consuming.

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8. Which estimation technique can be used if interfaces to software synthesis tools and hardware synthesis tools exist?

- a) performance value
- b) estimated cost
- c) estimated cost and performance value
- d) accurate cost and performance value

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Answer: d

Explanation: The accurate cost and performance value is possible if interfaces to software synthesis tools and hardware synthesis tools exist.

9. Which of the following is the base for scheduling algorithm?

- a) WCET
- b) time
- c) execution time
- d) address accessing time

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Answer: a

Explanation: The base for scheduling algorithm is the WCET, worst case execution time which is a bound on the execution time of tasks. Such computing is undecidable in the general case, so it is decidable for certain programs only such as programs without recursion, iteration count, while loops etc.

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## Embedded Systems Questions and Answers – Classification of Scheduling Algorithms

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Classification of Scheduling Algorithm”.

1. Which classification is based on the extension to standard operating systems?

- a) software and hardware deadline
- b) aperiodic deadline
- c) periodic deadline
- d) static and dynamic deadline

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Answer: a

Explanation: The real-time scheduling can be classified into various criteria. The fundamental classification is the software and hardware deadline which is based on the extension to standard operating systems.

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2. Which of the following defines the task which must be executed at every defined unit of time?

- a) aperiodic task
- b) periodic task
- c) job
- d) process

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Answer: b

Explanation: The periodic task is the one which must be executed in a defined unit of time say 'p' where p is called the period.

3. Which of the task are not periodic?

- a) periodic task
- b) unpredictable task
- c) aperiodic task
- d) job

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Answer: c

Explanation: The aperiodic task is the one in which the task is not periodic but the periodic task is the one in which the task are periodic. Each execution of a periodic task is known as the job.

4. Which of the following is an aperiodic task requesting the processor at unpredictable times?

- a) job
- b) aperiodic task
- c) sporadic
- d) periodic task

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Answer: c

Explanation: The aperiodic tasks request the processor at unpredictable times if and only if there is a minimum separation between the times at which they request the processor which is called sporadic.

5. Which of the scheduling algorithm are based on the assumption that tasks are executed until they are done?

- a) periodic task
- b) aperiodic task
- c) non-preemptive scheduling
- d) preemptive scheduling

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Answer: c

Explanation: The nonpreemptive scheduling is based on the assumptions that the tasks are executed until the task is done whereas the preemptive scheduling is used if the task has long execution times or for a short response time.

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6. Which of the following schedulers take decisions at run-time?

- a) preemptive scheduler
- b) non preemptive scheduler
- c) dynamic scheduler
- d) static scheduler

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Answer: c

Explanation: The dynamic schedulers take decisions at run-time and they are quite flexible but generate overhead at run-time whereas static scheduler is the ones in which the scheduler take their designs at the design time.

7. Which scheduler takes their designs at design time?

- a) preemptive scheduler
- b) non preemptive scheduler
- c) dynamic scheduler
- d) static scheduler

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Answer: d

Explanation: The static scheduler take their designs at the design time and it also generates tables of start times which are forwarded to a simple dispatcher but

the dynamic scheduler takes a decision at the run-time.

8. Which scheduler generates tables and forward to the dispatcher?

- a) static scheduler
- b) dynamic scheduler
- c) aperiodic scheduler
- d) preemptive scheduler

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Answer: a

Explanation: The static scheduler generates tables of start times which are forwarded to a simple dispatcher and it can be controlled by a timer which makes the dispatcher analyze the table.

9. Which of the following systems are entirely controlled by the timer?

- a) voltage triggered
- b) time triggered
- c) aperiodic task scheduler
- d) periodic task scheduler

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Answer: b

Explanation: The systems which are entirely controlled by a timer are known as entirely time-triggered systems. A temporal control structure is associated with the entirely time-triggered system which is encoded in a TDL, task descriptor list.

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10. What does TDL stand for?

- a) task descriptor list
- b) task design list
- c) temporal descriptor list
- d) temporal design list

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Answer: a

Explanation: TDL is a task descriptor list which contains the cyclic schedule for all activities of the node and the temporal control structure is encoded by the task descriptor table.

11. Which scheduling algorithm can be used in mixed software/hardware systems?

- a) simple algorithm
- b) complex algorithm
- c) uniprocessor algorithm
- d) multiprocessor algorithm

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Answer: b

Explanation: The complex algorithm is used in mixed software/hardware systems. It can be used to handle multiple processors.

12. Which algorithm can distinguish homogeneous multiprocessor system and heterogeneous multiprocessor system?

- a) complex algorithm
- b) simple algorithm
- c) scheduler algorithm
- d) preemptive algorithm

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Answer: a

Explanation: The simple algorithm can be used in handling single processors and the complex algorithm is used in mixed both in software and the hardware systems. It can also be used to distinguish homogeneous multiprocessor system and heterogeneous multiprocessor systems. The complex algorithm can be used to handle multiple processors whereas.

13. Which of the following scheduling test can be used to show that no scheduling exist?

- a) sufficient test
- b) necessary test
- c) complex test
- d) simple test

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Answer: b

Explanation: The necessary and sufficient conditions are used in the schedulability test. For necessary condition, the test is based only on the necessary conditions and it also can be used to show that no schedule exists. The sufficient condition indicates that no schedule exists even if there exists one.

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14. Which scheduling test is used to indicate that no scheduling exist even if there exist one?

- a) complex test
- b) simple test
- c) sufficient test
- d) necessary test

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Answer: c

Explanation: The sufficient condition indicates that no schedule exists even if there exist one and the necessary condition indicates that no schedule exists even if a schedule exists.

15. Which algorithm can be used to schedule tasks at run-time?

- a) online scheduler
- b) offline scheduler
- c) multiprocessor scheduler
- d) uniprocessor scheduler

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Answer: a

Explanation: The online scheduling algorithm schedules tasks at run-time which is based on the information regarding the task whereas offline algorithms schedule tasks take a priori knowledge about the execution times, arrival times and deadlines into account.

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# Embedded Systems Questions and Answers – Aperiodic Scheduling

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Aperiodic Scheduling”.

1. Which algorithm is based on Jackson’s rule?

- a) EDD
- b) LL
- c) EDF
- d) LST

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Answer: a

Explanation: The EDD or earliest due date is based on Jackson’s rule. The Jackson’s rule states that for a given a set of n independent tasks, any algorithm that executes the tasks in the order of nondecreasing deadlines is optimal with respect to reducing the maximum lateness. EDF is the earliest deadline first, LL is the least laxity and the LST is the least slack time first.

2. What does EDD stand for?

- a) earliest device date
- b) earliest due date
- c) earliest device deadline
- d) earliest deadline device

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Answer: b

Explanation: The earliest due date requires all tasks to be sorted by their deadlines and it is based on Jackson's rule. If the deadlines are known, EDD algorithm can be used.

3. Which of the following can be implemented as static scheduling algorithm?

- a) EDF
- b) LL
- c) EDD
- d) LST

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Answer: c

Explanation: The EDD can be implemented as static scheduling algorithm if the deadlines are known in advance and it follows Jackson's rule.

4. What does EDF stand for?

- a) earliest deadline fix
- b) earliest due fix
- c) earliest due first
- d) earliest deadline first

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Answer: d

Explanation: The EDF stands for earliest deadline first. This algorithm is optimal with respect to minimizing the maximum lateness and is implemented as dynamic scheduling algorithm for a set of n independent tasks with arbitrary arrival times, any algorithm that at any instant executes the task with the earliest absolute deadline among all the ready tasks is optimal with respect to minimizing the maximum lateness.

5. Which algorithm is dynamic scheduling algorithm?

- a) LL
- b) LST
- c) EDF
- d) EDD

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Answer: c

Explanation: The EDF or earliest deadline first can be implemented as a dynamic scheduling algorithm.

6. In which scheduling, the task priorities are a monotonically decreasing function of laxity?

- a) LL
- b) EDD
- c) EFD
- d) LST

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Answer: a

Explanation: In the least laxity algorithm, the laxity can be changed dynamically which shows that the task priorities are a monotonically decreasing function of laxity.

7. Which scheduling algorithm is an optimal scheduling policy for mono-processor system?

- a) preemptive algorithm
- b) LST
- c) EDD
- d) LL

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Answer: d

Explanation: The least laxity algorithm is a dynamic scheduling algorithm and hence it can be implemented as an optimal scheduling policy for the mono-processor system. The LL scheduling algorithm is also preemptive scheduling.

8. Which scheduling algorithm cannot be used with a standard OS providing fixed priorities?

- a) LL
- b) LST
- c) EDD
- d) EFD

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Answer: a

Explanation: The least laxity algorithm cannot be used with a standard OS providing fixed priorities because of its dynamic property.

9. Who proposed the LDF algorithm?

- a) Bayes
- b) Nyquist
- c) Lawler
- d) Stankovic

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Answer: c

Explanation: The latest deadline first or LDF is proposed by Lawler which performs a topological sort. It is based on the total order compatible with the partial order with respect to the task graph.

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10. What does LDF stand for?

- a) last deadline first
- b) least deadline first
- c) list deadline first
- d) latest deadline first

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Answer: d

Explanation: The LDF or latest deadline first is a scheduling algorithm which is proposed by Lawler.

11. Which algorithm is non-preemptive and can be used with a mono processor?

- a) LDF
- b) pre-emptive
- c) aperiodic
- d) LL

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Answer: a

Explanation: The latest deadline first or LDF is a non-preemptive scheduling algorithm and can be used with a mono processor whereas LL or least laxity is a preemptive scheduling algorithm.

12. Which algorithm requires the periodic checks of the laxity?

- a) LST
- b) LL
- c) EDD
- d) EFD

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Answer: b

Explanation: The LL scheduling algorithm requires the knowledge of the execution times and the periodic check of the laxity.

13. Who developed the heuristic algorithm?

- a) Stankovic and Ramamritham
- b) Stankovic and Lawler
- c) Lawler
- d) Stankovic

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Answer: a

Explanation: The heuristic algorithm is developed by Stankovic and Ramamritham in 1991.

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14. Which algorithm can be used if the preemptive is not allowed?

- a) heuristic algorithm
- b) LL
- c) EDD
- d) LST

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Answer: a

Explanation: The heuristic algorithm was proposed by Stankovic and Ramamritham in 1991 can be used if the preemption is not allowed.

15. Deadline interval – execution time =

- a) laxity
- b) execution time
- c) deadline interval
- d) period

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Answer: a

Explanation: The laxity is defined as the deadline interval minus the execution time. It is also known as the slack.

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# Embedded Systems Questions and Answers – Periodic Scheduling

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Periodic Scheduling”.

1. The execution of the task is known as

- a) process
- b) job
- c) task
- d) thread

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Answer: b

Explanation: The execution of the task is known as the job. The time for both the execution of the task and the corresponding job is same.

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2. Which scheduling algorithm is can be used for an independent periodic process?

- a) EDD
- b) LL
- c) LST
- d) RMS

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Answer: d

Explanation: The RMS os rate monotonic scheduling is periodic scheduling algorithm but EDD, LL, and LST are aperiodic scheduling algorithm.

3. What is the relationship between the priority of task and their period in RMS?

- a) decreases
- b) increases
- c) remains unchanged

d) linear

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Answer: a

Explanation: The priority of the task decreases monotonically with respect to their period in the rate monotonic scheduling, that is, the task with the long period will get a low priority but task with the short period will get a high priority.

4. Which of the following uses a preemptive periodic scheduling algorithm?

- a) Pre-emptive scheduling
- b) RMS
- c) LL
- d) LST

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Answer: b

Explanation: The rate monotonic scheduling is a periodic scheduler algorithm which follows a preemptive algorithm. LL is also preemptive scheduling but it is aperiodic scheduling algorithm.

5. Which of the following is based on static priorities?

- a) Periodic EDF
- b) RMS
- c) LL
- d) Aperiodic EDF

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Answer: b

Explanation: The rate monotonic scheduling is a periodic scheduler algorithm which follows a preemptive algorithm and have static priorities. EDF and LL have dynamic priorities.

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6. How many assumptions have to meet for a rate monotonic scheduling?

- a) 3
- b) 4
- c) 5
- d) 6

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Answer: d

Explanation: The rate monotonic scheduling has to meet six assumptions. These are: All the tasks should be periodic, all the tasks must be independent, the deadline should be equal to the period for all tasks, the execution time must be constant, the time required for the context switching must be negligible, it should hold the accumulation utilization equation.

7. Which of the following can be applied to periodic scheduling?

- a) EDF
- b) LL
- c) LST
- d) EDD

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Answer: a

Explanation: The earliest deadline first can be applied both to the periodic and aperiodic scheduling algorithm. But LL, LST, and EDD are aperiodic scheduling. It is not applicable to the periodic scheduling.

8. Which of the following periodic scheduling is dynamic?

- a) RMS
- b) EDF
- c) LST
- d) LL

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Answer: b

Explanation: The EDF or the earliest deadline first is a periodic scheduling algorithm which is dynamic but RMS or rate monotonic scheduling is the periodic algorithm which is static. The LL and LST are aperiodic scheduling algorithm.

9. Which of the following do the sporadic events are connected?

- a) Interrupts
- b) NMI
- c) Software interrupt
- d) Timer

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Answer: a

Explanation: The sporadic events are connected to the interrupts thereby execute them immediately as possible since the interrupt priority is the highest in the system.

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10. Which of the following can execute quickly, if the interrupt priority is higher in the system?

- a) EDD
- b) Sporadic event
- c) LL
- d) Aperiodic scheduling

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Answer: b

Explanation: The sporadic events are connected to the interrupts and execute them immediately because the interrupt priority is the highest priority level in the system.

11. Which of the following are used to execute at regular intervals and check for ready sporadic tasks?

- a) sporadic task server
- b) sporadic task client
- c) sporadic event application
- d) sporadic register

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Answer: a

Explanation: The special sporadic task servers are used that execute at regular intervals and check for ready sporadic tasks which improve the predictability of the whole system.

12. How is a sporadic task can turn into a periodic task?

- a) scheduling algorithm
- b) sporadic task event
- c) sporadic register
- d) sporadic task server

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Answer: d

Explanation: The special sporadic task servers execute at regular intervals and check for ready sporadic tasks and by this, sporadic tasks are essentially turned into periodic tasks which can improve the predictability of the whole system.

13. Which of the following is more difficult than the scheduling independent task?

- a) scheduling algorithm
- b) scheduling independent task
- c) scheduling dependent task
- d) aperiodic scheduling algorithm

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Answer: c

Explanation: The scheduling dependent task is more difficult than the independent scheduling task. The problem of deciding whether or not a schedule exists for a given set of dependent tasks and a given deadline is NP-complete.

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14. Which scheduling is the basis for a number of formal proofs of schedulability?

- a) LL
- b) RMS
- c) LST
- d) EDD

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Answer: b

Explanation: The rate monotonic scheduling which is an independent scheduling algorithm form the basis for a number of formal proofs of schedulability.

15. Which of the following is independent scheduling?

- a) LL
- b) LST
- c) EDD
- d) RMS

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Answer: d

Explanation: The RMS or rate monotonic scheduling is the independent scheduling algorithm which is included in the assumptions of RMS, that is, all tasks should be independent.

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# Embedded Systems Questions and Answers – Debugging Techniques

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Debugging Techniques”.

1. Which allows the parallel development of the hardware and software in the simulation?
  - a) high-level language simulation
  - b) low-level language simulation
  - c) cpu simulator
  - d) onboard simulator

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Answer: a

Explanation: The high-level language simulation allows parallel development of the software and the hardware and when two parts are integrated, that will work. It can simulate I/O using the keyboard as the inputs or task which passes input data for other modules.

2. Which of the following are used to test the software?
  - a) data entity
  - b) data entry
  - c) data table
  - d) data book

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Answer: c

Explanation: In the high-level language simulation, many techniques are used to simulate the system and one such is the data table which contains the data sequences which are used to test the software.

3. Which allows the UNIX software to be ported using a simple recompilation?
  - a) pSOS+
  - b) UNIX compatible library
  - c) pSOS+m
  - d) pOS+kernel

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Answer: b

Explanation: The most of the operating system support or provide the UNIX-compatible library which supports the UNIX software to be ported using a simple recompilation.

4. Which of the following can simulate the processor, memory, and peripherals?
  - a) input simulator
  - b) peripheral simulator

- c) memory simulator
- d) cpu simulator

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Answer: d

Explanation: The CPU simulator can simulate the memory, processor, and the peripherals and allow the low-level assembler code and the small HLL programs to be tested without the actual hardware.

5. How many categories are there for the low-level simulation?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: a

Explanation: There are two categories for the low-level simulation. The first category simulates the memory system, programming model and can offer simple debugging tools whereas the second category simulation provides timing information based on the number of clocks.

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6. Which of the following can simulate the LCD controllers and parallel ports?

- a) memory simulator
- b) sds
- c) input simulator
- d) output tools

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Answer: b

Explanation: There are certain tools which provide powerful tools for simulation and one such is the SDS which can simulate the processor, memory systems, integrated processor, onboard peripherals such as LCD controllers and parallel ports.

7. Which of the following provides a low-level method of debugging software?

- a) high-level simulator
- b) low-level simulator
- c) onboard debugger
- d) cpu simulator

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Answer: c

Explanation: The onboard debugger provides a very low-level method of simulating or debugging the software. It usually handles EPROMs which are plugged into the board or a set of application codes by providing a serial connection to communicate with the PC or workstation.

8. Which of the following has the ability to download code using a serial port?

- a) cpu simulator
- b) high-level language simulator
- c) onboard debugger
- d) low-level language simulator

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Answer: c

Explanation: The onboard debugger has the ability to download code from a floppy disk or by using a serial port.

9. What does the processor fetch from the EPROM if the board is powered?

- a) reset vector
- b) ready vector
- c) start vector
- d) acknowledge vector

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Answer: a

Explanation: The processor fetches its reset vector from the table which is stored in the EPROM when the board is powered and then starts the initialize the board.

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10. Which of the following device can transfer the vector table from the EPROM?

- a) ROM
- b) RAM
- c) CPU
- d) peripheral

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Answer: b

Explanation: When the board gets powered up, the reset vector from the table stored in the EPROM makes the initialisation of the board and is transferred to the RAM from the EPROM through the hardware where the EPROM memory address is temporarily altered.

11. Which of the following is used to determine the number of memory access in an onboard debugger?

- a) timer

- b) counter
  - c) input
  - d) memory
- [View Answer](#)

Answer: b

Explanation: The counter is used to determine a preset number of memory accesses, which is assumed that the table has been transferred by the debugger and the EPROM address can be safely be changed.

12. Which of the following has the ability to use the high-level language functions, instructions instead of the normal address?

- a) task level debugging
- b) low level debugging
- c) onboard debugging
- d) symbolic debugging

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Answer: d

Explanation: The symbolic debugging has the ability to use high-level language functions, instructions and the variables instead of the normal addresses and their contents.

13. Which of the following debugger works at the operating system level?

- a) task level debugging
- b) low level debugging
- c) onboard debugging
- d) symbolic debugging

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Answer: a

Explanation: The task level debugging has the ability to work at the operating level or at the particular tasks whereas the low-level debugger cannot set for particular task functions or operations, it can only set a breakpoint at the start of the routine which sends a message.

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# Embedded Systems Questions and Answers – Debugging Technique:Xray

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Debugging Technique:Xray”.

1. Which of the following has a single set of compiler and the debugger tools?

- a) Xray
- b) onboard debugger
- c) emulation
- d) high-level simulator

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Answer: a

Explanation: The Xray debugging technique is a product from the Microtec which is having a complete set of compiler and debugger tools which will work with the simulator, debugger, emulator and the onboard debugger.

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2. Who developed the Xray product?

- a) IBM
- b) Intel
- c) Microtec
- d) Motorola

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Answer: c

Explanation: The Xray which is a product from the Microtec is having a complete set of compiler and debugger tools.

3. Which part of the Xray can interface with a simulator?

- a) emulator
- b) debugger
- c) simulator
- d) onboard debugger

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Answer: b

Explanation: The Xray consists of the consistent debugger which can interface the emulator, simulator, task level debugger or onboard debugger.

4. Which can provide the consistent interface to the Xray?

- a) emulator
- b) simulator
- c) memory simulator
- d) debugger system

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Answer: d

Explanation: The Xray consists of the debugger which interfaces with the emulator, simulator, onboard debugger that provides the consistent interface to the Xray product. This can improve the overall productivity of the product since it does not require any relearning.

5. Which of the following can access the information directly in the Xray?

- a) emulator
- b) debugger
- c) simulator
- d) hardware

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Answer: c

Explanation: The Xray obtain its debugging information from a variety of sources and how it access these sources. The simulator can access direct information but the emulator can access the information via a serial line or via the ethernet or directly across a shared memory interface.

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6. Which of the following access the information through the ethernet in a Xray?

- a) simulator
- b) debugger
- c) onboard debugger
- d) emulator

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Answer: d

Explanation: The Xray obtain its debugging information from a variety of sources. The emulator can access the information via a serial line or via the ethernet or directly across a shared memory interface and the simulator can access the direct information.

7. Which tools help the Xray allows the software to be developed on the host system?

- a) compiler tool

- a) simulator tool
  - c) debugger tool
  - d) emulator tool
- [View Answer](#)

Answer: a

Explanation: The compiler tools allow the software to be developed on the host system and this system does not have to use the same processor as the target.

8. Which of the following is ideal for debugging codes at an early stage?

- a) compiler
- b) debugger
- c) simulator
- d) emulator

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Answer: c

Explanation: There are a variety of ways for executing the codes. The simulator provides an ideal way for debugging the codes at an early stage, that is before the hardware is available and it can allow the software to proceed in parallel with the hardware.

9. How can we extend the power of Xray?

- a) Xray interface
- b) Xray memory
- c) Xray input
- d) Xray peripheral

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Answer: a

Explanation: The power of the Xray product can be extended by the Xray interface method from the operating system debugger.  
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10. Which of the following uses the Xray interface method to provide the debugging interface?

- a) pSOS+m
- b) pSOS
- c) pSOS+
- d) NAP

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Answer: c

Explanation: The pSOS+ uses the Xray interface method to provide the debugging interfaces which can extend the power of the Xray.

11. How is the processor enter into a BDM state?

- a) BDM signal
- b) Start signal
- c) BDM acknowledge signal
- d) Start signal of the processor

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Answer: a

Explanation: The assertion of the BDM signal or by executing the special BDM instruction, the processor enter into the BDM state and when the processor enters into the BDM mode, low-level microcode takes the processor which allows the breakpoint to be set, registers to be accessed and so on.

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## Embedded Systems Questions and Answers – Emulation Techniques

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Emulation Techniques”.

1. What does ICE stand for?

- a) in-circuit emulation
- b) in-code EPROM
- c) in-circuit EPOM
- d) in-code emulation

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Answer: a

Explanation: The ICE or in-circuit emulation is one the traditional method used to emulate the processor in the embedded system so that the software can be downloaded and can be debugged in situ in the end application.

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2. Which of the following is a traditional method for emulating the processor?

- a) SDS
- b) ICE
- c) CPU simulator
- d) Low-level language simulator

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Answer: b

Explanation: The SDS is one of the simulation tool used in the embedded systems. CPU simulator and the low-level simulator are the other kinds of the simulator used in the embedded system design.

3. Which of the following does not have the ability to get hundred individual signal cables into the probe in the emulation technique?

- a) OnCE
- b) BDM
- c) ICE
- d) JTAG

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Answer: c

Explanation: The in-circuit emulation does not have the ability to get a hundred individual signal cables into the probe. This problem comes under the physical limitation of the probe, that is as the density of the processor increases the available sockets which provide good electrical contacts is becoming harder which causes a restriction to the probe.

4. What does JTAG stand for?

- a) joint tag address group
- b) joint test address group
- c) joint test access group
- d) joint test action group

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Answer: d

Explanation: The JTAG is a joint test action group which is an electronics industry association which developed the interfacing port that is standardised for testing the devices.

5. Which of the following allows access to all the hardware within the system?

- a) debugger
- b) JTAG

- c) onboard debugger
  - d) simulator
- [View Answer](#)

Answer: b

Explanation: The JTAG can access all the hardware within the system. They provide a way of taking over the pins of a device and allows the different bit patterns to be imposed on the pins which allow other circuits to be tested with the imposed pins.

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6. Which of the following works by using a serial port?

- a) Simulator
- b) JTAG
- c) BDM
- d) OnCE

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Answer: b

Explanation: The JTAG works by using a serial port and clocking data into a shift register and the output of the shift register drives the pins under the control of the port.

7. What is meant by OnCE?

- a) on-chip emulation
- b) off-chip emulation
- c) one-chip emulation
- d) once-chip emulation

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Answer: a

Explanation: The OnCE is an on-chip emulation which is a debugging facility used in the digital signal processor chips.

8. Which debugging facility is used in the Motorola's DSP 56x0x family?

- a) JTAG
- b) ICE
- c) OnCE
- d) BDM

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Answer: c

Explanation: The on-chip emulation provides a debugging facility in the DSP chips. The OnCE is developed for Motorola's DSP 56x0x family.

9. Which facility provides the provision of the debug ports in the ICE technique?

- a) simulator
- b) emulator
- c) debug support
- d) jtag

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Answer: c

Explanation: The debugging support to the processor enables the processor to be a single stepped and breakpoint under remote control from a host or the workstation. This facility can provide the provision of the debug ports.

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10. How the additional registers are accessed in the OnCE?

- a) parallel port
- b) serial port
- c) jtag
- d) address register

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Answer: b

Explanation: The on-chip emulation can access additional registers by using a special serial port within the device that provides control over the processor and access to its internal registers.

11. Which of the following emulators can provide its own in circuit emulation facility?

- a) Simulator
- b) Debugger
- c) SDS
- d) OnCE

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Answer: d

Explanation: Every system can provide its own in circuit emulation facilities by hooking the port to an interface port in a workstation or in the PC while connecting the OnCE port to an external connector.

12. What does BDM stand for?

- a) background debug mode

- b) basic debug mode
  - c) basic debug microcode
  - d) background decode mode
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Answer: a

Explanation: The BDM or background debug mode is similar to the on-chip emulator with a slight difference. BDM is provided on the Motorola MC683xx series of processors and for the 8-bit microcontroller like MC68HC12 etc.

13. Which emulator is used in MC68HC12?

- a) JTAG
- b) BDM
- c) On-CE
- d) SDS

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Answer: b

Explanation: The BDM or the background debug mode is provided on the Motorola MC683xx series of processors and for several 8-bit microcontrollers. One such microcontroller is the MC68HC12.

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14. Which of the following takes the processor, when the processor enters the BDM mode?

- a) address code
- b) high-level microcode
- c) low-level microcode
- d) data code

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Answer: c

Explanation: When the processor enters into the BDM mode, low-level microcode takes the processor which allows the breakpoint to be set, registers to be accessed and so on.

15. Which of the following has the additional circuitry which supports the background debug mode?

- a) memory
- b) input
- c) peripheral
- d) processor

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Answer: d

Explanation: The processor has the additional circuitry which can provide special support for the background debug mode and is under the control of the remote system connected to its BDM port.

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## Embedded Systems Questions and Answers – Buffers

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Buffers”.

1. Which of these is an area for temporary memory storage?

- a) buffer
- b) register
- c) table
- d) flag

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Answer: a

Explanation: The buffer is an area that is used to store data temporarily which can be used to compensate the timing problems.

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2. Which of the following can be used as a collection point of data?

- a) register
- b) buffer
- c) flag register
- d) accumulator

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Answer: b

Explanation: The buffer can be used as a collection point for data, that is all the important information can be collected and organised before processing.

3. Which device can compensate for the timing problems between the software?

- a) index
- b) register
- c) buffer
- d) memory

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Answer: c

Explanation: The buffer is used to store data temporarily which can be used to compensate the timing problems between the software and it can also be used as a collection point for data, that is all the important information can be collected and organised before processing.

4. What do a buffer consist of?

- a) memory and register
- b) memory and peripheral
- c) memory and flag register
- d) memory and pointer

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Answer: d

Explanation: The buffer consists of a pointer and memory which can be used to locate the next piece of data to be removed or accessed from the buffer.

5. Which of the following is a condition for buffer overrun?

- a) cannot accept data
- b) cannot receive data
- c) cannot provide data
- d) can provide data

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Answer: a

Explanation: The buffer involves two conditions. These are the buffer overrun condition and the buffer underrun condition. If the buffer cannot accept any more data, it is said to be buffer overrun.

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6. What is the state of the buffer if it asked for data and cannot provide it?

- a) overrun
- b) underrun
- c) remains unchanged

d) beyond overrun  
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Answer: b

Explanation: The buffer is said to be overrun if the buffer cannot accept any more data and said to be underrun if it asked for data but not able to provide it.

7. Which of the following can remove data from the buffer?

- a) memory
- b) ram
- c) pointer
- d) slack

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Answer: c

Explanation: The data can be removed from the buffer using a pointer. The pointer locates the next value and can move the data from the buffer and is moved to the next location by incrementing its value by the number of words or bytes.

8. How many bits does a 32-bit processor can access?

- a) 32-bit char
- b) 32-bit word
- c) 32-bit double
- d) 32-bit double word

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Answer: b

Explanation: The 32-bit processor can access 32-bit word and hence the pointer is incremented by one.

9. What occurs first if data is stored in the buffer?

- a) speed increases
- b) linear shoot
- c) overshoot
- d) delay

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Answer: d

Explanation: When the data is stored in the buffer, at first there will be a delay and the subsequent data is received from the buffer. This delay is known as buffer latency.

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10. Which of the following defines the earliest information that is passed through the buffer?

- a) buffer latency
- b) memory
- c) pointer
- d) peripheral

[View Answer](#)

Answer: a

Explanation: The buffer latency determines the earliest information that passes through the buffer and any response to that information will be delayed by the buffer latency irrespective of how fast the processor is.

11. Which of the following possesses a problem for data streams on the real-time operating system?

- a) pointer
- b) memory
- c) latency
- d) processor

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Answer: c

Explanation: The latency will be a problem for the real-time operating system such as the digital audio system which must have a consistent and regular stream of data.

12. Which of the following determines the time to take a simple sample?

- a) buffer
- b) latency
- c) pointer
- d) memory

[View Answer](#)

Answer: b

Explanation: The sampling is performed on a regular basis in which the filtering takes less time than the interval between the sample and this does not need a buffering and it will have very low latency. Each sample is received, processed and stored and the latency is the time take a single sample.

13. How is a stack created?

- a) slack and pointer
- b) stack and memory
- c) memory and a pointer

d) memory and a register

[View Answer](#)

Answer: d

Explanation: The slack is created in the same way as the buffer does, that is by using a memory and a pointer. The control associated with the buffer or memory is a register which acts as an address pointer.

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14. Which of the following acts as an address pointer?

- a) memory
- b) pointer
- c) stack
- d) register

[View Answer](#)

Answer: d

Explanation: The control associated with the buffer or memory is a register which acts as an address pointer.

15. Which of the following possesses an issue while concerning the memory size of the buffer?

- a) digital signal processor
- b) microprocessor
- c) memory
- d) pointer

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Answer: a

Explanation: The digital signal processor with on-chip memory and the microcontroller possesses an issue on concerning the memory size of the buffer with small amounts of RAM. But with the large system, this is not a major issue.

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# Embedded Systems Questions and Answers – Types of Buffers

1. Which of the buffers has a single piece of linear contiguous memory?

- a) circular buffer
- b) linear buffer
- c) directional buffer
- d) double buffer

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Answer: b

Explanation: The linear buffer is contiguous memory which is a single piece memory that is controlled by the pointers whose address increments linearly.  
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2. Which buffer will lose data when it is full?

- a) linear buffer
- b) circular buffer
- c) directional buffer
- d) double buffer

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Answer: a

Explanation: The linear buffer has a single piece of contiguous memory which is controlled by the pointers whose address increments linearly and it will lose data when it is full and fail to provide data when it is empty.

3. Which of the following buffers loses the incoming data when it is full?

- a) circular buffer
- b) double buffer
- c) linear buffer
- d) directional buffer

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Answer: c

Explanation: The linear buffer will lose the incoming data when full such that the data it contains become older, which is known as the overrun condition.

4. Which state of the linear buffer will provide old data, when it is empty?

- a) overrun
- b) critical timing
- c) peak overshoot
- d) underrun

[View Answer](#)

Answer: d

Explanation: In the linear buffer, when it is empty it will provide the old data, usually the last entry so that the processor will continue to process the incorrect data potentially, and this condition is known as underrun.

5. Which state of the linear buffer loses its incoming data when full?

- a) underrun
- b) overrun
- c) critical time
- d) pointer

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Answer: b

Explanation: In the overrun condition, the linear buffer will lose the incoming data when the buffer is filled and the data it contains become older.  
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6. Which technique can solve the errors in the linear buffer?

- a) low water mark
- b) high water mark
- c) low and high water mark
- d) pointer

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Answer: c

Explanation: The errors in the linear buffering include the loss of data especially during the regular sampling which can be avoided by the pointers that are checked against certain values and this result is used for fetching more data. These points are known as the low water mark and the high water mark.

7. Which of the following is similar to the high and low water marks at the coast?

- a) minimum and maximum water level
- b) low and high water mark
- c) small and big water mark
- d) medium and high water mark

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Answer: b

Explanation: There are some errors in the linear buffering which includes the loss of data especially in the regular sampling. This can be avoided by the pointers that are checked against certain values and the result is used to fetch more data. These points are known as the low water mark and the high water mark. It is

named so because it is similar to the high and low water marks seen at the coast which indicates the maximum and minimum levels that the tidal water will fall and rise.

8. Which of the following determines the number of entries in the buffer?

- a) low water mark
- b) high water mark
- c) low and high water mark
- d) small and big water mark

[View Answer](#)

Answer: a

Explanation: The number of entries below the low water mark determines the number of entries the buffer has and the amount of time which is available to fill the buffer before empties and the condition is known as underrun.

9. Which of the following determines the number of empty entries?

- a) low water tank
- b) high water tank
- c) small water tank
- d) big water tank

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Answer: b

Explanation: The high water tank measures the number of empty entries, that is the number of empty entries above the high water tank determines the length of time which is available to stop the filling of the buffer and it can prevent the data loss through overrunning.

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10. In which case, the buffer is used by two software task?

- a) single buffer
- b) linear buffer
- c) double buffer
- d) directional buffer

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Answer: a

Explanation: In the single buffer, the buffer is used by two software tasks to insert or extract information. The problem with this buffer is that the water level is above or below, and the free space that is used to fill the buffer does not lie in the correct location.

11. Which buffer is important for the signal data?

- a) double buffer
- b) single buffer
- c) linear buffer
- d) directional buffer

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Answer: d

Explanation: The directional buffer is used for the signal data or for the data which is sampled periodically. The data must be kept in the same order in order to preserve it in chronological order.

12. Which of the following uses two buffers?

- a) linear buffer
- b) single buffer
- c) double buffer
- d) directional buffer

[View Answer](#)

Answer: c

Explanation: The double buffer uses buffers as its name suggest, one buffer is for filling and the other buffer is for extraction.

13. Which of the following uses a single low water tank and a next data pointer?

- a) single buffer
- b) double buffer
- c) directional buffer
- d) linear buffer

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Answer: a

Explanation: The single buffer uses a single low water tank and a next data pointer. The next data pointer is used for accessing the next entry that should be extracted.

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# Embedded Systems Questions and Answers – Buffer Exchange

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Buffer Exchange”.

1. Which of the following allows the multiple tasks to process data simultaneously?

- a) single buffer
- b) double buffer
- c) buffer exchange
- d) directional buffer

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Answer: c

Explanation: The buffer exchange allows the multiple tasks to process simultaneously without having to have control structures to supervise access and it is also used to simplify the control code.

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2. Which buffering mechanism is common to the SPOX operating system?

- a) buffer exchange
- b) single buffer
- c) linear buffer
- d) directional buffer

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Answer: a

Explanation: The buffer exchange can support the SPOX operating system which is used for the digital signal processors and it is easy to implement.

3. Which buffers exchange the empty buffers for full ones?

- a) single buffer
- b) buffer exchange
- c) directional buffer
- d) double buffer

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Answer: b

Explanation: The buffer exchange can be used for exchanging the empty buffers with the full ones. It will have more than two buffers.

4. Which process takes place when the buffer is empty?

- a) read
- b) write
- c) read and write
- d) memory access

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Answer: a

Explanation: The buffer exchange will contain the data in case of the writing process but the buffer will be emptied in the case of the read cycle.

5. Which process takes place when the buffer contains data?

- a) read
- b) read and write
- c) acknowledge
- d) write

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Answer: d

Explanation: The buffer will be emptied in the case of the readin process and it will contain the data in case of the writing process.  
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6. Which of the following does not need to have a semaphore?

- a) double buffer
- b) single buffer
- c) buffer exchange
- d) directional buffer

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Answer: c

Explanation: There are many advantages over the buffer exchange. One such is that it will not have a semaphore to control any shared memory or buffers.

7. Which buffer can assimilate a large amount of data before processing?

- a) single buffer
- b) double buffer
- c) multiple buffers
- d) directional buffer

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Answer: c

Explanation: The requesting task can use multiple buffers which can assimilate large amounts of data before processing. This can be considered one of the advantages of the buffer exchange.

8. Which can reduce the latency?

- a) partial filling
- b) complete filling
- c) no filling
- d) multiple buffers

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Answer: a

Explanation: The latency is introduced because of the size of the buffer. The partial filling of data can be used to reduce the latency but it requires some additional control signal.

9. Which of the following can indicate when the buffer is full or ready for collection?

- a) intra-task communication
- b) inter-task communication
- c) memory task communication
- d) peripheral task communication

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Answer: b

Explanation: The level of the inter-task communication can indicate the buffer status, that is whether it is full or ready for collection.  
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10. What solution can be done for the inefficiency in the memory usage of small data?

- a) same size buffer
- b) single buffer
- c) variable size buffer
- d) directional buffer

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Answer: c

Explanation: The buffer exchange becomes inefficient while concerning the memory usage for small and the simple data. In order to solve this problem, variable size buffers can be used but this requires a more complex operation to handle the length of the valid data.

11. Which processor has a different segment buffer?

- a) 8051

- b) 8086
- c) ARM
- d) MC68HC11

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Answer: b

Explanation: The 8086 has a segmented architecture where the buffers are having a different segment. In such processors, the device drive is running in the supervisor mode, requesting task in the user mode and so on.

12. Which of the following can combine buffers in a regular and methodical way using pointers?

- a) buffer exchange
- b) directional buffer
- c) linked lists
- d) double buffer

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Answer: c

Explanation: The linked lists are the way of combining buffers in a methodical way and regular method by using the pointers to point the next entry in the list. This can be maintained by adding an entry to the which contains the address of the next buffer.

13. Which entry will have a special value in the linked list?

- a) first entry
- b) last entry
- c) second entry
- d) second last entry

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Answer: b

Explanation: The last entry will have a special value that indicates that the entry is the last one but the first entry uses the pointer entry to locate the position.

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14. Which entry can use the pointer in the linked list?

- a) first entry
- b) last entry
- c) second entry
- d) third entry

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Answer: a

Explanation: The first entry of the single linked list will use the pointer entry to point the location of the second entry and so on. The last entry will have a special value that indicates that the entry is the last one.

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## Embedded Systems Questions and Answers – Buffer Memory

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Buffer Memory”.

1. How a buffer memory allocate its memory through the linker?

- a) statically
- b) dynamically
- c) linearly
- d) non-linearly

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Answer: a

Explanation: The buffer memory can be allocated mainly in two ways, statically and dynamically. Statically, the memory is allocated through the linker and dynamically it can allocate memory during runtime by calling an operating system.

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2. How did a buffer memory allocate in the runtime?

- a) linearly
- b) non-linearly
- c) statically
- d) dynamically

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Answer: d

Explanation: The buffer memory allocation is done in two ways, statically and dynamically. Dynamically, it can allocate memory during runtime by calling an operating system.

3. Which allocation requires the memory to be defined before building the application?

- a) dynamic allocation
- b) static allocation
- c) linear allocation
- d) straight allocation

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Answer: b

Explanation: The static allocation requires the memory to be defined before building the application and allocates the memory through the special directives at the assembler level.

4. What factor depends on the allocation of buffer memory?

- a) nature
- b) size
- c) variable type and definition
- d) variable size and type

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Answer: c

Explanation: The amount of allocated buffer memory depends on the variable type and the definition, the strings and the character arrays are the most commonly used types.

5. Which are the system calls which are used by the UNIX operating system?

- a) malloc()
- b) unmalloc()
- c) malloc() and unmalloc()
- d) proc() and return

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Answer: c

Explanation: The malloc() and the unmalloc() are the system calls which is used by the UNIX operating system which allocates the memory dynamically and returns it.

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6. Which is the counterpart of the malloc()?

- a) unmalloc()
- b) proc()

- c) struc()
  - d) return()
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Answer: a  
Explanation: The malloc() and unmalloc() are the system calls in which the unmalloc() is the counterpart of the malloc().

7. How is the UNIX operating system allocates its memory?

- a) statically
- b) linearly
- c) non linearly
- d) dynamically

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Answer: d

Explanation: The malloc() and the unmalloc() are the system calls which is used by the UNIX operating system which allocates the memory dynamically and returns it.

8. Which term is used to describe a bug within the memory system?

- a) memory leakage
- b) buffer memory
- c) system call
- d) register leakage

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Answer: a

Explanation: The memory leakage is used to describe the bug within the memory system.

9. What are the common errors that are seen in memory leakage?

- a) memory size
- b) memory type
- c) stack frame error
- d) stack register

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Answer: c

Explanation: The stack frame errors are the common errors which are seen in the memory leakage and it is caused by the stack overflowing of its allocated memory space and the system call function failure.

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10. How the stack frame errors are caused?

- a) stack overflow
- b) underrun
- c) overrun
- d) timing

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Answer: a

Explanation: There are certain common errors called the stack frame errors which are responsible for the memory leakage and it is due to the stack overflowing of its allocated memory space and the system call function failure.

11. Which of the following clean up the stack?

- a) interrupt handler
- b) processor
- c) exception handler
- d) memory handler

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Answer: c

Explanation: The exception handler cleans up the stack memory before returning to the previous executing software thread or the generic handler.

12. Which of the following stores the context of the exception?

- a) stack
- b) register
- c) ROM
- d) RAM

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Answer: a

Explanation: The exception handler is the one which clean up the stack memory before returning to the previous executing software thread and the ROM stores the context of exception in the stack automatically or as a part of the exception routine.

13. Which of the following contains the return information of the stack?

- a) table
- b) vector
- c) frame

d) block  
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Answer: c

Explanation: The stack contains certain frames which are used to store the return information of the stack and thus the frame need to be removed by adjusting the stack pointer accordingly. Normally this is done to avoid the memory leakage.

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# Embedded Systems Questions and Answers – Introduction to Software and Hardware Implementation

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Introduction to Software and Hardware Implementation”.

1. Which of the following allows the reuse of the software and the hardware components?

- a) platform based design
- b) memory design
- c) peripheral design
- d) input design

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Answer: a

Explanation: The platform design allows the reuse of the software and the hardware components in order to cope with the increasing complexity in the design of embedded systems.

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2. Which of the following is the design in which both the hardware and software are considered during the design?

- a) platform based design
- b) memory based design
- c) software/hardware codesign

d) peripheral design  
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Answer: c

Explanation: The software/hardware codesign is the one which having both hardware and software design concerns. This will help in the right combination of the hardware and the software for the efficient product.

3. What does API stand for?

- a) address programming interface
- b) application programming interface
- c) accessing peripheral through interface
- d) address programming interface

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Answer: b

Explanation: The platform-based design helps in the reuse of both the hardware and the software components. The application programming interface helps in extending the platform towards software applications.

4. Which activity is concerned with identifying the task at the final embedded systems?

- a) high-level transformation
- b) compilation
- c) scheduling
- d) task-level concurrency management

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Answer: d

Explanation: There are many design activities associated with the platforms in the embedded system and one such is the task-level concurrency management which helps in identifying the task that needed to be present in the final embedded systems.

5. In which design activity, the loops are interchangeable?

- a) compilation
- b) scheduling
- c) high-level transformation
- d) hardware/software partitioning

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Answer: c

Explanation: The high-level transformation is responsible for the high optimizing transformations, that is, the loops can be interchanged so that the accesses to array components become more local.

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6. Which design activity helps in the transformation of the floating point arithmetic to fixed point arithmetic?

- a) high-level transformation
- b) scheduling
- c) compilation
- d) task-level concurrency management

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Answer: a

Explanation: The high-level transformation are responsible for the high optimizing transformations, that is, for the loop interchanging and the transformation of the floating point arithmetic to the fixed point arithmetic can be done by the high-level transformation.

7. Which design activity is in charge of mapping operations to hardware?

- a) scheduling
- b) high-level transformation
- c) hardware/software partitioning
- d) compilation

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Answer: c

Explanation: The hardware/software partitioning is the activity which is in charge of mapping operations to the software or to the hardware.

8. Which of the following is approximated during hardware/software partitioning, during task-level concurrency management?

- a) scheduling
- b) compilation
- c) task-level concurrency management
- d) high-level transformation

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Answer: a

Explanation: The scheduling is performed in several contexts. It should be approximated with the other design activities like the compilation, hardware/software partitioning, and task-level concurrency management. The scheduling should be precise for the final code.

9. Which of the following is a process of analyzing the set of possible designs?

- a) design space exploration
- b) scheduling

- c) compilation
  - d) hardware/software partitioning
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Answer: a

Explanation: The design space exploration is the process of analyzing the set of designs and the design which meet the specification is selected.  
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10. Which of the following is a meet-in-the-middle approach?

- a) peripheral based design
- b) platform based design
- c) memory based design
- d) processor design

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Answer: b

Explanation: The platform is an abstraction layer which covers many possible refinements to a lower level and is mainly follows a meet-in-the-middle approach.

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# Embedded Systems Questions and Answers – High Level Optimization

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “High Level Optimization”.

1. What does FRIDGE stand for?
  - a) fixed-point programming design environment
  - b) floating-point programming design environment
  - c) fixed-point programming decoding
  - d) floating-point programming decoding

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Answer: a

Explanation: Certain tools are available which are developed for the optimization programmes and one such tool is the FRIDGE or fixed-point programming design environment, commercially made by Synopsys System Studio.

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2. Which of the following tool can replace the floating point arithmetic to fixed point arithmetic?

- a) SDS
- b) FAT
- c) VFAT
- d) FRIDGE

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Answer: d

Explanation: There are certain tools available which are developed for the optimization programmes and one such tool is the FRIDGE or fixed-point programming design environment, commercially made available by Synopsys System Studio. This tool can be used in the transformation program, that is the conversion of floating point arithmetic to the fixed point arithmetic. This is widely used in signal processing.

3. Which programming algorithm is used in the starting process of the FRIDGE?

- a) C++
- b) JAVA
- c) C
- d) BASIC

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Answer: c

Explanation: The FRIDGE tool uses C programming algorithm in the initial stage and is converted to a fixed-C algorithm which extends C by two extends.

4. In which loop transformation, a single loop is split into two?

- a) loop tiling
- b) loop fusion
- c) loop permutation
- d) loop unrolling

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Answer: b

Explanation: Many loop transformations are done for the optimization of the program and one such loop transformation is the loop fusion in which a single loop is split and the loop fission includes the merging of the two separate loops.

5. Which loop transformations have several instances of the loop body?

- a) loop fusion
- b) loop unrolling
- c) loop fission
- d) loop tiling

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Answer: b

Explanation: The loop unrolling is a standard transformation which creates several instances of the loop body and the number of copies of the loop is known as the unrolling factor.

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6. The number of copies of a loop is called as

- a) rolling factor
- b) loop factor
- c) unrolling factor
- d) loop size

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Answer: c

Explanation: The number of copies of the loop is known as the unrolling factor and it is a standard transformation that produces instances of the loop body.

7. Which of the following can reduce the loop overhead and thus increase the speed?

- a) loop unrolling
- b) loop tiling
- c) loop permutation
- d) loop fusion

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Answer: a

Explanation: The loop unrolling can reduce the loop overhead, that is the fewer branches per execution of the loop body, which in turn increases the speed but is only restricted to loops with a constant number of iteration. The unrolling can increase the code size.

8. Which loop transformation can increase the code size?

- a) loop permutation
- b) loop fusion
- c) loop fission

d) loop unrolling  
View Answer

Answer: d

Explanation: The loop unrolling can decrease the loop overhead, the fewer branches per execution of the loop body and this can increase the speed but is only restricted to loops with a constant number of iteration and thus the loop unrolling can increase the code size.

9. Which memories are faster in nature?

- a) RAM
- b) ROM
- c) Scratch pad memories
- d) EEPROM

View Answer

Answer: c

Explanation: As the memory size decreases, it is faster in operation, that is the smaller memories are faster than the larger memories. The small memories are caches and the scratch pad memories.

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10. Which loop transformation reduces the energy consumption of the memory systems?

- a) loop permutation
- b) loop tiling
- c) loop fission
- d) loop fusion

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Answer: b

Explanation: The loop tiling can reduce the energy the consumption of the memory systems.

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# Embedded Systems Questions and Answers – Hardware or Software Partitioning

This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Hardware or Software Partitioning”.

1. What does COOL stand for?

- a) coprocessor tool
- b) codesign tool
- c) code tool
- d) code control

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Answer: b

Explanation: The COOL is the codesign tool which is one of the optimisation technique for partitioning the software and the hardware.  
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2. How many inputs part does COOL have?

- a) 2
- b) 4
- c) 5
- d) 3

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Answer: d

Explanation: The codesign tool consists of three input parts. These are target technology, design constraints and the behaviour and each input follows different functions. The target technology comprises the information about the different hardware platform components available within the system, design constraints are the second part of the input which contains the design constraints, and the behaviour part is the third input which describes the required overall behaviour.

3. Which part of the COOL input comprises information about the available hardware platform components?

- a) target technology
- b) design constraints
- c) both behaviour and design constraints
- d) behaviour

[View Answer](#)

Answer: a

Explanation: The codesign tool consists of three input parts which are described as target technology, design constraints and the behavior. Each input does different functions. The target technology comprises information about the different hardware platform components available within the system.

4. What does the second part of the COOL input comprise?

- a) behaviour and target technology
- b) design constraints
- c) behaviour
- d) target technology

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Answer: b

Explanation: The second part of the COOL input comprises of the design constraints such as the latency, maximum memory size, required throughput or maximum area for application-specific hardware.

5. What does the third part of the COOL input comprise?

- a) design constraints and target technology
- b) design constraints
- c) behaviour
- d) target technology

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Answer: c

Explanation: The codesign tool consists of three input parts and the third part of the COOL input describes the overall behaviour of the system. The hierarchical task graphs are used for this.

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6. How many edges does the COOL use?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: The codesign tool has 2 edges. These are timing edges and the communication edges. The timing edge provides the timing constraints whereas the communication edge contains the information about the amount of information to be exchanged.

7. Which edge provides the timing constraints?

- a) timing edge
- b) communication edge
- c) timing edge and communication edge

d) special edge  
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Answer: a

Explanation: The codesign tool has 2 edges. They are timing edges and the communication edges. The timing edge provides the timing constraints.

8. Which edge of the COOL contains information about the amount of information to be exchanged?

- a) regular edge
- b) timing edge
- c) communication edge
- d) special edge

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Answer: c

Explanation: The codesign tool has 2 edges and these are timing edges and the communication edges. The communication edge contains information about the amount of information to be exchanged.

9. What does Index set KH denotes?

- a) processor
- b) hardware components
- c) task graph nodes
- d) task graph node type

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Answer: b

Explanation: There is a certain index set which is used in the IP or the integer programming model. The KH denotes the hardware component types.  
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10. What does Index set L denotes?

- a) processor
- b) task graph node
- c) task graph node type
- d) hardware components

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Answer: c

Explanation: The index set is used in the IP or the integer programming model. The Index set KP denotes the processor, I denote the task graph nodes and the L denotes the task graph node type.

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# Embedded Systems Questions and Answers – Compilers

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Compilers”.

1. Which of the following helps in reducing the energy consumption of the embedded system?

- a) compilers
- b) simulator
- c) debugger
- d) emulator

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Answer: a

Explanation: The compilers can reduce the energy consumption of the embedded system and the compilers performing the energy optimizations are available.

2. Which of the following help to meet and prove real-time constraints?

- a) simulator
- b) debugger
- c) emulator
- d) compiler

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Answer: d

Explanation: There are several reasons for designing the optimization and compilers and one such is that it could help to meet and prove the real-time constraints.

3. Which of the following is an important ingredient of all power optimization?

- a) energy model
- b) power model
- c) watt model
- d) power compiler

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Answer: b

Explanation: Saving energy can be done at any stage of the embedded system development. The high-level optimization techniques can reduce power consumption and similarly compiler optimization also can reduce the power consumption and the most important thing in power optimization are the power model.

4. Who proposed the first power model?

- a) Jacome
- b) Russell
- c) Tiwari
- d) Russell and Jacome

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Answer: c

Explanation: Tiwari proposed the first power model in the year 1974. The model includes the so-called bases and the inter-instruction instructions. Base costs of the instruction correspond to the energy consumed per instruction execution when an infinite sequence of that instruction is executed. Inter instruction costs model the additional energy consumed by the processor if instructions change.

5. Who proposed the third power model?

- a) Tiwari
- b) Russell
- c) Jacome
- d) Russell and Jacome

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Answer: d

Explanation: The third model was proposed by Russell and Jacome in the year 1998.

6. Which compiler is based on the precise measurements of two fixed configurations?

- a) first power model
- b) second power model
- c) third power model
- d) fourth power model

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Answer: c

Explanation: The third model was proposed by Russell and Jacome in the year 1998 and is based on the precise measurements of the two fixed configurations.

7. What does SPM stand for?

- a) scratch pad memories
- b) sensor parity machine
- c) scratch pad machine
- d) sensor parity memories

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Answer: a

Explanation: The smaller memories provide faster access and consume less energy per access and SPM or scratch pad memories is a kind of small memory which access fastly and consume less energy per access and it can be exploited by the compiler.

8. Which model is based on precise measurements using real hardware?

- a) encc energy-aware compiler
- b) first power model
- c) third power model
- d) second power model

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Answer: a

Explanation: The encc-energy aware compiler uses the energy model by Steinke et al. it is based on the precise measurements of the real hardware. The power consumption of the memory, as well as the processor, is included in this model.

9. What is the solution to the knapsack problem?

- a) many-to-many mapping
- b) one-to-many mapping
- c) many-to-one mapping
- d) one-to-one mapping

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Answer: d

Explanation: The knapsack problem is associated with the size constraints, that is the size of the scratch pad memories. This problem can be solved by one-to-one mapping which was presented in an integer programming model by Steinke et al.

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10. How can one compute the power consumption of the cache?

- a) Lee power model
- b) First power model
- c) Third power model
- d) CACTI

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Answer: d

Explanation: The CACTI can compute the power consumption of the cache which is proposed by Wilton and Jouppi in the year 1996.

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## Embedded Systems Questions and Answers – The Compilation Process

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “The Compilation Process”.

1. Which of the following function can interpret data in the C language?

- a) printf
- b) scanf
- c) proc
- d) file

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Answer: b

Explanation: The scanf and printf are the well-known functions in the C language which is used to interpret data and print data respectively.

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2. What is the first stage of the compilation process?

- a) pre-processing
- b) post-processing
- c) compilation
- d) linking

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Answer: a

Explanation: The pre-processing involves the first stage of the compilation process in which the include files are added. This file defines the standard functions, constants etc and the output is fed to the compiler.

3. Which of the following produces an assembler file in the compilation process?

- a) pre-processor
- b) assembler
- c) compiler
- d) post-processing

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Answer: c

Explanation: The output of the pre-processor is given to the compiler in which it produces an assembler file from the instruction codes of the processor.

4. Which file is converted to an object file?

- a) hex file
- b) decoded file
- c) coded file
- d) assembly file

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Answer: d

Explanation: The output of the pre-processor is given to the compiler which produces an assembler file from the instruction codes of the processor and this possesses libraries. The assembly file is then converted into the object file and this contains the hexadecimal coding.

5. Which of the following contains the hexadecimal coding?

- a) object file
- b) assembly file
- c) coded file
- d) decoded file

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Answer: a

Explanation: The output of the pre-processor is given to the compiler which produces an assembler file from the instruction codes of the processor and this possesses libraries and then these assembly file is converted into the object file and this possesses the coding of hexadecimal.

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6. Which of the following processes the source code before it goes to the compiler?

- a) compiler
- b) simulator
- c) pre-processor
- d) emulator

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Answer: c

Explanation: The pre-processor is responsible for processing the source code before it goes to the compiler and this in turn allows the programmer to define variable types, constants, and much other information.

7. Which of the following allows the programmer to define constants?

- a) pre-processor
- b) compiler
- c) emulator
- d) debugger

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Answer: a

Explanation: The pre-processor processes the source code before it goes to the compiler and this allows the programmer to define variable types, constants, and much other information.

8. Which statement replaces all occurrences of the identifier with string?

- a) # define identifier string
- b) # include
- c) # define MACRO()
- d) # ifdef

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Answer: a

Explanation: # define statement can replace all occurrences of the identifier with string. Similarly, it is able to define the constants, which also make the code easier to understand.

9. Which of the following has the include file?

- a) emulator
- b) debugger
- c) pre-processor
- d) simulator

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Answer: c

Explanation: The pre-processor produces the source code before it goes to the compiler and this allows the programmer to define variable types, constants, and much other information. This pre-processor also has to include files and combines them into the program source.

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10. Which statement is used to condense the code to improve the eligibility?

- a) # define MACRO()
- b) # include
- c) if
- d) else-if

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Answer: a

Explanation: The # define MACRO() statement is used to condense the code for improving the code eligibility or for space reasons.

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## Embedded Systems Questions and Answers – The Compilation Process-II

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This set of Embedded Systems Multiple Choice Questions & Answers focuses on “The Compilation Process-II”.

1. Which of the following are header files?

- a) #include
- b) file
- c) struct()
- d) proc()

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Answer: a

Explanation: The #include is a header file which defines the standard constants, variable types, and many other functions. This can also include some standard libraries.

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2. Which is the standard C compiler used for the UNIX systems?

- a) simulator
- b) compiler
- c) cc
- d) sc

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Answer: c

Explanation: The cc is the standard C compiler used in the UNIX system. Its command lines can be pre-processed, compiled, assembled and linked to create an executable file.

3. Which compiling option is used to compile programs to form part of a library?

- a) -c
- b) -p
- c) -f
- d) -g

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Answer: a

Explanation: There are several options for the compilers. The option -c compiles the linking stage and then leaves the object file. This option is used to compile programs to form a part of the library.

4. Which compiling option can be used for finding which part of the program is consuming most of the processing time?

- a) -f
- b) -g
- c) -p
- d) -c

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Answer: c

Explanation: The -p instructs the compiler to produce codes which count the number of times each routine is called and this is useful for finding the processing time of the programs.

5. Which compiling option can generate symbolic debug information for debuggers?

- a) -c

- b) -p
- c) -f
- d) -g

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Answer: d

Explanation: The -g generates the symbolic debug information for the debuggers. Without this, the debugger cannot print the variable values, it can only work at the assembler level. The symbolic information is passed through the compilation process and stored in the executable file.

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6. Which of the following is also known as loader?

- a) locator
- b) linker
- c) assembler
- d) compiler

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Answer: b

Explanation: The linker is also known as a loader. It can take the object file and searches the library files to find the routine it calls.

7. Which of the following gives the final control to the programmer?

- a) linker
- b) compiler
- c) locator
- d) simulator

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Answer: a

Explanation: The linker can give the final control to the programmer concerning how unresolved references are reconciled, where the sections are located in the memory, which routines are used, and so on.

8. Which command takes the object file and searches library files to find the routine calls?

- a) simulator
- b) emulator
- c) debugger
- d) linker

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Answer: d

Explanation: The linker is also known as a loader. It can take the object file and searches the library files to find the routine it calls. The linker can give the final control to the programmer concerning how unresolved references are reconciled, where the sections are located in the memory, which routines are used, and so on.

9. Which assembler option is used to turn off long or short address optimization?

- a) -n
- b) -V
- c) -m
- d) -o

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Answer: a

Explanation: The option -o puts the assembler into the file obj file, -V can write the assembler's version number on the standard error output, -m runs the macro preprocessor on the source file and -n turns off the long or short address optimization.

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10. Which assembler option runs the m4 macro preprocessor on the source file?

- a) -n
- b) -m
- c) -V
- d) -o

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Answer: b

Explanation: The option -o puts the assembler into the file obj file, -V can write the assembler's version number on the standard error output, -m runs the macro preprocessor on the source file and -n turns off the long or short address optimization.

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# Embedded Systems Questions and Answers – Introduction to VHDL

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Introduction to VHDL”.

1. Which of the following language can describe the hardware?

- a) C
- b) C++
- c) JAVA
- d) VHDL

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Answer: d

Explanation: The VHDL is the hardware description language which describes the hardware whereas the C, C++ and JAVA are software languages.

2. What do VHDL stand for?

- a) Verilog hardware description language
- b) VHSIC hardware description language
- c) very hardware description language
- d) VMEbus description language

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Answer: b

Explanation: VHDL is the VHSIC(very high speed integrated circuit) hardware description language which was developed by three companies, IBM, Intermetrics and Texas Instruments and the first version of the VHDL is established in the year 1984 and later on the VHDL is standardised by the IEEE.

3. What does VHSIC stand for?

- a) very high speed integrated chip
- b) very high sensor integrated chip
- c) Verilog system integrated chip
- d) Verilog speed integrated chip

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Answer: a

Explanation: The VHSIC stands for very high speed integrated chip and VHDL was designed in the context of the VHSIC, developed by the department of defence in the US.

4. Each unit to be modelled in a VHDL design is known as

- a) behavioural model
- b) design architecture
- c) design entity

d) structural model

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Answer: c

Explanation: Each unit to be modelled in a VHDL design is known as the design entity or the VHDL entity. There are two types of ingredients are used. These are the entity declaration and the architecture declaration.

5. Which of the following are capable of displaying output signal waveforms resulting from stimuli applied to the inputs?

- a) VHDL simulator
- b) VHDL emulator
- c) VHDL debugger
- d) VHDL locator

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Answer: a

Explanation: The VHDL simulator is capable of displaying the output signal waveforms which results from the stimuli or trigger applied to the input.

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6. Which of the following describes the connections between the entity port and the local component?

- a) port map
- b) one-to-one map
- c) many-to-one map
- d) one-to-many maps

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Answer: a

Explanation: The port map describes the connection between the entity port and the local component. The component is declared by component declaration and the entity ports are mapped with the port mapping.

7. Who proposed the CSA theory?

- a) Russell
- b) Jacome
- c) Hayes
- d) Ritchie

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Answer: c

Explanation: The CSA theory is proposed by Hayes and this theory is based on the systematic way of building up value sets.

8. Which of the following is a systematic way of building up value sets?

- a) CSA theory
- b) Bayes theorem
- c) Russell's power mode;
- d) first power model

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Answer: a

Explanation: The CSA theory is proposed by Hayes. The theory is based on the systematic way of building up value sets, that is the electronics design system uses a variety of value sets, like 2, 3 etc. The goal of developing discrete value sets is to avoid the problems of solving network equations.

9. Which of the following is an abstraction of the signal impedance?

- a) level
- b) strength
- c) size
- d) nature

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Answer: b

Explanation: The systems contain electrical signals of different strengths and it needs to compute the strength and the logic level resulting from a connection of two or more sources of electrical signals. The strength is the abstraction of the signal impedance.

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10. Which of the following is an abstraction of the signal voltage?

- a) level
- b) strength
- c) nature
- d) size

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Answer: a

Explanation: Most of the systems contain electrical signals of different strengths and levels. The level of the signal is the abstraction of the signal voltage and the strength is the abstraction of the signal impedance.

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# Embedded Systems Questions and Answers – Introduction to VHDL-II

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This set of Embedded Systems online test focuses on “Introduction to VHDL-II”.

1. How many kinds of wait statements are available in the VHDL design?

- a) 3
- b) 4
- c) 5
- d) 6

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Answer: b

Explanation: There are four kinds of wait statements. These are wait on, wait for, wait until and wait.

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2. Which wait statement does follow a condition?

- a) wait for
- b) wait until
- c) wait
- d) wait on

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Answer: b

Explanation: The wait until follows a condition. The condition may be an arithmetic or logical one and the wait for statement follows time duration, it might be in microseconds or nanoseconds or any other time unit. Similarly, the wait on statement follows a signal list and the wait statement suspends indefinitely.

3. Which wait statement does follow duration?

- a) wait for
- b) wait
- c) wait until
- d) wait on

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Answer: a  
Explanation: The wait for statement follows time duration, it might be in microseconds or nanoseconds or any other time unit.

4. Which of the following is a C++ class library?

- a) C++
- b) C
- c) JAVA
- d) SystemC

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Answer: d  
Explanation: System C is a C++ class library which helps in solving the behavioural, resolution, simulation time problems.

5. Which model of SystemC uses floating point numbers to denote time?

- a) SystemC 1.0
- b) SystemC 2.0
- c) SystemC 3.0
- d) SystemC 4.0

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Answer: a

Explanation: The SystemC includes several models of the time units. SystemC 1.0 uses floating point numbers which denote time.

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6. Which model of SystemC uses the integer number to define time?

- a) SystemC 1.0
- b) SystemC 2.0
- c) SystemC 3.0
- d) SystemC 4.0

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Answer: b

Explanation: The SystemC includes several models of the time. System 2.0 is an integer model to define time and this model also supports physical units such as microseconds, nanoseconds, picoseconds etc.

7. Which model of the SystemC helps in the communication purpose?

- a) SystemC 2.0
- b) SystemC 3.0
- c) SystemC 1.0
- d) SystemC 4.0

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Answer: a

Explanation: The SystemC 2.0 provides the channel port and interface ports for the communication purpose.

8. Which C++ class is similar to the hardware description language like VHDL?

- a) SystemC
- b) Verilog
- c) C
- d) JAVA

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Answer: a

Explanation: The SystemC is a C++ class which is similar to the hardware description languages like VHDL and Verilog. The execution and simulation time in the SystemC is almost similar to the VHDL.

9. What does ESL stand for?

- a) EEPROM system level
- b) Electronic-system level
- c) Electrical system level
- d) Electron system level

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Answer: b

Explanation: The ESL is electronic-system level and the SystemC is associated with the ESL and TLM. The SystemC is also applied to the architectural exploration, performance modelling, software development and so on.

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10. What to TLM stand for?

- a) transfer level modelling
- b) triode level modelling
- c) transaction level modelling
- d) transistor level modelling

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Answer: c

Explanation: The TLM is transaction-level modelling and the SystemC is associated with the ESL and TLM.

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# Embedded Systems Questions and Answers – Verilog and System Verilog in Embedded System

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Verilog and System Verilog in Embedded Systems”.

1. Which of the following is standardised as IEEE 1364?

- a) C
- b) C++
- c) FORTRAN
- d) Verilog

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Answer: d

Explanation: The Verilog is a hardware description language which was developed for modelling hardware and electronic devices. This was later standardised by IEEE standard 1364.

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2. Who developed the Verilog?

- a) Moorby
- b) Thomas
- c) Russell and Ritchie
- d) Moorby and Thomson

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Answer: d

Explanation: The Verilog is a hardware description language which was developed by Moorby and Thomson in 1991 and it was standardised as IEEE standard

1364. The Verilog is modelled for the electronics devices.

3. Which versions of the Verilog is known as System Verilog?

- a) Verilog version 3.0
- b) Verilog version 1.0
- c) Verilog version 1.5
- d) Verilog version 4.0

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Answer: a

Explanation: The Verilog versions 3.0 and 3.1 is called as the System Verilog. These include several extensions to the Verilog version 2.0.

4. Which of the following is a Verilog version 1.0?

- a) IEEE standard 1394-1995
- b) IEEE standard 1364-1995
- c) IEEE standard 1394-2001
- d) IEEE standard 1364-2001

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Answer: b

Explanation: The IEEE standard 1364-1995 is the first version of the Verilog and IEEE standard 1394-2001 is the Verilog version 2.0.

5. Which of the following provides multiple-valued logic with eight signal strength?

- a) Verilog
- b) VHDL
- c) C
- d) C++

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Answer: a

Explanation: The Verilog supports the multiple-valued logic with eight different signal strength but Verilog is less flexible compared to the VHDL, that is, it allows the hardware entities to be instantiated in loops which help to build up a structural description.

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6. Which of the following is a superset of Verilog?

- a) Verilog
- b) VHDL
- c) System Verilog
- d) System VHDL

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Answer: c

Explanation: The System Verilog is a superset of the Verilog. But later on, System Verilog and Verilog has merged into a new IEEE standard 1800-2009.

7. Which hardware description language is more flexible?

- a) VHDL
- b) Verilog
- c) C
- d) C++

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Answer: a

Explanation: The Verilog is less flexible compared to the VHDL, that is, it allows the hardware entities to be instantiated in loops which help to build up a structural description. But Verilog, on the other hand, focuses more on the built-in features.

8. Which of the following provide more features for transistor-level descriptions?

- a) C++
- b) C
- c) VHDL
- d) Verilog

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Answer: d

Explanation: The Verilog offers more features than the VHDL but VHDL is more flexible compared to the Verilog. The Verilog can provide transistor-level descriptions but the VHDL cannot provide this description.

9. Which hardware description language is popular in the US?

- a) System Verilog
- b) System log
- c) Verilog
- d) VHDL

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Answer: c

Explanation: Verilog and VHDL are almost similar in their characteristics and have a similar number of users. The VHDL is more popular in Europe whereas Verilog is more popular in the US.

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10. Which hardware description language is more popular in Europe?

- a) VHDL
- b) System log
- c) Verilog
- d) C

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Answer: a

Explanation: The Verilog and VHDL are hardware description language and these are similar in their characteristics and have a similar number of users. The VHDL is more popular in Europe. The Verilog is more popular in the US.

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## Embedded Systems Questions and Answers – Levels of Hardware Modelling

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Levels of Hardware Modelling”.

1. Which of the following is an analogue extension of the VHDL?

- a) VHDL-AMS
- b) System VHDL
- c) Verilog
- d) System Verilog

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Answer: a

Explanation: The VHDL-AMS is the extension of the VHDL and this includes the analogue and mixed behaviour of the signals.

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2. Which of the following support the modelling partial differentiation equation?

- a) gate level

b) algorithmic level

c) system level

d) switch level

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Answer: c

Explanation: There are a variety of levels for designing the embedded systems and each level has its own language. The system level is one such kind which has many peculiarities with respect to the other levels. The system model denotes the entire embedded system and includes the mechanical as well as the information processing aspects. This also supports the modelling of the partial differential equations, which is a key requirement in the modelling.

3. Which level simulates the algorithms that are used within the embedded systems?

a) gate level

b) circuit level

c) switch level

d) algorithmic level

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Answer: d

Explanation: The algorithmic level simulates the algorithm which is used within in the embedded system.

4. Which level model components like ALU, memories registers, muxes and decoders?

a) switch level

b) register-transfer level

c) gate level

d) circuit level

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Answer: b

Explanation: The register-transfer level modelling models all the components like the arithmetic and logical unit(ALU), memories, registers, muxes, decoders etc and this modelling is always cycled truly.

5. Which of the following is the most frequently used circuit-level model?

a) SPICE

b) VHDL

c) Verilog

d) System Verilog

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Answer: a

Explanation: The SPICE is simulation program with integrated circuit emphasis, which is a frequently used circuit-level in the early days. It is used to find the behavior and the integrity of the circuit.

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6. Which model includes geometric information?

a) switch-level model

b) layout model

c) gate level model

d) register-transfer level

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Answer: b

Explanation: The layout reflects the actual circuit model. It includes the geometric information and cannot be simulated directly since it does not provide the information regarding the behavior.

7. Which model cannot simulate directly?

a) circuit level model

b) switch-level model

c) gate level model

d) layout model

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Answer: d

Explanation: The layout model reflects the actual circuit model and this includes the geometric information and this model cannot be simulated directly because it does not provide the information regarding the behavior.

8. Which of the following models the components like resistors, capacitors etc?

a) register-transfer level

b) layout model

c) circuit level model

d) switch-level model

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Answer: c

Explanation: The circuit-level model simulation is used for the circuit theory and its components such as the resistors, inductors, capacitors, voltage sources, current sources. This simulation also involves the partial differential equations.

9. Which model uses transistors as their basic components?

- a) switch model
- b) gate level
- c) circuit level
- d) layout model

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Answer: a

Explanation: The switch model can be used in the simulation of the transistors since the transistor is the very basic component in a switch. It is capable of reflecting bidirectional transferring of the information.

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10. Which model is used to denote the boolean functions?

- a) switch level
- b) gate level model
- c) circuit level
- d) layout model

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Answer: b

Explanation: The gate level model is used to denote the boolean functions and the simulation only consider the behaviour of the gate.

11. Which model is used for the power estimation?

- a) gate-level model
- b) layout model
- c) circuit model
- d) switch model

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Answer: a

Explanation: The gate level model is used to denote the boolean functions and the simulation only consider the behaviour of the gate. This model is also useful in the power estimation since it provides accurate information about the signal transition probabilities.

12. In which model, the effect of instruction is simulated and their timing is not considered?

- a) gate-level model
- b) circuit model
- c) coarse-grained model
- d) layout model

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Answer: c

Explanation: The coarse-grained model is a kind of the instruction set level modelling in which only the effect of instruction is simulated and the timing is not considered. The information which is provided in the manual is sufficient for this type of modelling.

13. Which models communicate between the components?

- a) transaction level modelling
- b) fine-grained modelling
- c) coarse-grained modelling
- d) circuit level model

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Answer: a

Explanation: The transaction level modelling is a type of instruction set level model. This modelling helps in the modelling of components which is used for the communication purpose. It also models the transaction, such as read and writes cycles.

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14. Which of the following has a cycle-true set of simulation?

- a) switch-level model
- b) layout model
- c) circuit-level
- d) fine-grained model

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Answer: d

Explanation: The fine-grained model has the cycle-true instruction set simulation. In this modelling, it is possible to compute the exact number of clock cycles which is required to run an application.

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# Embedded Systems Questions and Answers – Testing

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Testing”.

1. Which of the following is a set of specially selected input patterns?

- a) test pattern
- b) debugger pattern
- c) bit pattern
- d) byte pattern

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Answer: a

Explanation: While testing any devices or embedded systems, we apply some selected inputs which is known as the test pattern and observe the output. This output is compared with the expected output. The test patterns are normally applied to the already manufactured systems.

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2. Which is applied to a manufactured system?

- a) bit pattern
- b) parity pattern
- c) test pattern
- d) byte pattern

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Answer: c

Explanation: For testing any devices or embedded systems, we use some sort of selected inputs which is known as the test pattern and observe the output and is compared with the expected output. These test patterns are normally applied to the manufactured systems.

3. Which of the following is based on fault models?

- a) alpha-numeric pattern
- b) test pattern
- c) bit pattern
- d) parity pattern

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Answer: b

Explanation: The test pattern generation is normally based on the fault models and this model is also known as the stuck-at model. The test pattern is based on a certain assumption, that is why it is called the stuck-at model.

4. Which is also called stuck-at model?

- a) byte pattern

- b) parity pattern
- c) bit pattern
- d) test pattern

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Answer: d

Explanation: The test pattern generation is basically based on the fault models and this type of model is also known as the stuck-at model. These test patterns are based on a certain assumption, hence it is known as the stuck-at model.

5. How is the quality of the test pattern evaluated?

- a) fault coverage
- b) test pattern
- c) size of the test pattern
- d) number of errors

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Answer: a

Explanation: The quality of the test pattern can be evaluated on the basis of the fault coverage. It is the percentage of potential faults that can be found for a given test pattern set, that is fault coverage equals the number of detectable faults for a given test pattern set divided by the number of faults possible due to the fault model.

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6. What is DfT?

- a) discrete Fourier transform
- b) discrete for transaction
- c) design for testability
- d) design Fourier transform

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Answer: c

Explanation: The design of testability or DfT is the process of designing for the better testability.

7. Which of the following is also known as boundary scan?

- a) test pattern
- b) JTAG
- c) FSM
- d) CRC

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Answer: b

Explanation: The JTAG is a technique for connecting scan chains of several chips and is also known as boundary scan.

8. What does BILBO stand for?

- a) built-in logic block observer
- b) bounded input bounded output
- c) built-in loading block observer
- d) built-in local block observer

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Answer: a

Explanation: The BILBO or the built-in logic block observer is proposed as a circuit combining, test response compaction, test pattern generation, and serial input/output capabilities.

9. What is CRC?

- a) code reducing check
- b) counter reducing check
- c) counting redundancy check
- d) cyclic redundancy check

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Answer: d

Explanation: The CRC or the cyclic redundancy check is the error detecting code which is commonly used in the storage device and the digital networks.

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10. What is FSM?

- a) Fourier state machine
- b) finite state machine
- c) fast state machine
- d) free state machine

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Answer: b

Explanation: The FSM is the finite state machine. It will be having a finite number of states and is used to design both the sequential logic circuit and the computer programs. It can be used for testing the scan design in the testing techniques.

11. Which of the following have flip-flops which are connected to form shift registers?

- a) scan design

- b) test pattern
- c) bit pattern
- d) CRC

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Answer: a

Explanation: All the flip-flop storing states are connected to form a shift register in the scan design. It is a kind of test path.

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# Embedded Systems Questions and Answers – Risk and Dependability Analysis

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Risk and Dependability Analysis”.

1. Which is a top-down method of analyzing risks?

- a) FTA
- b) FMEA
- c) Hazards
- d) Damages

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Answer: a

Explanation: The FTA is Fault tree analysis which is a top-down method of analyzing risks. It starts with damage and comes up with the reasons for the damage. The analysis is done graphically by using gates.

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2. What is FTA?

- a) free tree analysis

- b) fault tree analysis
  - c) fault top analysis
  - d) free top analysis
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Answer: b

Explanation: The FTA is also known as the Fault tree analysis which is a top-down method of analyzing risks. The analysis starts with damage and comes up with the reasons for the damage. The analysis can be checked graphically by using gates.

3. Which gate is used in the geometrical representation, if a single event causes hazards?

- a) AND
- b) NOT
- c) NAND
- d) OR

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Answer: d

Explanation: The fault tree analysis is done graphically by using gates mainly AND gates and OR gates. The OR gate is used to represent the single event which is hazardous. Similarly, AND gates are used in the graphical representation if several events cause hazards.

4. Which analysis uses the graphical representation of hazards?

- a) Power model
- b) FTA
- c) FMEA
- d) First power model

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Answer: b

Explanation: The FTA is done graphically by using gates mainly AND gates and OR gates. The OR gate is used to represent the single event which is hazardous.

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5. Which gate is used in the graphical representation, if several events cause hazard?

- a) OR
- b) NOT
- c) AND
- d) NAND

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Answer: c

Explanation: The fault tree analysis is done graphically by using gates. The main gates used are AND gates and OR gates. The AND gates are used in the graphical representation if several events cause hazards.

6. What is FMEA?

- a) fast mode and effect analysis
- b) front mode and effect analysis
- c) false mode and effect analysis
- d) failure mode and effect analysis

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Answer: d

Explanation: The FMEA is the failure mode and the effect analysis, in which the analysis starts at the components and tries to estimate their reliability.

7. Which of the following can compute the exact number of clock cycles required to run an application?

- a) layout model
- b) coarse-grained model
- c) fine-grained model
- d) register-transaction model

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Answer: c

Explanation: The fine-grained model has the cycle-true instruction set simulation. In this modelling, it is possible to compute the exact number of clock cycles which is required to run an application.

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8. Which model is capable of reflecting the bidirectional transfer of information?

- a) switch-level model
- b) gate level
- c) layout model
- d) circuit-level model

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Answer: a

Explanation: The switch model can be used in the simulation of the transistors since the transistor is the very basic component in a switch. It is capable of reflecting bidirectional transferring of the information.

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# Embedded Systems Questions and Answers – Formal Verification

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This set of Embedded Systems Multiple Choice Questions & Answers (MCQs) focuses on “Formal Verification”.

1. What is meant by FOL?

- a) free order logic
- b) fast order logic
- c) false order logic
- d) first order logic

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Answer: d

Explanation: Many formal verification techniques are used and these are classified on the basis of the logics employed. The techniques are propositional logic, first order logic, and higher order logic. The FOL is the abbreviated form of the first order logic which includes the quantification.

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2. What is HOL?

- a) higher order logic
- b) higher order last
- c) highly organised logic
- d) higher order less

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Answer: a

Explanation: The formal verification techniques are classified on the basis of the logics employed. The techniques are propositional logic, first order logic, and higher order logic. The HOL is the abbreviation of the higher order logic in which the proofs are automated and manually done with some proof support.

3. What is BDD?

- a) boolean decision diagram
- b) binary decision diagrams

- c) binary decision device
- d) binary device diagram

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Answer: b

Explanation: The binary decision diagram is a kind of data structure which is used to represent the Boolean function.

4. Which formal verification technique consists of a Boolean formula?

- a) HOL
- b) FOL
- c) Propositional logic
- d) Both HOL and FOL

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Answer: c

Explanation: The propositional logic technique is having the boolean formulas and the boolean function. The tools used in propositional logic is the tautology checker or the equivalence checker which in turn uses the binary decision diagrams which are also known as BDD.

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5. Which of the following is also known as equivalence checker?

- a) BDD
- b) FOL
- c) Tautology checker
- d) HOL

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Answer: c

Explanation: The propositional logic technique consists of the boolean formulas and the boolean function. The tools used in this type of logic is the tautology checker or the equivalence checker which in turn uses the BDD or the binary decision diagrams.

6. Which of the following is possible to locate errors in the specification of the future bus protocol?

- a) EMC
- b) HOL
- c) BDD
- d) FOL

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Answer: c

Explanation: The model checking was developed using the binary decision diagram and the BDD and it was possible to locate errors in the specification of the future bus protocol.

7. Which of the following is a popular system for model checking?

- a) HOL
- b) FOL
- c) BDD
- d) EMC

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Answer: d

Explanation: The EMC-system is developed by Clark and it describes the CTL formulas, which is the computational tree logics.

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8. What is CTL?

- a) computational tree logic
- b) code tree logic
- c) cpu tree logic
- d) computer tree logic

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Answer: a

Explanation: The EMC-system is a popular system for model checking which is developed by Clark that describes the CTL formulas, which is also known as computational tree logics. The CTL consist of two parts, a path quantifier, and a state quantifier.

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# VLSI Questions and Answers – Basic MOS Transistors-1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Basic MOS Transistors-1”.

1. Electronics are characterized by \_\_\_\_\_  
a) low cost  
b) low weight and volume  
c) reliability  
d) all of the mentioned  
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Answer: d

Explanation: Electronics are characterized by reliability, low power dissipation, extremely low weight and volume, low cost, can cope up with high degree of sophistication and complexity.

2. Speed power product is measured as the product of \_\_\_\_\_  
a) gate switching delay and gate power dissipation  
b) gate switching delay and gate power absorption  
c) gate switching delay and net gate power  
d) gate power dissipation and absorption  
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Answer: a

Explanation: Speed power product is measure in picojoules and it is the product of gate switching delay and gate power dissipation.

3. nMOS devices are formed in \_\_\_\_\_  
a) p-type substrate of high doping level  
b) n-type substrate of low doping level  
c) p-type substrate of moderate doping level  
d) n-type substrate of high doping level  
[View Answer](#)

Answer: c

Explanation: nMOS devices are formed in a p-type substrate of moderate doping level. nMOS devices have higher mobility and is cheaper.

4. Source and drain in nMOS device are isolated by \_\_\_\_\_  
a) a single diode  
b) two diodes  
c) three diodes  
d) four diodes  
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Answer: b

Explanation: The source and drain regions are formed by diffusing n-type impurity, it gives rise to depletion region which extend in more lightly doped p-region. Thus Source and drain in an nMOS device are isolated by two diodes.

5. In depletion mode, source and drain are connected by \_\_\_\_\_

- a) insulating channel
- b) conducting channel
- c) Vdd
- d) Vss

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Answer: b

Explanation: In depletion mode, source and drain are connected by conducting channel but the channel can be closed by applying suitable negative voltage to the gate.

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6. What is the condition for non saturated region?

- a)  $V_{ds} = V_{gs} - V_t$
- b)  $V_{gs}$  lesser than  $V_t$
- c)  $V_{ds}$  lesser than  $V_{gs} - V_t$
- d)  $V_{ds}$  greater than  $V_{gs} - V_t$

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Answer: c

Explanation: The condition for non saturated region is  $V_{ds}$  lesser  $V_{gs} - V_t$ . In non saturation region, MOSFET acts as voltage source. Varying  $V_{ds}$  will provide a significant change in drain current.

7. In enhancement mode, device is in \_\_\_\_\_ condition.

- a) conducting
- b) non conducting
- c) partially conducting
- d) insulating

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Answer: b

Explanation: In enhancement mode, the device is in non conducting condition. For n-type FET, the threshold voltage is positive and p-type threshold voltage is negative.

8. What is the condition for non conducting mode?

- a)  $V_{ds}$  lesser than  $V_{gs}$
- b)  $V_{gs}$  lesser than  $V_{ds}$
- c)  $V_{gs} = V_{ds} = 0$
- d)  $V_{gs} = V_{ds} = V_s = 0$

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Answer: d

Explanation: In enhancement mode the device is in non conducting mode, and its condition is  $V_{ds} = V_{gs} = V_s = 0$ .

9. nMOS is \_\_\_\_\_

- a) donor doped
- b) acceptor doped
- c) all of the mentioned
- d) none of the mentioned

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Answer: b

Explanation: nMOS transistors are acceptor doped. Acceptor is a dopant which when added forms p-type region. Some of the acceptors are silicon, boron, aluminium etc.

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10. MOS transistor structure is \_\_\_\_\_

- a) symmetrical
- b) non symmetrical
- c) semi symmetrical
- d) pseudo symmetrical

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Answer: a

Explanation: MOS transistor structure is completely symmetrical with respect to source and drain.

11. pMOS is \_\_\_\_\_

- a) donor doped
- b) acceptor doped
- c) all of the mentioned
- d) none of the mentioned

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Answer: a

Explanation: nMOS is acceptor doped and pMOS is donor doped devices. Acceptor doped forms p-type region and donor doped forms n-type region.

12. Inversion layer in enhancement mode consists of excess of \_\_\_\_\_

- a) positive carriers
- b) negative carriers
- c) both in equal quantity
- d) neutral carriers

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Answer: b

Explanation: Inversion layer in enhancement mode consists of excess of negative carriers that is electron.

13. What is the condition for linear region?

- a)  $V_{gs}$  lesser than  $V_t$
- b)  $V_{gs}$  greater than  $V_t$
- c)  $V_{ds}$  lesser than  $V_{gs}$
- d)  $V_{ds}$  greater than  $V_{gs}$

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Answer: b

Explanation: The condition for linear region is  $V_{gs} > V_t$ . The power of MOS in the linear region is less. It is a power dissipating region.  
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14. As source drain voltage increases, channel depth \_\_\_\_\_

- a) increases
- b) decreases
- c) logarithmically increases
- d) exponentially increases

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Answer: b

Explanation: As source drain voltage  $V_{ds}$  increases, the channel depth at the drain end decreases.

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# VLSI Questions and Answers – Basic MOS Transistors-2

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This set of VLSI Interview Questions and Answers focuses on “Basic MOS Transistors-2”.

1. MOS transistors consist of which of the following?

- a) semiconductor layer
- b) metal layer
- c) layer of silicon-di-oxide
- d) all of the mentioned

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Answer: d

Explanation: MOS transistors is formed as a sandwich consisting of a semiconductor layer, a silicon-di-oxide layer and a metal layer.  
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2. In MOS transistors \_\_\_\_\_ is used for their gate.

- a) metal
- b) silicon-di-oxide
- c) polysilicon
- d) gallium

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Answer: c

Explanation: In MOS transistors, polycrystalline silicon is used for their gate region instead of metal. Polysilicon gates have replaced all other older devices.

3. The gate region consists of \_\_\_\_\_

- a) insulating layer
- b) conducting layer
- c) lower metal layer
- d) p type layer

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Answer: b

Explanation: The gate region is a sandwich consisting of semiconductor layer, an insulating layer and an upper metal layer.

4. Electrical charge flows from \_\_\_\_\_

- a) source to drain
- b) drain to source
- c) source to ground
- d) source to gate

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Answer: a

Explanation: Electrical charge or current flows from source to drain depending on the charge applied to the gate region.

5. Source in MOS transistors is doped with \_\_\_\_\_ material.

- a) n-type
- b) p-type
- c) n & p type
- d) none of the mentioned

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Answer: a

Explanation: Source and drain in the MOS transistors are doped with N-type material and substrate is doped with p-type material.  
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6. In N channel MOSFET which is the more negative of the elements?

- a) source
- b) gate
- c) drain
- d) source and drain

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Answer: a

Explanation: In N channel MOSFET, source is the more negative of the elements and in the case of P channel MOSFET, it is the more positive of the elements.

7. If the gate is given sufficiently large charge, electrons will be attracted to \_\_\_\_\_

- a) drain region
- b) channel region
- c) switch region
- d) bulk region

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Answer: b

Explanation: If the gate is given sufficiently large charge, the negative charge carriers, electrons will be attracted from the bulk of the substrate material into the channel region below the oxide.

8. Enhancement mode device acts as \_\_\_\_\_ switch, depletion mode acts as \_\_\_\_\_ switch.

- a) open, closed
- b) closed, open
- c) open, open
- d) close, close

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Answer: a

Explanation: Enhancement mode transistor acts as open switch whereas depletion mode transistor acts as normally closed switch.

9. Depletion mode MOSFETs are more commonly used as \_\_\_\_\_

- a) switches
- b) resistors
- c) buffers
- d) capacitors

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Answer: b

Explanation: Depletion mode MOSFETs are more commonly used as resistors than as switches. As permanently on switch it has high resistance.  
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10. Enhancement mode MOSFETs are more commonly used as \_\_\_\_\_

- a) switches
- b) resistors
- c) buffers
- d) capacitors

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Answer: a

Explanation: Enhancement mode MOSFETs are more commonly used as switches and depletion mode devices are more used as resistors.

11. Depletion mode transistor should be large.

- a) true
- b) false

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Answer: a

Explanation: Depletion mode transistors should be made large that is long and thin to create the large 'on' resistance.

12. Which expression is true?

- a) charging time < discharging time
- b) charging time > discharging time
- c) charging time = discharging time
- d) charging time and discharging time are not related

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Answer: b

Explanation: When driving a capacitive output load, charging time will be long compared to the discharging time.

13. Overheating in device occurs due to less number of resistors per unit area.

- a) true
- b) false

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Answer: b

Explanation: When the number of resistors per unit area increases, the device may not dissipate heat very well. This results in device overheating which leads to its failure.

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14. In n channel MOSFET \_\_\_\_\_ is constant.

- a) channel length
- b) channel width
- c) channel depth
- d) channel concentration

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Answer: a

Explanation: In all n channel MOSFET transistors, channel length is constant whereas channel width can be varied.

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# VLSI Questions and Answers – VLSI Design

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “VLSI Design”.

1. VLSI technology uses \_\_\_\_\_ to form integrated circuit.

- a) transistors
- b) switches
- c) diodes
- d) buffers

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Answer: a

Explanation: Very large scale integration is the process of creating an integrated circuit with thousands of transistors into one single chip.

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2. Medium scale integration has \_\_\_\_\_

- a) ten logic gates
- b) fifty logic gates
- c) hundred logic gates
- d) thousands logic gates

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Answer: c

Explanation: Small scale integration has one or more logic gate. Further improved technology is medium scale integration which consists of hundred logic gates. Large scale integration has thousand logic gates.

3. The difficulty in achieving high doping concentration leads to \_\_\_\_\_

- a) error in concentration
- b) error in variation
- c) error in doping
- d) distribution error

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Answer: b

Explanation: As photolithography comes closer to the fundamental law of optics, achieving high accuracy in doping concentration becomes difficult, which leads to error due to variation.

4. \_\_\_\_\_ is used to deal with effect of variation.

- a) chip level technique
- b) logic level technique
- c) switch level technique
- d) system level technique

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Answer: d

Explanation: Designers must simulate multiple fabrication process or use system level technique for dealing with effects of variation.

5. As die size shrinks, the complexity of making the photomasks \_\_\_\_\_

- a) increases
- b) decreases
- c) remains the same
- d) cannot be determined

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Answer: a

Explanation: As the die size shrinks due to scaling, the number of die per wafer increases and the complexity of making the photomasks increases rapidly.  
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6. \_\_\_\_\_ architecture is used to design VLSI.

- a) system on a device
- b) single open circuit
- c) system on a chip
- d) system on a circuit

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Answer: c

Explanation: SoC that is system on a chip architecture is used to design the very high level integrated circuit.

7. What is the design flow of VLSI system?

- i. architecture design
- ii. market requirement
- iii. logic design
- iv. HDL coding

- a) ii-i-iii-iv
- b) iv-i-iii-ii
- c) iii-ii-i-iv
- d) i-ii-iii-iv

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Answer: a

Explanation: The order of the design flow of VLSI circuit is market requirement, architecture design, logic design, HDL coding and then verification.

8. \_\_\_\_\_ is used in logic design of VLSI.

- a) LIFO
- b) FIFO
- c) FILO
- d) LILO

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Answer: b

Explanation: First in first out (FIFO) technique and finite state machine technique is used in the logic design of the VLSI circuits.  
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9. Which provides higher integration density?

- a) switch transistor logic
- b) transistor buffer logic
- c) transistor transistor logic
- d) circuit level logic

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Answer: c

Explanation: Transistor-transistor logic offers higher integration density and it became the first integrated circuit revolution.

10. Physical and electrical specification is given in \_\_\_\_\_

- a) architectural design
- b) logic design
- c) system design

d) functional design  
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Answer: d

Explanation: Functional design defines the major functional units of the system, interconnections, physical and electrical specifications.

11. Which is the high level representation of VLSI design?

- a) problem statement
- b) logic design
- c) HDL program
- d) functional design

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Answer: a

Explanation: Problem statement is a high level representation of the system. Performance, functionality and physical dimensions are considered here.

12. Gate minimization technique is used to simplify the logic.

- a) true
- b) false

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Answer: a

Explanation: Gate minimization technique is used to find the simplest, smallest and effective implementation of the logic.  
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# VLSI Questions and Answers – nMOS Fabrication

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “nMOS Fabrication”.

1. nMOS fabrication process is carried out in \_\_\_\_\_

- a) thin wafer of a single crystal
- b) thin wafer of multiple crystals
- c) thick wafer of a single crystal
- d) thick wafer of multiple crystals

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Answer: a

Explanation: nMOS fabrication process is carried out in thin wafer of a single crystal with high purity.

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2. \_\_\_\_\_ impurities are added to the wafer of the crystal.

- a) n impurities
- b) p impurities
- c) silicon
- d) crystal

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Answer: b

Explanation: p impurities are introduced as the crystal is grown. This increases the hole concentration in the device.

3. What kind of substrate is provided above the barrier to dopants?

- a) insulating
- b) conducting
- c) silicon
- d) semiconducting

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Answer: a

Explanation: Above a layer of silicon dioxide which acts as a barrier, an insulating layer is provided upon which other layers may be deposited and patterned.

4. The photoresist layer is exposed to \_\_\_\_\_

- a) Visible light
- b) Ultraviolet light
- c) Infra red light
- d) LED

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Answer: b

Explanation: The photoresist layer is exposed to ultraviolet light to mark the regions where diffusion is to take place.

5. In nMOS device, gate material could be \_\_\_\_\_

- a) silicon
- b) polysilicon
- c) boron
- d) phosphorus

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Answer: b

Explanation: In nMOS device, the gate material could be metal or polysilicon. This polysilicon layer has heavily doped polysilicon deposited by CVD.

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6. Which is the commonly used bulk substrate in nMOS fabrication?

- a) silicon crystal
- b) silicon-on-sapphire
- c) phosphorus
- d) silicon-di-oxide

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Answer: c

Explanation: In nMOS fabrication, the bulk substrate used can be either bulk silicon or silicon-on-sapphire.

7. In nMOS fabrication, etching is done using \_\_\_\_\_

- a) plasma
- b) hydrochloric acid
- c) sulphuric acid
- d) sodium chloride

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Answer: a

Explanation: In nMOS fabrication, etching is done using hydrofluoric acid or plasma. Etching is a process used to remove layers from the surface.

8. Heavily doped polysilicon is deposited using \_\_\_\_\_

- a) chemical vapour decomposition
- b) chemical vapour deposition
- c) chemical deposition

d) dry deposition  
View Answer

Answer: b  
Explanation: The polysilicon layer consists of heavily doped polysilicon deposited by chemical vapour deposition.

9. In diffusion process \_\_\_\_\_ impurity is desired.

- a) n type
- b) p type
- c) np type
- d) none of the mentioned

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Answer: a

Explanation: Diffusion is carried out by heating the wafer to high temperature and passing a gas containing the desired ntype impurity.  
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10. Contact cuts are made in \_\_\_\_\_

- a) source
- b) drain
- c) metal layer
- d) diffusion layer

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Answer: a

Explanation: Contact cuts are made in the desired polysilicon area, source and gate. COnact cuts are those places where connection has to be made.

11. Interconnection pattern is made on \_\_\_\_\_

- a) polysilicon layer
- b) silicon-di-oxide layer
- c) metal layer
- d) diffusion layer

View Answer

Answer: c

Explanation: The metal layer is masked and etched to form interconnection pattern. The metal layer was formed using aluminium deposited over the formed surface.

12. Siilicon-di-oxide is a good insulator.

- a) true
- b) false

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Answer: a

Explanation: Siilicon-di-oxide is a very good insulator so a very thin layer is required in the fabrication of MOS transistor.

13. \_\_\_\_\_ is used to suppress unwanted conduction.

- a) phosphorus
- b) boron
- c) silicon
- d) oxygen

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Answer: b

Explanation: Boron is used to suppress the unwanted conduction between transistor sites. It is implanted in the exposed regions.  
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14. Which is used for the interconnection?

- a) boron
- b) oxygen
- c) aluminium
- d) silicon

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Answer: c

Explanation: Aluminium is the suitable material used for the circuit interconnection or connecting two layers.

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# VLSI Questions and Answers – CMOS Fabrication

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “CMOS Fabrication”.

1. CMOS technology is used in developing which of the following?

- a) microprocessors
- b) microcontrollers
- c) digital logic circuits
- d) all of the mentioned

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Answer: d

Explanation: CMOS technology is used in developing microcontrollers, microprocessors, digital logic circuits and other integrated circuits.

2. CMOS has \_\_\_\_\_

- a) high noise margin
- b) high packing density
- c) high power dissipation
- d) high complexity

[View Answer](#)

Answer: b

Explanation: Some of the properties of CMOS are that it has low power dissipation, high packing density and low noise margin.

3. In CMOS fabrication, nMOS and pMOS are integrated in same substrate.

- a) true
- b) false

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Answer: a

Explanation: In CMOS fabrication, nMOS and pMOS are integrated in the same chip substrate. n-type and p-type devices are formed in the same structure.

4. P-well is created on \_\_\_\_\_

- a) p substrate
- b) n substrate
- c) p & n substrate
- d) none of the mentioned

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Answer: b

Explanation: P-well is created on n substrate to accommodate n-type devices whereas p-type devices are formed in the ntype substrate.

5. Oxidation process is carried out using \_\_\_\_\_

- a) hydrogen
- b) low purity oxygen
- c) sulphur
- d) nitrogen

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Answer: a

Explanation: Oxidation process is carried out using high purity oxygen and hydrogen. Oxidation is a process of oxidizing or being oxidised.  
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6. Photoresist layer is formed using \_\_\_\_\_

- a) high sensitive polymer
- b) light sensitive polymer
- c) polysilicon
- d) silicon di oxide

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Answer: b

Explanation: Light sensitive polymer is used to form the photoresist layer. Photoresist is a light sensitive material used to form patterned coating on a surface.

7. In CMOS fabrication, the photoresist layer is exposed to \_\_\_\_\_

- a) visible light
- b) ultraviolet light
- c) infra red light
- d) fluorescent

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Answer: b

Explanation: The photoresist layer is exposed to ultraviolet light to mark the regions where diffusion is to take place.

8. Few parts of photoresist layer is removed by using \_\_\_\_\_

- a) acidic solution
- b) neutral solution
- c) pure water
- d) diluted water

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Answer: a

Explanation: Few parts of photoresist layer is removed by treating the wafer with basic or acidic solution. Acidic solutions are those which have pH less than 7 and basic solutions have greater than 7.

9. P-well doping concentration and depth will affect the \_\_\_\_\_

- a) threshold voltage
- b) Vss
- c) Vdd
- d) Vgs

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Answer: a

Explanation: Diffusion should be carried out very carefully, as doping concentration and depth will affect both threshold voltage and breakdown voltage.  
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10. Which type of CMOS circuits are good and better?

- a) p well
- b) n well
- c) all of the mentioned
- d) none of the mentioned

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Answer: b

Explanation: N-well CMOS circuits are better than p-well CMOS circuits because of lower substrate bias effect.

11. N-well is formed by \_\_\_\_\_

- a) decomposition
- b) diffusion
- c) dispersion
- d) filtering

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Answer: b

Explanation: N-well is formed by using ion implantation or diffusion. Ion implantation is a process by which ions of a material are accelerated in an electrical field and impacted into a solid. Diffusion is a process in which net movement of ions or molecules plays a major role.

12. \_\_\_\_\_ is sputtered on the whole wafer.

- a) silicon
- b) calcium
- c) potassium
- d) aluminium

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Answer: d

Explanation: Aluminium is sputtered on the whole wafer before removing the excess metal from the wafer.

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# VLSI Questions and Answers – BiCMOS Technology

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “BiCMOS Technology”.

1. MOS technology has more load driving capability.

- a) true
- b) false

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Answer: b

Explanation: One of the disadvantages of MOS technology is it has limited load driving capabilities.

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2. What is the disadvantage of the MOS device?

- a) limited current sourcing
- b) limited voltage sinking
- c) limited voltage sourcing

d) unlimited current sinking

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Answer: a

Explanation: MOS devices have limited current sourcing and current sinking abilities.

3. What are the advantages of BiCMOS?

- a) higher gain
- b) high frequency characteristics
- c) better noise characteristics
- d) all of the mentioned

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Answer: d

Explanation: BiCMOS provides higher gain, better noise and high frequency characteristics than MOS transistors.

4. What are the features of BiCMOS?

- a) low input impedance
- b) high packing density
- c) high output drive current
- d) bidirectional

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Answer: a

Explanation: Some of the features of BiCMOS are low input impedance, low packing density, unidirectional, high output drive current, etc.

5. BiCMOS has low power dissipation.

- a) true
- b) false

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Answer: b

Explanation: BiCMOS has high power dissipation and CMOS has low power dissipation.

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6. CMOS is \_\_\_\_\_

- a) unidirectional
- b) bidirectional
- c) directional
- d) none of the mentioned

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Answer: a

Explanation: BiCMOS is unidirectional and CMOS is bidirectional.

7. In bipolar transistor, its quality can be improved by \_\_\_\_\_

- a) increasing collector resistance
- b) decreasing collector resistance
- c) collector resistance does not affect the quality
- d) decreasing gate resistance

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Answer: b

Explanation: The quality of bipolar transistor can be improved by reducing the collector resistance, which can be done by using the additional layer of n+ subcollector.

8. BiCMOS can be used in \_\_\_\_\_

- a) amplifying circuit
- b) driver circuits
- c) divider circuit
- d) multiplier circuit

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Answer: b

Explanation: BiCMOS is more advantageous and improved than CMOS and it can be used in I/O and driver circuits.

9. What are the advantages of E-beam masks?

- a) small feature size
- b) larger feature size
- c) looser layer
- d) complex design

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Answer: a

Explanation: The advantages of E-beam masks are it has tighter layer to layer registration and it has smaller feature sizes.

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10. Which process is used in E-beam machines?

- a) raster scanning
- b) vector scanning
- c) raster & vector scanning
- d) none of the mentioned

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Answer: c

Explanation: The two approaches to the design of E-beam machines are raster scanning and vector scanning.

11. What is the feature of vector scanning?

- a) faster
- b) slow
- c) easy handling
- d) very simple design

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Answer: a

Explanation: Vector scanning is faster but data handling involved is more complex. Vector scanning is done between the end points.

12. Which has high input resistance?

- a) nMOS
- b) CMOS
- c) pMOS
- d) BiCMOS

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Answer: b

Explanation: CMOS technology has high input resistance and is best for constructing simple low-power logic gates.

13. BiCMOS has lower standby leakage current.

- a) true
- b) false

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Answer: b

Explanation: BiCMOS has the potential for high standby leakage current and has high power consumption compared to CMOS.  
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# VLSI Questions and Answers – nMOS and CMOS Fabrication

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “nMOS and CMOS Fabrication”.

1. What is Lithography?

- a) Process used to transfer a pattern to a layer on the chip
- b) Process used to develop an oxidation layer on the chip
- c) Process used to develop a metal layer on the chip
- d) Process used to produce the chip

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Answer: a

Explanation: Lithography is the process used to develop a pattern to a layer on the chip.

2. Silicon oxide is patterned on a substrate using \_\_\_\_\_

- a) Physical lithography
- b) Photolithography
- c) Chemical lithography
- d) Mechanical lithography

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Answer: b

Explanation: Silicon oxide is patterned on a substrate using Photolithography.

3. Positive photo resists are used more than negative photo resists because \_\_\_\_\_

- a) Negative photo resists are more sensitive to light, but their photo lithographic resolution is not as high as that of the positive photo resists
- b) Positive photo resists are more sensitive to light, but their photo lithographic resolution is not as high as that of the negative photo resists
- c) Negative photo resists are less sensitive to light
- d) Positive photo resists are less sensitive to light

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Answer: a

Explanation: Negative photo resists are more sensitive to light, but their photo lithographic resolution is not as high as that of the positive photo resists. Therefore, negative photo resists are used less commonly in the manufacturing of high-density integrated circuits.

4. The \_\_\_\_\_ is used to reduce the resistivity of poly silicon.

- a) Photo resist
- b) Etching
- c) Doping impurities
- d) None of the mentioned

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Answer: c

Explanation: The resistivity of poly silicon is reduced by Doping impurities.

5. The isolated active areas are created by technique known as \_\_\_\_\_

- a) Etched field-oxide isolation
- b) Local Oxidation of Silicon
- c) Etched field-oxide isolation or Local Oxidation of Silicon
- d) None of the mentioned

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Answer: c

Explanation: To create isolated active areas both the techniques can be used. Among them Local Oxidation of Silicon(LOCOS) is most efficient.

6. The chemical used for shielding the active areas to achieve selective oxide growth is?

- a) Silver Nitride
- b) Silicon Nitride
- c) Hydrofluoric acid
- d) Polysilicon

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Answer: b

Explanation: Selective oxide growth is achieved by shielding the active areas. Silicon nitride ( $\text{Si}_3\text{N}_4$ ) is used for shielding the active areas during oxidation, which effectively inhibits oxide growth.

7. The dopants are introduced in the active areas of silicon by using which process?

- a) Diffusion process
- b) Ion Implantation process
- c) Chemical Vapour Deposition
- d) Either Diffusion or Ion Implantation Process

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Answer: d

Explanation: Two ways to add dopants are diffusion and ion implantation.

8. To grow the polysilicon gate layer, which of the following chemical is used for chemical vapour deposition?

- a) Silicon Nitride( $\text{Si}_3\text{N}_4$ )
- b) Silane gas( $\text{SiH}_4$ )
- c) Silicon oxide
- d) None of the mentioned

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Answer: b

Explanation: Silicon Wafer is placed in a reactor with silane gas ( $\text{SiH}_4$ ), and they are heated again to grow the polysilicon layer by chemical vapor deposition.

9. The process by which Aluminium is grown over the entire wafer, also filling the contact cuts is?

- a) Sputtering
- b) Chemical vapour deposition
- c) Epitaxial growth
- d) Ion Implantation

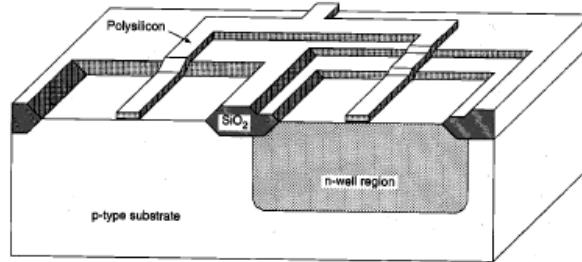
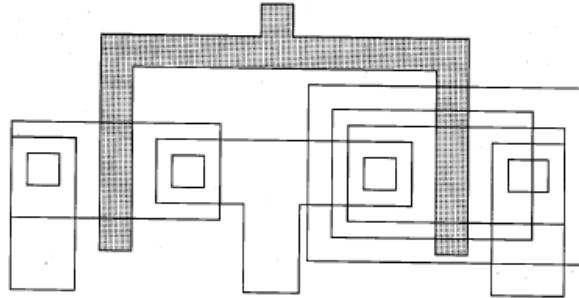
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Answer: a

Explanation: Aluminum is sputtered over the entire wafer, it also fills the contact cuts.

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10. Which process is involved in growing the shaded region?



- a) Chemical vapor deposition (CVD)

- b) Sputtering and patterned by etching

- c) Chemical vapor deposition (CVD) and patterned by HF acid etching

- d) Chemical vapor deposition (CVD) and patterned by dry (plasma) etching

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Answer: d

Explanation: The poly silicon layer is produced using chemical vapor deposition (CVD) and it is patterned by dry (plasma) etching.

11. Chemical Mechanical Polishing is used to \_\_\_\_\_

- a) Remove silicon oxide
- b) Remove silicon nitride and pad oxide
- c) Remove polysilicon gate layer

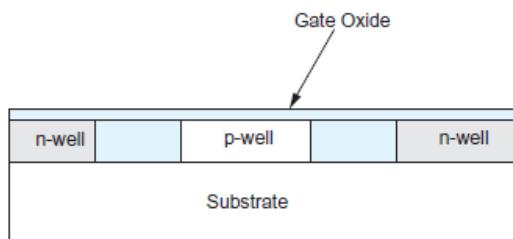
d) Reduce the size of the layout

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Answer: b

Explanation: The pad oxide and nitride are removed using a Chemical Mechanical Polishing (CMP) step.

12. Gate oxide layer consists of \_\_\_\_\_



- a) SiO<sub>2</sub> layer, overlaid with a few layers of an oxynitrided oxide
- b) Only SiO<sub>2</sub> Layer
- c) SiO<sub>2</sub> layer with Polysilicon Layer
- d) SiO<sub>2</sub> layer and stack of epitaxial layers of Polysilicon

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Answer: a

Explanation: Current processes seldom use a pure SiO<sub>2</sub> gate oxide, but prefer to produce a stack that consists of a few atomic layers, each 3–4 Å thick, of SiO<sub>2</sub> for reliability, overlaid with a few layers of oxy-nitrided oxide (one with nitrogen added).

13. What is Piranha Solution?

- a) It is a 3:1 to 5:1 mix of nitric acid and hydrogen peroxide that is used to develop the oxide layer on silicon substrate
- b) It is a 3:1 to 5:1 mix of sulphuric acid and hydrofluoric acid that is used to clean silicon wafers removing organic and metal contaminants or photo resist after metal patterning
- c) It is a 3:1 to 5:1 mix of sulphuric acid and hydrogen peroxide that is used to grow the oxide layer on the silicon
- d) It is a 3:1 to 5:1 mix of sulphuric acid and hydrogen peroxide that is used to clean wafers of organic and metal contaminants or photo resist after metal patterning

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Answer: d

Explanation: Piranha solution is a 3:1 to 5:1 mix of sulfuric acid and hydrogen peroxide that is used to clean silicon wafers of metal and organic contaminants or photo-resist after metal patterning.

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## VLSI Questions and Answers – Ids versus Vds Relationships

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Ids versus Vds Relationships”.

1. Ids depends on \_\_\_\_\_

- a) Vg
- b) Vds
- c) Vdd
- d) Vss

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Answer: b

Explanation: Ids depends on both Vgs and Vds. The charge induced is dependent on the gate to source voltage Vgs also charge can be moved from source to drain under influence of electric field created by Vds.

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2. Ids can be given by \_\_\_\_\_

- a)  $Q_c \times T$
- b)  $Q_c / T$
- c)  $T / Q_c$
- d)  $Q_c / 2T$

[View Answer](#)

Answer: b

Explanation: Ids can be given as charge induced in the channel( $Q_c$ ) divided by transit time ( $T$ ). Ids is equivalent to  $(-Isd)$ .

3. Transit time can be given by \_\_\_\_\_

- a)  $L / v$
- b)  $v / L$
- c)  $v \times L$
- d)  $v \times d$

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Answer: a

Explanation: Transit time ( $T$ ) can be given by lenght of channel( $L$ ) by velocity( $v$ ). Transit time is the time required for an electron to travel between two electrodes.

4. Velocity can be given as \_\_\_\_\_

- a)  $\mu / V_{ds}$
- b)  $\mu / E_{ds}$
- c)  $\mu \times E_{ds}$
- d)  $E_{ds} / \mu$

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Answer: b

Explanation: Velocity can be given as the product of electron or hole mobility( $\mu$ ) and electric field( $E_{ds}$ ). It gives the flow velocity which an electron attains due to electric field.

5.  $E_{ds}$  is given by \_\_\_\_\_

- a)  $V_{ds} / L$
- b)  $L / V_{ds}$
- c)  $V_{ds} \times L$
- d)  $V_{dd} / L$

[View Answer](#)

Answer: a

Explanation: Electric field( $E_{ds}$ ) can be given as the ratio of  $V_{ds}$  and  $L$ .  $E_{ds}$  is the electric field created from drain to source due to volta  $V_{ds}$ .

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6. What is the mobility of proton or hole at room temperature?

- a)  $650 \text{ cm}^2/\text{V sec}$
- b)  $260 \text{ cm}^2/\text{V sec}$
- c)  $240 \text{ cm}^2/\text{V sec}$

d)  $500 \text{ cm}^2/\text{V sec}$

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Answer: c

Explanation: The value of mobility of proton or hole at room temperature is  $240 \text{ cm}^2/\text{V sec}$ . This gives the measure of how fast an electron can move.

7. In resistive region \_\_\_\_\_

- a)  $V_{ds}$  greater than  $(V_{gs} - V_t)$
- b)  $V_{ds}$  lesser than  $(V_{gs} - V_t)$
- c)  $V_{gs}$  greater than  $(V_{ds} - V_t)$
- d)  $V_{gs}$  lesser than  $(V_{ds} - V_t)$

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Answer: b

Explanation: In non saturated or resistive region,  $V_{ds}$  lesser than  $V_{gs} - V_t$  where  $V_{ds}$  is the voltage between drain and source,  $V_{gs}$  is the gate-source voltage and  $V_t$  is the threshold voltage.

8. What is the condition for saturation?

- a)  $V_{gs} = V_{ds}$
- b)  $V_{ds} = V_{gs} - V_t$
- c)  $V_{gs} = V_{ds} - V_t$
- d)  $V_{ds} > V_{gs} - V_t$

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Answer: b

Explanation: The condition for saturation is  $V_{ds} = V_{gs} - V_t$  since at this point IR drop in the channel equals the effective gate to channel voltage at the drain.

9. Threshold voltage is negative for \_\_\_\_\_

- a) nMOS depletion
- b) nMOS enhancement
- c) pMOS depletion
- d) pMOS enhancement

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Answer: a

Explanation: The threshold voltage for nMOS depletion denoted as  $V_{td}$  is negative.

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10. The current  $I_{ds}$  \_\_\_\_\_ as  $V_{ds}$  increases.

- a) increases
- b) decreases
- c) remains fairly constant
- d) exponentially increases

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Answer: c

Explanation: The current  $I_{ds}$  remains fairly constant as  $V_{ds}$  increases in the saturation region.

11. In linear region \_\_\_\_\_ channel exists.

- a) uniform
- b) non-uniform
- c) wide
- d) uniform and wide

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Answer: a

Explanation: In linear region of MOSFET, the channel is uniform and narrow. This is the concentration distribution.

12. When the channel pinches off?

- a)  $V_{gs} > V_{ds}$
- b)  $V_{ds} > V_{gs}$
- c)  $V_{ds} > (V_{gs} - V_{th})$
- d)  $V_{gs} > (V_{ds} - V_{th})$

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Answer: c

Explanation: In MOSFET, in saturation region, when  $V_{ds} > (V_{gs} - V_{th})$ , the channel pinches off that is the channel current at the drain spreads out.

13. When the threshold voltage is more, leakage current will be?

- a) more
- b) less
- c) all of the mentioned
- d) none of the mentioned

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Answer: b

Explanation: Increasing the threshold voltage, leads to small leakage current when turned off and reduces current flow when turned on.  
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14. MOSFET is used as \_\_\_\_\_

- a) current source
- b) voltage source
- c) buffer
- d) divider

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Answer: a

Explanation: MOSFET is used as current source. Bipolar junction transistor also acts as good current source.

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## VLSI Questions and Answers – Parameters of MOS Transistors

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Parameters of MOS Transistors”.

1. The work function difference is negative for \_\_\_\_\_

- a) silicon substrate
- b) polysilicon gate
- c) silicon substrate & polysilicon gate
- d) none of the mentioned

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Answer: c

Explanation: The work function difference between gate and Si ( $F_{ms}$ ) is negative for silicon substrate and polysilicon gate.

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2. Substrate bias voltage is positive for nMOS.

- a) true
- b) false

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Answer: b

Explanation: Substrate bias voltage  $V_{sb}$  is positive for pMOS and negative for nMOS.

3. According to body effect, substrate is biased with respect to \_\_\_\_\_

- a) source
- b) drain
- c) gate
- d)  $V_{ss}$

[View Answer](#)

Answer: a

Explanation: According to body effect, the substrate is biased with respect to the source. Body effect can be seen as a change in the threshold voltage.

4. Increasing  $V_{sb}$  \_\_\_\_\_ the threshold voltage.

- a) does not effect
- b) decreases
- c) increases
- d) exponentially increases

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Answer: c

Explanation: Increasing the substrate bias voltage  $V_{sb}$ , increases the threshold voltage because it depletes the channel of charge carriers.

5. Transconductance gives the relationship between \_\_\_\_\_

- a) input current and output voltage
- b) output current and input voltage
- c) input current and input voltage
- d) output current and output voltage

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Answer: b

Explanation: Transconductance expresses the relationship between output current  $I_{ds}$  and input voltage  $V_{gs}$ .

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6. Transconductance can be increased by \_\_\_\_\_

- a) decreasing the width
- b) increasing the width
- c) increasing the length
- d) decreasing the length

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Answer: b

Explanation: Transconductance  $gm$  of a MOS device can be increased by increasing its width and it does not depend on length.

7. Increasing the transconductance \_\_\_\_\_

- a) increases input capacitance
- b) decreasing area occupied
- c) decreasing input capacitance
- d) decrease in output capacitance

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Answer: a

Explanation: Increasing the transconductance  $gm$  results in an increase in input capacitance and area occupied as it is directly proportional.

8.  $I_{ds}$  is \_\_\_\_\_ to length  $L$  of the channel.

- a) directly proportional
- b) inversely proportional
- c) not related
- d) logarithmically related

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Answer: b

Explanation:  $I_{ds}$  is inversely proportional to the length  $L$  of the channel and using this relationship strong dependence of output conductance on channel length can be demonstrated.

9. Switching speed of a MOS device depends on \_\_\_\_\_

- a) gate voltage above a threshold
- b) carrier mobility
- c) length channel
- d) all of the mentioned

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Answer: d

Explanation: Switching speed of a MOS device depends on gate voltage above a threshold and on carrier mobility and inversely as the square of channel length.  
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10. A fast circuit requires \_\_\_\_\_

- a) high gm
- b) low gm
- c) does not depend on gm
- d) low cost

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Answer: a

Explanation: A fast circuit requires gm as high as possible as the switching speed depends on gate voltage above threshold and on carrier mobility and inversely to square of channel length.

11. Surface mobility depends on \_\_\_\_\_

- a) effective drain voltage
- b) effective gate voltage
- c) channel length
- d) effective source voltage

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Answer: b

Explanation: Surface mobility is dependent on the effective gate voltage ( $V_{gs}-V_t$ ). Electron mobility on oriented n-type inversion layer surface is larger than that on an oriented surface.

12. What is a MOS transistor?

- a) minority carrier device
- b) majority carrier device
- c) majority & minority carrier device
- d) none of the mentioned

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Answer: b

Explanation: MOS transistor is a majority carrier device, in which current in a conducting channel between the source and drain is modulated by a voltage.

13. The MOS transistor is non conducting when?

- a) zero source bias
- b) zero threshold voltage
- c) zero gate bias
- d) zero drain bias

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Answer: c

Explanation: The MOS transistor normally is at cut-off or becomes non-conducting with zero gate bias (gate voltage-source voltage).  
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## VLSI Questions and Answers – nMOS Inverter

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “nMOS Inverter”.

1. Inverters are essential for \_\_\_\_\_

- a) NAND gates
- b) NOR gates
- c) sequential circuits
- d) all of the mentioned

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Answer: d

Explanation: Inverters are needed for restoring logic levels for NAND and NOR gates, sequential and memory circuits.

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2. In basic inverter circuit \_\_\_\_\_ is connected to ground.

- a) source
- b) gates
- c) drain
- d) resistance

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Answer: a

Explanation: A basic inverter circuit consists of transistor with a source connected to ground and a load resistor connected from drain to positive supply rail Vdd.

3. In inverter circuit \_\_\_\_\_ transistors is used as load

- a) enhancement mode
- b) depletion mode
- c) all of the mentioned
- d) none of the mentioned

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Answer: b

Explanation: Depletion mode transistors are preferred to be used as load in inverter circuits as it occupies a lesser area and are produced on silicon substrate unlike resistors.

4. For depletion mode transistor, gate should be connected to \_\_\_\_\_

- a) source
- b) drain
- c) ground
- d) positive voltage rail

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Answer: a

Explanation: For the depletion mode transistor, gate is connected to source so it is always on and only the characteristic curve  $V_{gs}=0$  is relevant.

5. In nMOS inverter configuration depletion mode device is called as \_\_\_\_\_

- a) pull up
- b) pull down
- c) all of the mentioned
- d) none of the mentioned

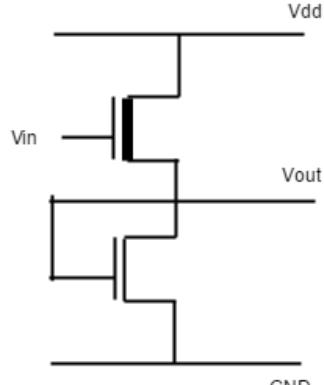
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Answer: a

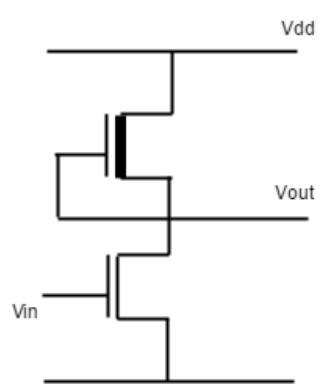
Explanation: In nMOS inverter configuration, depletion mode devices are called as pull up and enhancement mode devices are called as pull down transistor.

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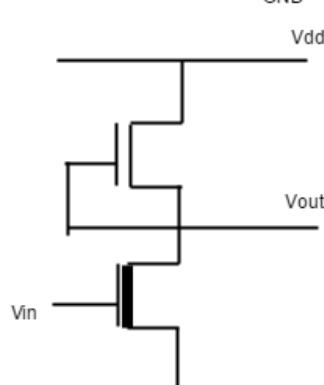
6. How is nMOS inverter represented?



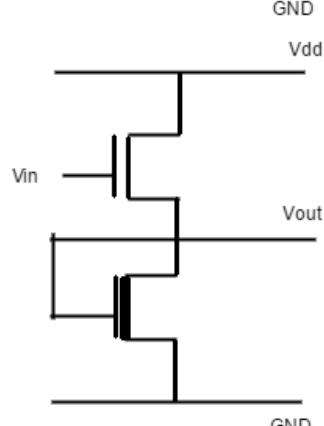
a)



b)



c)



d)

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Answer: b

Explanation: nMOS inverter can be represented using two transistors, depletion mode pMOS transistor followed by nMOS transistor. Input is given to the nMOS.

7. What is the ratio of  $Z_{p.u}/Z_{p.d.}$ ?

- a) 1/4
- b) 4/1
- c) 1/2
- d) 2/1

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Answer: b  
Explanation: The ratio of  $Z_{p.u}/Z_{p.d}$ , where  $Z$  is determined by the length to width ratio of the transistor, is given by 4/1.

8. Pass transistors are transistors used as \_\_\_\_\_

- a) switches connected in series
- b) switches connected in parallel
- c) inverters used in series
- d) inverter used in parallel

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Answer: a

Explanation: Pass transistors are transistor used as switches in series with lines carrying logic levels due to its isolated nature of the gate.

9. An inverter driven through one or more pass transistors has  $Z_{p.u}/Z_{p.d}$  ratio of \_\_\_\_\_

- a) 1/4
- b) 4/1
- c) 1/8
- d) 8/1

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Answer: d

Explanation: An inverter driven directly from output of another has the ratio of 4/1 and if driven through one or more pass transistors has the ratio of 8/1.  
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10. In depletion mode pull-up, dissipation is high since current flows when?

- a)  $V_{in} = 1$
- b)  $V_{in} = 0$
- c)  $V_{out} = 1$
- d)  $V_{out} = 0$

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Answer: a

Explanation: In nMOS depletion mode pull-up, dissipation is high since current flows  $V_{in} = \text{logical 1}$ .

11. In complementary transistor pull-up, current flows when?

- a)  $V_{in} = 1$
- b)  $V_{in} = 0$
- c) current doesn't flow
- d)  $V_{out} = V_{in}$

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Answer: c

Explanation: In complementary transistor pull-up no current flows either for logical 1 or 0, full logical 1 and 0 levels are presented at the output.

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## VLSI Questions and Answers – CMOS Inverter

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “CMOS Inverter”.

1. CMOS inverter has \_\_\_\_\_ regions of operation.

- a) three
- b) four
- c) two
- d) five

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Answer: d

Explanation: CMOS inverter has five distinct regions of operation which can be determined by plotting CMOS inverter current versus Vin.  
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2. If n-transistor conducts and has large voltage between source and drain, then it is said to be in \_\_\_\_\_ region.

- a) linear
- b) saturation
- c) non saturation
- d) cut-off

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Answer: b

Explanation: If n-transistor conducts and has large voltage between source and drain, then it is in saturation.

3. If p-transistor is conducting and has small voltage between source and drain, then it is said to work in \_\_\_\_\_

- a) linear region
- b) saturation region
- c) non saturation resistive region
- d) cut-off region

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Answer: c

Explanation: If p-transistor is conducting and has small voltage between source and drain, then it is said to be in unsaturated resistive region.

4. In the region where inverter exhibits gain, the two transistors are in \_\_\_\_\_ region.

- a) linear
- b) cut-off
- c) non saturation
- d) saturation

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Answer: d

Explanation: In the region where the inverter exhibits gain, the two transistors n and p operates in saturation region.

5. If both the transistors are in saturation, then they act as \_\_\_\_\_

- a) current source
- b) voltage source
- c) divider
- d) buffer

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Answer: a

Explanation: When both the transistors are in saturation, then act as current sources so that the equivalent circuit is two current sources between Vdd and Vss.  
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6. If  $\beta_n = \beta_p$ , then  $V_{in}$  is equal to \_\_\_\_\_

- a)  $V_{dd}$
- b)  $V_{ss}$
- c)  $2V_{dd}$

d) 0.5Vdd  
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Answer: d

Explanation: If  $\beta_n = \beta_p$ , then  $V_{in} = 0.5V_{dd}$  which implies that the changeover between logic levels is symmetrically disposed about the point.

7. Mobility depends on \_\_\_\_\_

- a) Transverse electric field
- b)  $V_g$
- c)  $V_{dd}$
- d) Channel length

View Answer

Answer: a

Explanation: Mobility is affected by the transverse electric field and thus also depends on  $V_{gs}$  and the mobility of p-device and n-device are inherently unequal.

8. In CMOS inverter, transistor is a switch having \_\_\_\_\_

- a) infinite on resistance
- b) finite off resistance
- c) buffer
- d) infinite off resistance

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Answer: b

Explanation: In CMOS inverter, transistor is a switch having finite on resistance and infinite off resistance.

9. CMOS inverter has \_\_\_\_\_ output impedance.

- a) low
- b) high
- c) very high
- d) none of the mentioned

View Answer

Answer: a

Explanation: CMOS inverter has low output impedance and this makes it less prone to noise and disturbance.

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10. What is the input resistance of CMOS inverter?

- a) high
- b) low
- c) very low
- d) none of the mentioned

View Answer

Answer: a

Explanation: Input resistance of CMOS inverter is extremely high as it is a perfect insulator and draws no dc input source.

11. Increasing fan-out \_\_\_\_\_ the propagation delay.

- a) increases
- b) decreases
- c) does not affect
- d) exponentially decreases

View Answer

Answer: a

Explanation: In CMOS inverter, increasing the fan-out also increases the propagation delay. Fan-out is a term that defines the maximum number of digital inputs that the output of a single logic gate can feed.

12. Fast gate can be built by keeping \_\_\_\_\_

- a) low output capacitance
- b) high on resistance
- c) high output capacitance
- d) input capacitance does not affect speed of the gate

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Answer: a

Explanation: Fast gate can be built by keeping the output capacitance small and by decreasing the on resistance of the transistor.

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# VLSI Questions and Answers – Characteristics of npn Bipolar Transistors

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Characteristics of npn Bipolar Transistors”.

1. The transconductance of a bipolar is given by \_\_\_\_\_

- a)  $(kT/q)/I_c$
- b)  $I_c/(kT/q)$
- c)  $(q/KT)/I_c$
- d)  $I_c/(q/KT)$

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Answer: b

Explanation: Transconductance  $gm$  of a bipolar transistor is given by  $gm = I_c/(kT/q)$ . Transconductance is the electrical characteristic relating the current through the output of a device to the voltage across the input of a device.

2. Transconductance depends on the process.

- a) true
- b) false

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Answer: b

Explanation: Transconductance  $gm$  is independent of process.

3.  $gm$  is \_\_\_\_\_ on input voltage  $V_{be}$ .

- a) inversely proportional
- b) proportional
- c) exponentially dependent
- d) is not dependent

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Answer: c

Explanation: Transconductance  $gm$  is exponentially dependent on input voltage  $V_{be}$  (base to emitter voltage).

4.  $gm$  is \_\_\_\_\_ to  $I_c$ .

- a) directly proportional
- b) inversely proportional

- c) not dependent
- d) exponentially proportional

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Answer: a

Explanation: Transconductance gm is directly proportional to Ic, collector current.

5. Transconductance is a \_\_\_\_\_

- a) weak function
- b) strong function
- c) weak and strong function
- d) none of the mentioned

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Answer: a

Explanation: Transconductance gm is a weak function of transistor size.

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6. gm of bipolar is less than gm of MOS.

- a) true
- b) false

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Answer: b

Explanation: Transconductance gm of bipolar is greater than gm of MOS if inputs are controlled by equal amounts of charge.

7. Which of the following is true when inputs are controlled by equal amounts of charge?

- a)  $C_g(MOS) = C_{base}(bipolar)$
- b)  $C_g(MOS) > C_{base}(bipolar)$
- c)  $C_g(MOS) < C_{base}(bipolar)$
- d)  $C_s(MOS) < C_{base}(bipolar)$

[View Answer](#)

Answer: a

Explanation:  $C_g(MOS) = C_{base}(bipolar)$  when inputs are controlled by equal amounts of charge, and then  $gm(bipolar) \gg gm(MOS)$ .

8. Which has better I/A?

- a) CMOS
- b) bipolar
- c) nMOS
- d) pMOS

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Answer: b

Explanation: Current/Area (I/A) of bipolar is five times better than CMOS and this can be calculated using base resistance and base transit time.

9. Bipolar transistor exhibits \_\_\_\_\_ delay.

- a) turn on
- b) turn off
- c) storage
- d) all of the mentioned

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Answer: d

Explanation: Bipolar transistors exhibits turn-on, turn-off, storage delays.

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10. In bipolar transistor, which is heavily doped?

- a) base region
- b) emitter region
- c) collector region
- d) base and emitter

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Answer: b

Explanation: In bipolar transistor, emitter region is heavily doped and the base region is lightly doped.

11. Bipolar transistor is a symmetrical device.

- a) true
- b) false

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Answer: b

Explanation: Bipolar transistor is not symmetrical like other transistors.

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# VLSI Questions and Answers – BiCMOS Inverters

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “BiCMOS Inverters”.

1. In BiCMOS, bipolar transistors are used to \_\_\_\_\_

- a) drive input loads
- b) drive output loads
- c) to perform logic functions
- d) to amplify the input voltage

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Answer: b

Explanation: In BiCMOS, bipolar transistors are used to drive output loads. Bipolar transistor can also be used as amplifier, switch or as an oscillator.

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2. In BiCMOS, MOS switches are used to \_\_\_\_\_

- a) drive input loads
- b) drive output loads
- c) to perform logic functions
- d) to amplify the input voltage

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Answer: c

Explanation: In BiCMOS circuits, MOS switches are used to perform logic functions. The ability to turn the power MOS “ON” and “OFF” allows the device to be used as a very efficient switch with switching speeds much faster than standard bipolar junction transistors.

3. The nMOS and pMOS transistors used in BiCMOS is \_\_\_\_\_

- a) depletion mode
- b) enhancement mode
- c) only pMOS

d) only nMOS  
View Answer

Answer: b

Explanation: The nMOS and pMOS transistors used in BiCMOS device operates in enhancement mode. Enhancement mode devices are mostly common switching elements in MOS.

4. The inverter has \_\_\_\_\_

- a) low input impedance
- b) high input impedance
- c) high output impedance
- d) high input and output impedance

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Answer: a

Explanation: The inverter has low input impedance. The basic inverter circuit requires a transistor with source connected to ground and a load resistor connected from the drain to positive supply Vdd.

5. The inverter has \_\_\_\_\_

- a) low output impedance
- b) low input impedance
- c) low power dissipation
- d) high input and output impedance

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Answer: a

Explanation: The inverter has low output impedance and low input impedance. These are some of the properties of a BiCMOS inverter.  
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6. The inverter has \_\_\_\_\_

- a) high current driving capability
- b) occupies smaller area
- c) high noise margin
- d) all of the mentioned

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Answer: d

Explanation: The inverter has high current driving capability, occupies smaller area and has high noise margins.

7. Output voltage swing should be reduced for a better performance of BiCMOS circuit.

- a) true
- b) false

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Answer: a

Explanation: For a better performance BiCMOS circuit, the output voltage swing should be reduced. The possible maximum output peak-to-peak voltage obtained without clipping is called as output voltage swing.

8. BiCMOS inverter requires high load current sourcing.

- a) true
- b) false

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Answer: a

Explanation: BiCMOS inverter needs high load current sinking and sourcing. Sinking provides a grounded connection to the load, whereas sourcing provides a voltage source to the load.

9. BiCMOS has \_\_\_\_\_ standby leakage current.

- a) higher
- b) lower
- c) very low
- d) none of the mentioned

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Answer: a

Explanation: BiCMOS has higher standby leakage current and thus has high power consumption.  
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10. For improved base current discharge \_\_\_\_\_ enhancement type nMOS devices have to be added.

- a) two
- b) three
- c) one
- d) four

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Answer: a

Explanation: For improved base current discharge, two enhancement type nMOS transistors have to be added.

11. The BJTs in the BiCMOS circuit is in \_\_\_\_\_ configuration.

- a) Push-pull
- b) Totem pole
- c) Active high
- d) Active low

[View Answer](#)

Answer: b

Explanation: In BiCMOS circuit, the BJT transistors are in Totem pole configuration.

12. The MOSFETS are arranged in this configuration to provide \_\_\_\_\_

- a) Zero static power dissipation
- b) High Input impedance
- c) Both zero static power dissipation and high input impedance
- d) None of the mentioned

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Answer: c

Explanation: MOSFETs provide zero static power dissipation and high input impedance.

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## VLSI Questions and Answers – Latch-up in CMOS

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Latch-up in CMOS”.

1. In latch-up condition, parasitic component gives rise to \_\_\_\_\_ conducting path.

- a) low resistance
- b) high resistance
- c) low capacitance

d) high capacitance  
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Answer: a

Explanation: In latch-up condition, the parasitic component gives rise to low resistance conducting path between Vdd and Vss with disastrous results. Careful control during fabrication is necessary to avoid this problem.

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2. Latch-up can be induced by \_\_\_\_\_

- a) incident radiation
- b) reflected radiation
- c) etching
- d) diffracted radiation

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Answer: a

Explanation: Latch-up can be induced by glitches on the supply rail or by incident radiation.

3. How many transistors might bring up latch up effect in p-well structure?

- a) two
- b) three
- c) one
- d) four

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Answer: a

Explanation: Two transistors and two resistances might bring up the latch-up effect in p-well structure. These are associated with p-well and with regions of the substrate.

4. Substrate doping level should be decreased to avoid the latch-up effect.

- a) true
- b) false

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Answer: b

Explanation: An increase in substrate doping level with a consequent drop in the value of  $R_s$  can be used as a remedy for latch-up problem.

5. What can be introduced to reduce the latch-up effect?

- a) latch-up rings
- b) guard rings
- c) latch guard rings
- d) substrate rings

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Answer: b

Explanation: The introduction of guard rings can reduce the effect of latch-up problem. Guard rings are diffusions which decouple the parasitic bipolar transistors.

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6. Which process produces a circuit which is less prone to latch-up effect?

- a) CMOS
- b) nMOS
- c) pMOS
- d) BiCMOS

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Answer: d

Explanation: BiCMOS process produces circuits that are less likely to suffer from latch-up problems where as CMOS circuits are very highly prone to latch-up problems.

7. Which one of the following is the main factor for reducing the latch-up effect?

- a) reduced p-well resistance
- b) reduced n-well resistance
- c) increased n-well resistance
- d) increased p-well resistance

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Answer: b

Explanation: One of the main factors in reducing the latch-up effect is reduced n-well resistance  $R_w$ . Reduction in  $R_w$  means that a larger lateral current is necessary to invite latch-up and higher value of holding current is also required.

8. The parasitic PNP transistor has the effect of \_\_\_\_\_ carrier lifetime.

- a) increasing
- b) decreasing
- c) exponentially decreasing
- d) exponentially increasing

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Answer: b

Explanation: The parasitic PNP transistor has the effect of reducing carrier lifetime in the n-base region.

9. The reduction in carrier lifetime brings about \_\_\_\_\_

- a) reduction in alpha
- b) reduction in beta
- c) reduction in current
- d) reduction in voltage

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Answer: b

Explanation: The parasitic PNP transistor has the effect of reducing carrier lifetime in the n-base region which results in radiation in beta.  
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10. To reduce latch-up effect substrate resistance should be high.

- a) true
- b) false

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Answer: b

Explanation: To reduce the latch-up effect, substrate resistance  $R_s$  should be low. Reduction of  $R_s$  and  $R_w$  means that larger lateral current is necessary to invite latch-up.

11. Latch-up is the generation of \_\_\_\_\_

- a) low impedance path
- b) high impedance path
- c) low resistance path
- d) high resistance path

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Answer: a

Explanation: Latch-up is the generation of low-impedance path in CMOS chips between the power supply and ground rails.

12. Latch-up is brought about by BJTs \_\_\_\_\_

- a) with positive feedback
- b) with negative feedback
- c) with no feedback
- d) without BJT

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Answer: a

Explanation: Latch-up occurs due to BJTs for silicon-controlled rectifiers with positive feedback and virtually short circuit the power and ground rail.

13. Sudden transient in power can cause latch-up.

- a) true
- b) false

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Answer: a

Explanation: Sudden transient in power and ground buses are also among the reason which causes latch-up effect.  
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14. BJT gain should be \_\_\_\_\_ to avoid latch-up effect.

- a) increased
- b) decreased
- c) should be maintained constant
- d) changed randomly

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Answer: b

Explanation: BJT gain should be reduced by lowering the minority carrier lifetime through doping of the substrate to lower the latch-up effect.

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## VLSI Questions and Answers – BiCMOS Logic Gates

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “BiCMOS Logic Gates”.

1. The BiCMOS are preferred over CMOS due to \_\_\_\_\_
- a) Switching speed is more compared to CMOS
  - b) Sensitivity is less with respect to the load capacitance
  - c) High current drive capability
  - d) All of the mentioned

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Answer: d

Explanation: These are the 3 advantages of BiCMOS over CMOS.

2. The transistors used in BiCMOS are \_\_\_\_\_
- a) BJT
  - b) MOSFET
  - c) Both BJT and MOSFETs
  - d) JFET

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Answer: c

Explanation: BiCMOS is a combination of both MOSFET and BJT.

3. The high current driving capability of the BiCMOS is due to \_\_\_\_\_
- a) NMOS in saturation mode
  - b) PMOS in saturation mode
  - c) CMOS
  - d) BJT

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Answer: d

Explanation: BJT has the high current driving capability.

4. In BiCMOS inverter, the BJT used are \_\_\_\_\_
- a) Only Npn BJT
  - b) Only Pnp BJT
  - c) Both npn and pnp BJT
  - d) Multi emitter npn BJT

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Answer: a

Explanation: npn BJTs are used in BiCMOS inverter.

5. Which of the following is the drawback of the BiCMOS circuits?

- a) Sensitivity is less load capacitance
- b) Bipolar transistors are used for driving current to the load capacitance but not for the logic operations
- c) Increased fabrication Complexity
- d) All of the mentioned

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Answer: c

Explanation: The other 2 are the merits of BiCMOS, Increased fabrication Complexity is a demerit of BiCMOS circuits.

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6. The Bipolar Transistor is fabricated on \_\_\_\_\_

- a) Same substrate of nMOS
- b) N-well in p Substrate
- c) P-well in n Substrate
- d) Same substrate of pMOS

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Answer: a

Explanation: BiCMOS is fabricated on the same substrate of nMOS.

7. The n-well created for Bipolar Transistor in BiCMOS is used as \_\_\_\_\_

- a) Substrate
- b) Collector
- c) Emitter
- d) None of the mentioned

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Answer: b

Explanation: The created nWell is used as Collector region for BiCMOS.

8. The n-well collector is formed by \_\_\_\_\_

- a) Lightly doped n-type epitaxial layer on p-Substrate
- b) Heavily doped n-type epitaxial layer on p-Substrate
- c) Lightly doped n-type diffused layer on p-Substrate
- d) Heavily doped n-type diffused layer on p-Substrate

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Answer: a

Explanation: To make the doping concentration less than the emitter.

9. The collector contact region is doped with higher concentration of n-type impurities due to \_\_\_\_\_

- a) It creates a depletion region at the contact surface
- b) It creates a low conductivity path between collector region and contact
- c) It reduces contact resistance
- d) It can withstand high voltages as compared to collector region

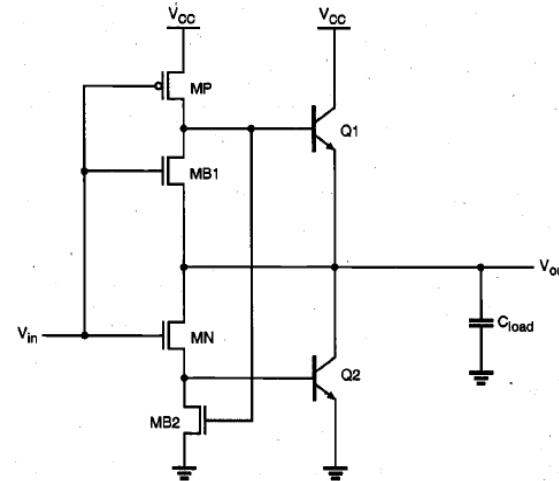
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Answer: c

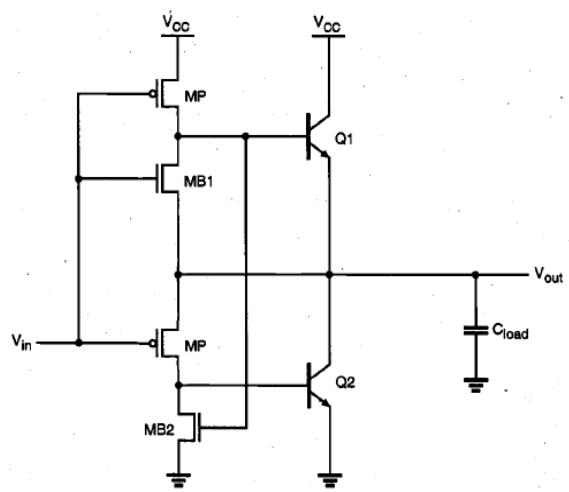
Explanation: The collector contact region is doped with higher concentration of n-type impurities reduces contact resistance.

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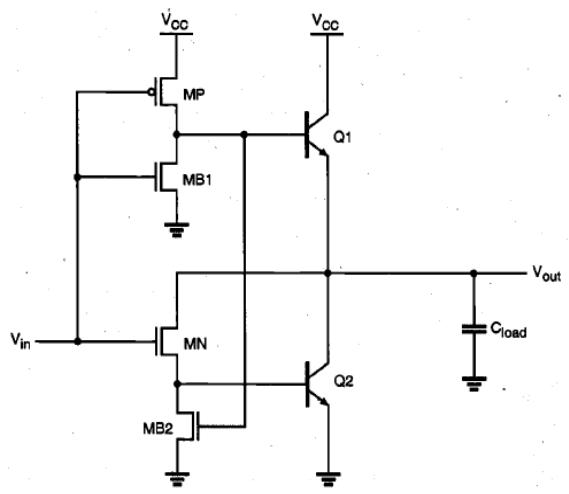
10. Which is the proper BiCMOS inverter circuit?



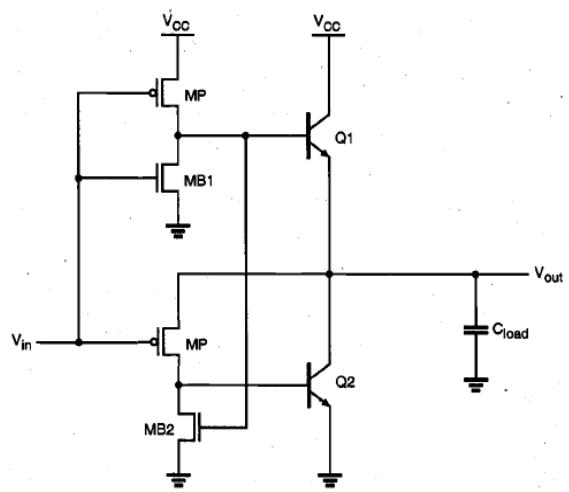
a)



b)



c)



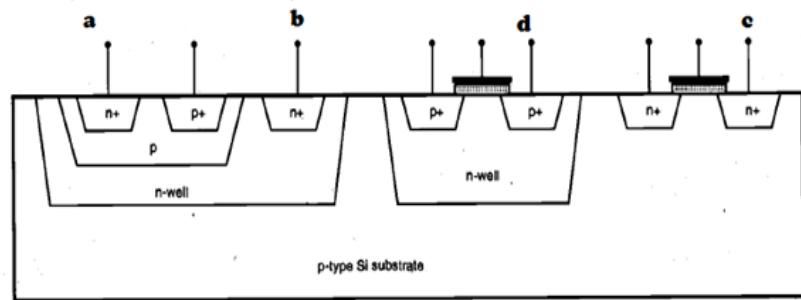
d)

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Answer: c

Explanation: None.

11. In the following diagram of BiCMOS, the labels a, b, c, d denote?



- a) A = Collector, B = Base, C = Source, D = Drain
- b) A = Emitter, B = Base, C = Drain, D = Source
- c) A = Emitter, B = Collector, C = Source, D = Drain
- d) A = Collector, B = Emitter, C = Drain, D = Source

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Answer: c

Explanation: None.

12. What is the work of BJT in BiCMOS?

- a) Current controlled Voltage source
- b) Voltage controlled Current source
- c) Current controlled current source
- d) Voltage controlled current source

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Answer: b

Explanation: The Current  $I_C$  and  $I_E$  are controlled by base emitter bias voltage.

13. In BiCMOS, the analysis of the operation of BJT is well explained by \_\_\_\_\_

- a) RC Model
- b) Emitter resistor model
- c) Ebers Moll Model
- d) Hybrid model

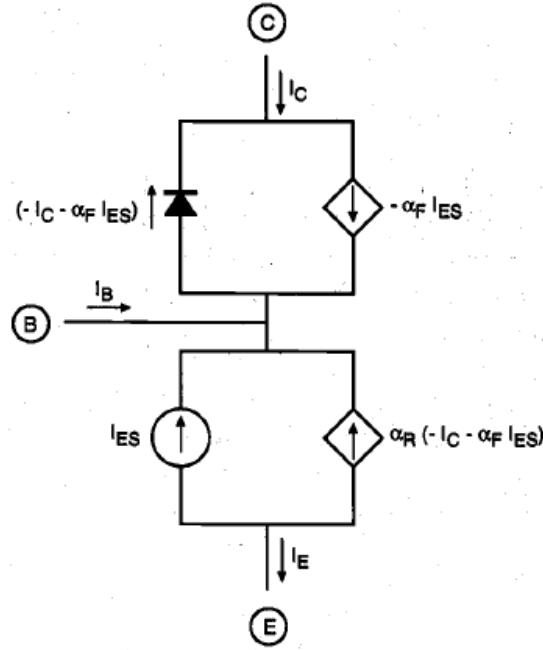
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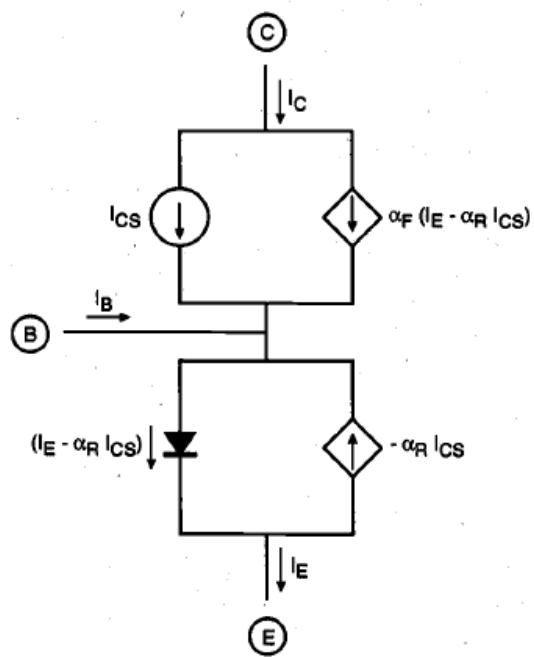
Explanation: None.

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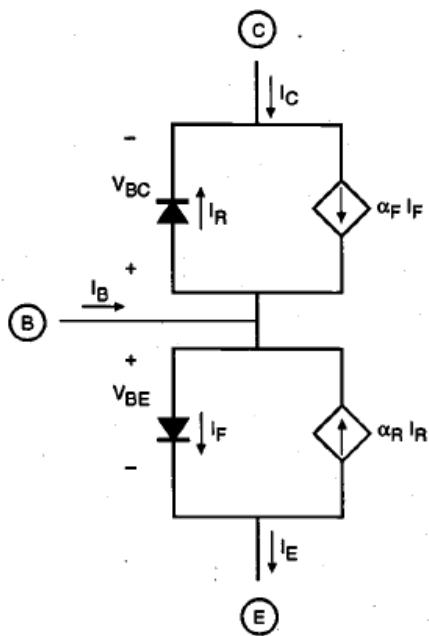
14. The Ebers Moll equivalent circuit of BJT operating in forward active region is?



a)



b)



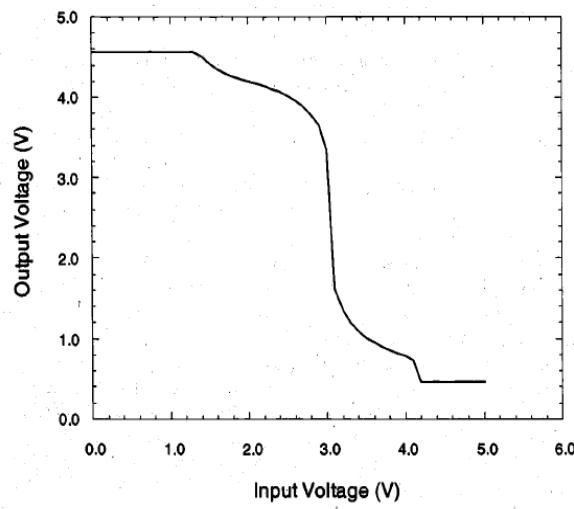
c)

- d) None of the mentioned  
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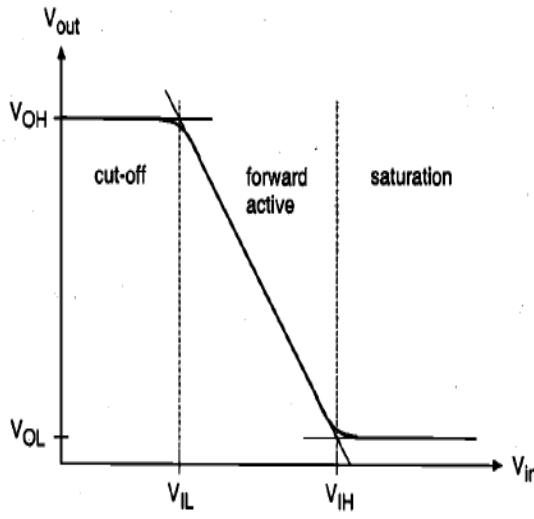
Answer: b

Explanation: None.

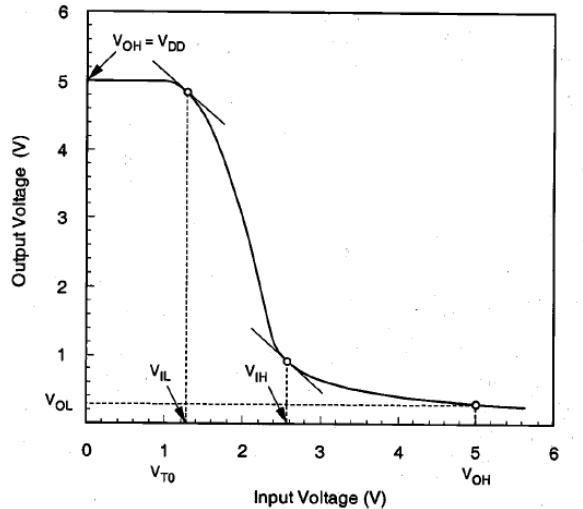
15. The transfer characteristics of BiCMOS inverter is?



a)



b)



c)

d) None of the mentioned

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Answer: a

Explanation: None.

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# VLSI Questions and Answers – Stick Diagram

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Stick Diagram”.

1. Stick diagrams are those which convey layer information through?

- a) thickness
- b) color
- c) shapes
- d) layers

[View Answer](#)

Answer: b

Explanation: Stick diagrams are those which convey layer information through color codes. Thickness is not considered in this stick diagram representation.

2. Which color is used for n-diffusion?

- a) red
- b) blue
- c) green
- d) yellow

[View Answer](#)

Answer: c

Explanation: Green color is used to show the presence of n-diffusion layer. The n-type diffusion will dope the source or drain region in the p-well region.

3. Which color is used for implant?

- a) red
- b) blue
- c) green
- d) yellow

[View Answer](#)

Answer: d

Explanation: Yellow color is used to represent implant layer.

4. Which color is used for contact areas?

- a) red
- b) brown
- c) black

d) blue

[View Answer](#)

Answer: c

Explanation: Black color is used to represent contact areas. This is the part where two different touch or cross each other.

5. Which color is used for polysilicon?

- a) brown
- b) red
- c) white
- d) orange

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Answer: b

Explanation: Red is used to represent polysilicon layers. It is a semi-conductor like material and is a hyper pure form of silicon.

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6. Which color is used for polysilicon 2?

- a) blue
- b) brown
- c) orange
- d) white

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Answer: c

Explanation: Orange color is used to represent polysilicon-2 layer.

7. Which color is used for buried contact?

- a) black
- b) white
- c) green
- d) brown

[View Answer](#)

Answer: d

Explanation: Brown color is used to represent buried contact. Buried contact is most widely used, subject to fewer design rule restrictions are smaller in area.

8. n and p transistors are separated by using \_\_\_\_\_

- a) differentiation line
- b) separation line
- c) demarcation line
- d) black line

[View Answer](#)

Answer: c

Explanation: Demarcation line separates n and p transistors. Demarcation line is similar to dotted line in brown.

9. \_\_\_\_\_ layer should be over \_\_\_\_\_ layer.

- a) ntype, polysilicon
- b) polysilicon, ntype
- c) ptype, ntype
- d) ntype, ptype

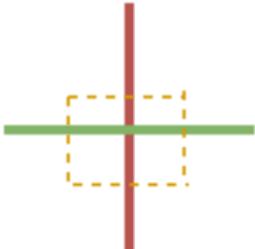
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Answer: b

Explanation: Polysilicon layer should be over n-type layer. This is the standard pattern used in stick diagram representation.

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10. How is nMOS depletion mode transistor represented?



a)



b)



c)



d)

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Answer: c

Explanation: nMOS depletion mode transistor can be represented by using polysilicon over ntype layer and with an implant.

11. Implant is represented using \_\_\_\_\_

- a) black, dark line
- b) black, dotted line
- c) yellow, dark line
- d) yellow, dotted line

[View Answer](#)

Answer: d

Explanation: Implant is represented using yellow color dotted lines. It is drawn in the middle of the nMOS or pMOS wherever the implant is used.

12. Stick diagram gives the position of placement of the element.

- a) true
- b) false

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Answer: b

Explanation: Stick diagram does not show exact placement of components, transistor length, wire length and width, tub boundaries, etc.

13. When two or more cuts of same type cross or touch each other, that represents \_\_\_\_\_

- a) contact cut
- b) electrical contact
- c) like contact
- d) cross contact

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Answer: b

Explanation: When two or more sticks of same type cross or touch each other, then that forms a contact called electrical contact.

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# VLSI Questions and Answers – Design Rules and Layout-1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Design Rules and Layout-1”.

1. Circuit design concepts can also be represented using a symbolic diagram.

- a) true
- b) false

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Answer: a

Explanation: Circuit design concepts can be represented using stick diagrams and symbolic diagrams. Stick diagrams represents different layers with color codes. Symbolic diagram represents the structure with symbols with color codes.

2. Circuit designers need \_\_\_\_\_ circuits.

- a) tighter
- b) smaller layout
- c) decreased silicon area
- d) all of the mentioned

[View Answer](#)

Answer: d

Explanation: Circuit designers in general prefer tighter, smaller layouts for improved performance and decreased silicon area.

3. Process engineers want \_\_\_\_\_ process.

- a) smaller
- b) tighter
- c) reproducible
- d) non reproducible

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Answer: c

Explanation: Process engineers want design rules which are controllable and reproducible process.

4. Maturity level of the process line affects design rules.

- a) true
- b) false

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Answer: a

Explanation: Yes, the maturity level of the process line affects design rules.

5. Design rules does not specify \_\_\_\_\_

- a) linewidths
- b) separations
- c) extensions
- d) colours

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Answer: d

Explanation: Design rules specify line widths, separations and extensions in terms of lambda.

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6. The width of n-diffusion and p-diffusion layer should be?

- a) 3?
- b) 2?
- c) ?
- d) 4?

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Answer: b

Explanation: The width of n-diffusion and p-diffusion should be 2? according to design rules.

7. What should be the spacing between two diffusion layers?

- a) 4?
- b) ?
- c) 3?
- d) 2?

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Answer: c

Explanation: The spacing between two diffusion layers should be 3? according to design rules and standards.

8. What should be the width of metal 1 and metal 2 layers?

- a) 3?, 3?
- b) 2?, 3?
- c) 3?, 4?
- d) 4?, 3?

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Answer: c

Explanation: The width of the metal 1 layer should be 3? and metal 2 should be 4?.

9. Implant should extend \_\_\_\_\_ from all the channels.

- a) 2?
- b) 3?
- c) 4?
- d) ?

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Answer: a

Explanation: Implant for a n-mos depletion mode transistor should extend minimum of 2? from the channel in all the directions.

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10. Which type of contact cuts are better?

- a) buried contacts
- b) butted contacts
- c) butted & buried contacts
- d) none of the mentioned

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Answer: a

Explanation: Buried contacts are much better than butted contacts. In butted contacts the two layers are joined together or binded together using adhesive type of material where as in buried contact one layer is interconnected or fitted into another.

11. Which design method occupies or uses lesser area?

- a) lambda rules
- b) micron rules
- c) layer rule
- d) source rule

[View Answer](#)

Answer: b

Explanation: Micron rules occupies or consumes lesser area. 50% of the area usage can be reduced by using micron rules over lambda rules.

12. Which gives scalable design rules?

- a) lambda rules
- b) micron rules
- c) layer rules

d) thickness rules  
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Answer: a

Explanation: Lambda rules gives scalable design rules and micron rules gives absolute dimensions.

13. Devices designed with lambda design rules are prone to shorts and opens.

- a) true
- b) false

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Answers: b

Explanation: Lambda design rules prevent shorting, opens, contact from slipping out of the area to be contacted.  
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# VLSI Questions and Answers – Design Rules and Layout-2

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This set of VLSI Questions and Answers for Freshers focuses on “Design Rules and Layout-2”.

1. Diffusion and polysilicon layers are connected together using \_\_\_\_\_

- a) butting contact
- b) buried contact
- c) separate contact
- d) cannot be connected

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Answer: a

Explanation: Diffusion and polysilicon layer are joined together using butting contact. In butting contact the two layers are joined or binded together.

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2. Which is a more complex process?

- a) buried contact
- b) butting contact
- c) buried & butting contact
- d) none of the mentioned

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Answer: a

Explanation: Butting contact is a complex process whereas buried contact is simple process because butting contact should be done more carefully to serve well and be strong.

3. Which contact cut occupies smaller area?

- a) buried contact
- b) butting contact
- c) buried & butting contact
- d) none of the mentioned

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Answer: a

Explanation: Buried contact occupies smaller area than butting contact as in buried contacts one layer will be completely within or almost within the another layer.

4. Isolation layer between two metal layers must be thinner.

- a) true
- b) false

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Answer: b

Explanation: Isolation layer between two metal layers should be thicker. Metal to metal separation is large and is brought about mainly by difficulties in defining metal edges accurately.

5. The oxide layer below the first metal layer is deposited using \_\_\_\_\_

- a) diffusion method
- b) chemical vapour deposition
- c) solid deposition
- d) scattering method

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Answer: b

Explanation: The oxide layer below the first metal layer is deposited using chemical vapour deposition method. This is a chemical process used to produce high quality high performance solid materials.

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6. Which layer is used for power and signal lines?

- a) metal
- b) polysilicon
- c) n-diffusion
- d) p-diffusion

[View Answer](#)

Answer: a

Explanation: Metal layers are used for power and signal lines as metals has good thermal and electrical conductivity.

7. Minimum feature size for thick oxide is?

- a) 2?
- b) 3?
- c) 4?
- d) ?

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Answer: b

Explanation: The minimum feature size for thick oxide is 3? and minimum separation between thin oxide regions is also 3?.

8. Hatching is compatible with \_\_\_\_\_

- a) monochrome encoding
- b) bicode encoding
- c) tricode encoding
- d) not compatible with any encoding

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Answer: a

Explanation: Hatching is compatible with monochrome encoding and also may be added to color mask coding. It is designed using closely spaced lines or sticks.

9. Minimum n-well width should be \_\_\_\_\_ micro meter.

- a) 2

- b) 3

c) 4

d) 6

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Answer: b

Explanation: The minimum width of n-well is 3 micro meter because n-well should be with little thickness and in it p-type devices are formed.

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10. The minimum spacing between two n-well is \_\_\_\_\_ micro meter.

a) 4

b) 5

c) 8

d) 8.5

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Answer: d

Explanation: The minimum spacing between two n-well is 8.5 micro meter according to the lambda based design rules.

11. Which can bring about variations in threshold voltage?

a) oxide thickness

b) ion implantation

c) poly variations

d) all of the mentioned

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Answer: d

Explanation: One of the problems in the manufacture using design rule is that variation in threshold voltage occurs. And this is caused by oxide thickness, ion implantation and poly variations.

12. What are the advantages of design rules?

a) durable

b) scalable

c) portable

d) all of the mentioned

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Answer: d

Explanation: Some of the advantages of generalised design rules are those are durable, scalable, portable, increases designer efficiency and automatic translation to final layout can be done.

13. Minimum diffusion space is \_\_\_\_\_

a) 2?

b) 3?

c) 4?

d) ?

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Answer: b

Explanation: Minimum diffusion space is 3? to avoid the possibility of their associated regions overlapping and conducting current.

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14. Contact cuts should be \_\_\_\_\_ apart.

a) 2?

b) 3?

c) 4?

d) ?

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Answer: a

Explanation: Two contact cuts should be 2? apart to prevent holes from merging.

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## VLSI Questions and Answers – Sheet Resistance

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Sheet Resistance”.

1. Area A of a slab can be given as \_\_\_\_\_

- a)  $t * W$
- b)  $t / W$
- c)  $L * W$
- d)  $L * t$

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Answer: a

Explanation: Area A of a uniform slab is given as the product of thickness t and width W of the slab. Its unit is (micrometer)<sup>2</sup>.  
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2. For 5 micron technology, What is the Rs value for a metal?

- a) 0.03
- b) 0.04
- c) 0.02
- d) 0.01

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Answer: a

Explanation: For a 5 micron technology, the Rs value for a metal is 0.03. It is the standard typical sheet resistance values.

3. For 2 micron technology, what is the Rs value for polysilicon?

- a) 10-40
- b) 20-50
- c) 15-30
- d) 15-100

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Answer: c

Explanation: For 2 micron technology, the Rs value for polysilicon is 15-30.

4. Which has higher Rs values?

- a) n-diffusion
- b) p-diffusion
- c) n-diffusion & p-diffusion
- d) none of the mentioned

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Answer: b

Explanation: The Rs values for p-diffusion is 2.5 times greater than that of the n-diffusion.

5. For 1.2 micron technology, what is the Rs value for diffusion?

- a) 20-40
- b) 20-45
- c) 15-30
- d) 25-50

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Answer: b

Explanation: For 1.2 micron technology, the Rs value for diffusion is 20-45.

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6. What is the relationship between channel resistance and sheet resistance?

- a)  $R = Rs$
- b)  $R = Z * Rs$
- c)  $R = Z / Rs$
- d)  $R = Rs / Z$

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Answer: b

Explanation: The relationship between channel resistance and sheet resistance can be given as  $R = Z * Rs$ . Sheet resistance is a measure of the resistance of thin films that are nominally uniform in thickness.

7. Z can be given as the ration of \_\_\_\_\_

- a) lower channel by upper channel
- b) upper channel by lower channel
- c) all of the mentioned
- d) none of the mentioned

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Answer: b

Explanation: Z (length to width) ratio can be given as the ratio of upper channel to lower channel. It is just a numerical quantity and has no unit.

8. Deposition of metal or silicon alloy can be done by \_\_\_\_\_

- a) sputtering
- b) evaporation
- c) sputtering and evaporation
- d) deposition should not be made

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Answer: c

Explanation: Deposition of metal or silicon alloy can be done by either sputtering or evaporation. Sputtering is a process whereby particles are ejected from a solid target material due to bombardment of the target by energetic particles.

9. Deposition of metal can be done by co-evaporation.

- a) true
- b) false

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Answer: a

Explanation: Deposition of metal or silicon alloy can also be done by co-evaporation from the elements.

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10. Processing of the device is better using \_\_\_\_\_

- a) polysilicon
- b) silicides
- c) polysilicon & silicides
- d) none of the mentioned

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Answer: a

Explanation: Processing of the device is better using polysilicon than silicides even though the properties of silicides are better than polysilicon.

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## VLSI Questions and Answers – Area Capacitance

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Area Capacitance”.

1. Conducting layer is separated from substrate using \_\_\_\_\_
- a) dielectric layer
  - b) silicon layer
  - c) metal layer
  - d) diffusion layer

[View Answer](#)

Answer: a

Explanation: Conducting layer is separated from the substrate by using dielectric or insulating layer as both are electrical insulators that can be polarized by an applied electric field.

2. Gate to channel capacitance of 5 micron technology is \_\_\_\_\_ pF X  $10^{-4}$  (micrometer) $^2$ .
- a) 1
  - b) 2
  - c) 4
  - d) 0.4

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Answer: c

Explanation: Gate to channel capacitance of 5 micron technology is 4 pF X  $10^{-4}$  (micrometer) $^2$ . It is the standard typical calculated value.

3. Area capacitance of diffusion region of 2 micron technology is \_\_\_\_\_ pF X  $10^{-4}$  (micrometer) $^2$ .
- a) 2
  - b) 2.75
  - c) 3.75
  - d) 4.75

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Answer: c

Explanation: Area capacitane of diffusion region of 2 micron technology is  $3.75 \text{ pF} \times 10^{-4} (\text{micrometer})^2$ .

4. What is the relative capacitance of diffusion region of 5 micron technology?
- a) 1
  - b) 0.25
  - c) 1.25
  - d) 2

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Answer: b

Explanation: The relative capacitance of diffusion region of 5 micron technology is 0.25. The relative value is calculated by comparing two values of same type.

5. A feature size square has \_\_\_\_\_

- a) L > W
- b) W > L
- c) L = W
- d) L > d

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Answer: c

Explanation: A feature size square has  $L = W$  and its gate to channel capacitance value is called as square  $C_g$ .  
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6. What is the standard square  $C_g$  value of a 5 micron technology?

- a) 0.01 pF
- b) 0.1 pF
- c) 1 pF
- d) 10 pF

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Answer: a

Explanation: The standard square  $C_g$  value of a 5 micron technology is 0.01 pF. This standard square  $C_g$  value can be calculated by using the area of standard square value and the capacitance value.

7. What is the standard square  $C_g$  value of a 1.2 micron technology?

- a) 0.01 pF
- b) 0.0023 pF
- c) 0.023 pF
- d) 0.23 pF

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Answer: b

Explanation: The standard square  $C_g$  value of a 1.2 micron technology is 0.0023 pF.

8. Relative area for  $L = 20?$  and  $W = 3?$  is?

- a) 10
- b) 15
- c) 1/15
- d) 1/10

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Answer: b

Explanation: Relative area for  $L = 20?$  and  $W = 3?$  is  $= (20? \times 3?) / (2? \times 2?) = 15$ . Relative area has no unit as two quantities of same type have been used.

9. What is the value of gate capacitance?

- a) 0.25 square  $C_g$
- b) 1 square  $C_g$
- c) 1.25 square  $C_g$
- d) 1.5 square  $C_g$

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Answer: b

Explanation: The value of gate capacitance is one square  $C_g$ . This is the standard value.  
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10. What is the delay unit of 5 micron technology?

- a) 1 nsec
- b) 0.1 nsec
- c) 0.01 nsec
- d) 1 sec

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Answer: b

Explanation: Delay unit of 5 micron technology is 0.1 nsec.

11. What is the delay unit of 1.2 micron technology?

- a) 0.064 nsec
- b) 0.0064 nsec
- c) 0.046 nsec
- d) 0.0046 nsec

[View Answer](#)

Answer: c

Explanation: The delay unit of 1.2 micron technology is 0.046 nsec.

12. What is the transition point of an inverter?

- a) Vdd
- b) 0.5 Vdd
- c) 0.25 Vdd
- d) 2 Vdd

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Answer: b

Explanation: The transition point of an inverter is 0.5 Vdd. The transition point is the point where different phases of same substance can be obtained in equilibrium.

13. What is the desired or safe delay value for 5 micron technology?

- a) 0.3 nsec
- b) 0.5 nsec
- c) 0.1 nsec
- d) 0.2 nsec

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Answer: a

Explanation: The desired or safe delay value for 5 micron technology is 0.3 nsec.

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# VLSI Questions and Answers – Inverter Delays

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Inverter Delays”.

1. The resistance value associated with Rp.u is?

- a) 2Rs
- b) Rs
- c) 4Rs

d)  $Rs/2$

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Answer: c

Explanation: The resistance value associated with  $R_{p.u.}$  is  $4Rs$ . Resistance is the measure of difficulty to pass an electric current through that material.

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2. The resistance value associated with  $R_{p.d.}$  is?

- a)  $2Rs$
- b)  $Rs$
- c)  $4Rs$
- d)  $Rs/2$

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Answer: b

Explanation: The resistance value associated with  $R_{p.d.}$  is  $1Rs$ . This is the measure of difficulty to pass current through the pull-down device.

3. The overall delay of nMOS inverter pair is?

- a)  $4T$
- b)  $T$
- c)  $5T$
- d)  $2T$

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Answer: c

Explanation: The overall delay of nMOS inverter pair is  $T+4T = 5T$ . This delay is the time taken for the input signal to get inverted and arrive at the output.

4. The inverter pair delay for inverters having 4:1 ratio is?

- a)  $4T$
- b)  $T$
- c)  $5T$
- d)  $2T$

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Answer: c

Explanation: The inverter pair delay for inverters having 4:1 ratio is  $5T$ . This measure of delay is for two inverters, in which the output of the first is given as the input for the second inverter.

5. The asymmetry of resistance value can be eliminated by \_\_\_\_\_

- a) decreasing the width
- b) increasing the width
- c) increasing the length
- d) increasing the width

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Answer: b

Explanation: The asymmetry of resistance value can be eliminated by increasing the width of the p-device channel.

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6. The ratio of rise time to fall time can be equated to \_\_\_\_\_

- a)  $\beta_n/\beta_p$
- b)  $\beta_p/\beta_n$
- c)  $\beta_p * \beta_n$
- d)  $\beta_p / 2\beta_n$

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Answer: a

Explanation: The ratio of rise time to fall time can be equated to  $\beta_n/\beta_p$ . Rise time is the time taken by a signal to change from a specified low value to a specified high value. Fall time is the time taken for the amplitude of a pulse to decrease from a specified value to another specified value.

7. The value  $\mu_n$  is equal to \_\_\_\_\_

- a)  $\mu_p$
- b)  $0.5\mu_p$
- c)  $1.5\mu_p$
- d)  $2.5\mu_p$

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Answer: d

Explanation: The value of  $\mu_n = 2.5 \mu_p$ . This shows that  $\mu_n$  value is greater than that of the  $\mu_p$ .

8. Which quantity is slower?

- a) rise time
- b) fall time
- c) all of the mentioned
- d) none of the mentioned

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Answer: a

Explanation: Rise time is slower by a factor of 2.5 than fall time.

9. Condition for achieving symmetrical operation is \_\_\_\_\_

- a)  $W_p = W_n$
- b)  $W_p$  greater than  $W_n$
- c)  $W_p$  lesser than  $W_n$
- d)  $W_p$  lesser than  $2W_n$

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Answer: b

Explanation: The condition for achieving symmetrical operation is  $W_p = 2.5 W_n$ .

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10. Rise time and fall time is \_\_\_\_\_ to load capacitance CL.

- a) directly proportional
- b) inversely proportional
- c) exponentially equal
- d) not related

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Answer: a

Explanation: Rise time and fall time is directly proportional to load capacitance CL.

11. Rise time and fall time is \_\_\_\_\_ to Vdd.

- a) directly proportional
- b) inversely proportional
- c) exponentially equal
- d) not related

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Answer: b

Explanation: Rise time and fall time are inversely proportional to Vdd. This shows that if Vdd is reduced fall time and rise time increase.

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# VLSI Questions and Answers – Drivers

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Drivers”.

1. For shorter delays \_\_\_\_\_ resistance should be used.

- a) smaller
- b) larger
- c) does not depend on resistance
- d) very large

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Answer: a

Explanation: For shorter delays low resistance should be used as delay is directly proportional or related to resistance.

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2. To reduce resistance value of inverters, channels must be made \_\_\_\_\_

- a) wider
- b) narrower
- c) lengthier
- d) shorter

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Answer: a

Explanation: Channels must be made wider to reduce the resistance value that is low resistance values for Z<sub>p.u.</sub> ad Z<sub>p.d.</sub> imply low L:W ratios and thus consequently an inverter to meet this need occupies a larger area.

3. As width increases, capacitive load \_\_\_\_\_

- a) increases
- b) decreases
- c) does not change
- d) exponentially increases

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Answer: a

Explanation: As width of the channel increases, capacitive load also increases and with this the area occupied also increases. The rate at which the width increases affects the stages N and load capacitance.

4. Delay per stage for logic 0 to 1 transition can be given as \_\_\_\_\_

- a) fT
- b) 2fT
- c) 3fT
- d) 4fT

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Answer: a

Explanation: Delay per stage for logic 0 to 1 transition can be given as fT. With large f, N decreases but delay per stage increases.

5. Delay per stage for logic 1 to 0 transition can be given as \_\_\_\_\_

- a) fT
- b) 2fT
- c) 3fT
- d) 4fT

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Answer: d

Explanation: Delay per stage for logic 1 to 0 transition can be given as 4fT. Using the delay for transition from 1 to 0 and 0 to 1 total nMOS delay can be obtained.

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6. What is the total delay of an nMOS pair?

- a) fT
- b) 2fT
- c) 5fT
- d) 4fT

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Answer: c

Explanation: Total delay of an nMOS pair is equal to 5fT. This can be calculated by knowing delay per stage, that is for two different transitions from 0 to 1 and vice versa.

7. What is the total delay of a CMOS pair?

- a) 5fT
- b) 7fT
- c) 8fT
- d) 4fT

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Answer: b

Explanation: Total delay of an CMOS pair is equal to 7fT. This can be calculated by knowing the delay per stage of CMOS.

8. The number of stages N can be given as \_\_\_\_\_

- a)  $\ln(y)*\ln(f)$
- b)  $\ln(y)/\ln(f)$
- c)  $\ln(f)/\ln(y)$
- d)  $\ln(f)/\ln(2y)$

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Answer: b

Explanation: The number of stages N can be given as  $\ln(y)/\ln(f)$ . By knowing whether the number of stages N is even or odd we can calculate the total delay for nMOS, CMOS etc.

9. When number of stages N is even, the total delay for nMOS can be?

- a)  $1.5NfT$
- b)  $2.5NfT$
- c)  $3.5NfT$
- d)  $4.5NfT$

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Answer: b

Explanation: When number of stages N is even, the total delay for nMOS can be given as  $2.5NfT$ . This is calculated by using the formula  $(N/2)*5fT$ .

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10. When number of stages N is even, the total delay for CMOS can be?

- a)  $1.5NfT$
- b)  $2.5NfT$
- c)  $3.5NfT$
- d)  $4.5NfT$

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Answer: c

Explanation: When the number of stages N is even, the total delay for CMOS can be given as  $3.5NfT$ . This is calculated by using the formula  $(N/2)*7fT$ .

11. In BiCMOS drivers, the input voltage Vbe is \_\_\_\_\_ on base width.

- a) directly proportional
- b) inversely proportional
- c) logarithmically proportional
- d) exponentially proportional

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Answer: c

Explanation: In BiCMOS driver, the input voltage Vbe is logarithmically proportional to the base width Wb and on electron mobility.

12. Which has a larger value?

- a)  $T_{in}$
- b)  $T_L$
- c)  $R_C$
- d) None of the mentioned

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Answer: a

Explanation: In BiCMOS drivers, the initial time  $T_{in}$  necessary to charge base emitter junction is larger than the time  $T_L$  requires to charge the output load capacitance.

13. In BiCMOS driver, a good bipolar transistor should have \_\_\_\_\_

- a) low  $R_C$
- b) high  $h_{FE}$
- c) high  $g_m$
- d) all of the mentioned

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Answer: d

Explanation: In BiCMOS drivers, a good bipolar transistor should have low  $R_C$ , high  $h_{FE}$ , high  $g_m$ , etc.

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# VLSI Questions and Answers – Propagation Delays

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Propagation Delays”.

1. Propagation time is directly proportional to \_\_\_\_\_  
a) x  
b) 1/x  
c)  $x^2$   
d)  $1/x^2$

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Answer: c

Explanation: Propagation time is directly proportional to square of the Propagation distance ( $x^2$ ). It is the time taken by the signal to move from input port to output port.

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2. The total resistance can be given as \_\_\_\_\_  
a)  $nR_s$   
b)  $nrR_s$   
c)  $rR_s$   
d)  $R_s$

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Answer: b

Explanation: The total resistance can be given as the product of  $nrR_s$  where r is the relative resistance per section in terms of  $R_s$ .

3. Total capacitance can be given as \_\_\_\_\_  
a)  $n(\text{square } C_g)$   
b)  $nc(\text{square } C_g)$   
c)  $c(\text{square } C_g)$   
d)  $\text{square } C_g$

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Answer: b

Explanation: Total capacitance can be given as the product of  $nC_g^2$  where  $C_g$  is the relative capacitance per section in terms of square  $C_g$ .

4. Overall delay is directly proportional to \_\_\_\_\_

- a) n
- b)  $1/n$
- c)  $n^2$
- d)  $1/n^2$

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Answer: c

Explanation: The overall delay is directly proportional to  $n^2$ , where n is the number of pass transistors in series.

5. The number of pass transistors connected in series can be increased if \_\_\_\_\_

- a) compressor is connected
- b) buffer is connected
- c) ground is connected
- d) voltage regulator is connected

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Answer: b

Explanation: The number of pass transistors connected in series can be increased by connecting buffer in between.  
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6. Buffer is used because \_\_\_\_\_

- a) it increases the speed
- b) decreases sensitivity to noise
- c) decreases speed
- d) does not affect speed

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Answer: a

Explanation: Buffer is used for long polysilicon runs because it increases the speed and reduces the sensitivity to noise.

7. The overall delay is \_\_\_\_\_ to the relative resistance r.

- a) directly proportional
- b) inversely proportional
- c) exponentially proportional
- d) not dependent

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Answer: a

Explanation: The overall delay is directly proportional to the relative resistance r. Overall delay is given as product of  $n^2rcT$ .

8. Small disturbances of noise \_\_\_\_\_

- a) decreases the inverter voltage
- b) increases the output voltage
- c) switches the inverter stage between 0 to 1
- d) does not switch the stage and keeps it stable

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Answer: c

Explanation: Small disturbances of noise switches the inverter stage between 0 and 1 or vice versa. It disturbs the normal operation or behaviour.

9. The buffer speeds up the \_\_\_\_\_

- a) rise time
- b) fall time
- c) all of the mentioned
- d) none of the mentioned

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Answer: a

Explanation: The buffer speeds up the rise time of propagated signal edge. A buffer is the combination of two inverters in which one output is fed to the other as the input.

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10. Overall delay increases as n \_\_\_\_\_

- a) increases
- b) decreases
- c) exponentially decreases
- d) logarithmically decreases

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Answer: a

Explanation: Overall delay increases as n increases where n is the number of pass transistors connected in series.

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# VLSI Questions and Answers – Wiring Capacitances

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Wiring Capacitances”.

1. Which contributes to the wiring capacitance?

- a) fringing fields
- b) interlayer capacitance
- c) peripheral capacitance
- d) all of the mentioned

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Answer: d

Explanation: The sources of capacitances that contribute to the total wiring capacitance are fringing field capacitance, interlayer capacitance and peripheral capacitance.

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2. What does the value d in fringing field capacitance measures?

- a) thickness of wire
- b) length of the wire
- c) wire to substrate separation
- d) wire to wire separation

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Answer: c

Explanation: The quantity d in fringing field capacitance measures the wire to substrate separation. It is the distance between the wire and the substrate used in the device.

3. Total wire capacitance is equal to \_\_\_\_\_

- a) area capacitance
- b) fringing field capacitance

c) area capacitance + fringing field capacitance  
d) peripheral capacitance

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Answer: c

Explanation: Total wire capacitance can be given as the sum of area capacitance and fringing field capacitance.

4. Interlayer capacitance occurs due to \_\_\_\_\_

- a) separation between plates
- b) electric field between plates
- c) charges between plates
- d) parallel plate effect

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Answer: d

Explanation: Interlayer capacitance occurs due to a parallel plate effect between one layer and another. When one capacitance value comes closer to another they create some combined effects.

5. Which capacitance must be higher?

- a) metal to polysilicon capacitance
- b) metal to substrate capacitance
- c) metal to metal capacitance
- d) diffusion capacitance

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Answer: a

Explanation: Metal to polysilicon capacitance should be higher than metal to substrate capacitance. This is due to that when one layer underlies the other and in consequence interlayer capacitance is highly dependent on layout.

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6. Peripheral capacitance is given in \_\_\_\_\_ eper unit length.

- a) nano farad
- b) pico farad
- c) micro farad
- d) farad

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Answer: b

Explanation: Peripheral capacitance is given in picofarads per unit length. This is the sidewall capacitance. Each diode has this side wall capacitance.

7. For greater relative value of peripheral capacitance \_\_\_\_\_ should be small.

- a) source area
- b) drain area
- c) source & drain area
- d) none of the mentioned

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Answer: c

Explanation: The smaller the source or drain area, the greater the relative value of peripheral capacitance as they are both inversely related.

8. Diffusion capacitance is equal to \_\_\_\_\_

- a) area capacitance
- b) peripheral capacitance
- c) fringing field capacitance
- d) area capacitance + peripheral capacitance

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Answer: d

Explanation: Diffusion capacitance is given by the sum of area capacitance and peripheral capacitance.

9. Polysilicon is suitable for \_\_\_\_\_

- a) small distance
- b) large distance
- c) all of the mentioned'
- d) none of the mentioned

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Answer: a

Explanation: Polysilicon is unsuitable for routing Vdd or Vss other than for very small distance because of the relatively high Rs value of the polysilicon layer.

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10. Which has a high voltage drop?

- a) metal layer
- b) polysilicon layer
- c) diffusion layer
- d) silicide layer

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Answer: b

Explanation: Polysilicon layer has high voltage drop. It has a moderate RC product.

11. Which layer has high capacitance value?

- a) metal
- b) diffusion
- c) silicide
- d) polysilicon

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Answer: b

Explanation: Diffusion or active layer has high capacitance value due to which it has low or moderate IR drop.

12. Which layer has high resistance value?

- a) polysilicon
- b) silicide
- c) diffusion
- d) metal

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Answer: a

Explanation: Polysilicon layer has high resistance value and due to this it has high IR drop.

13. While measuring the output load capacitance  $C_{gs}$ , n and  $C_{gs}$ , p is not considered. Why?

- a) Because  $C_{gs}$ , n and  $C_{gs}$ , p are the capacitances at the input nodes
- b) Because  $C_{gs}$ , n and  $C_{gs}$ , p does not exist during the operation of CMOS inverter
- c) Because  $C_{gs}$ , n and  $C_{gs}$ , p are storing opposite charges and cancel out each other during the calculation of load capacitance
- d) None of the mentioned

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Answer: a

Explanation:  $C_{gs}$ , n and  $C_{gs}$ , p are gate to source capacitances of nMOS and pMOS transistors in CMOS inverter. They are measured at input node. Therefore they are not considered for calculation of load capacitance.

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14. During the calculation of load capacitance of a 1st stage CMOS inverter, the input node capacitances,  $C_{gs}$ , n and  $C_{gs}$ , p of the 2nd stage CMOS inverter is also considered.

- a) True
- b) False

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Answer: b

Explanation: Instead thin oxide capacitance over the gate area is used for calculation.

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## VLSI Questions and Answers – Sheet Resistance of MOS Transistors and Inverters

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Sheet Resistance of MOS Transistors and Inverters”.

1. The resistance of uniform slab of the conducting material is?

- a) Linear(proportional) with length
- b) Inversely proportional to thickness
- c) Inversely proportional to width
- d) All of the mentioned

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Answer: d

Explanation: The resistance of a uniform slab of conducting material can be expressed as

$$R = (\rho \cdot l) / (t \cdot w)$$

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2. The sheet resistance of the conducting material is?

- a) RS = resistivity/length
- b) RS = resistivity/width
- c) RS = resistivity/thickness
- d) None of the mentioned

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Answer: c

Explanation: The sheet resistance of the conducting material is given by  $RS = \text{resistivity}/\text{thickness}$ .

3. In CMOS manufacturing process Sheet resistance is used instead of resistivity because \_\_\_\_\_

- a) Resistivity is same for all doped regions
- b) Resistivity and thickness are characteristics which cannot be controlled by the circuit designer, and it is expressed as the single sheet resistance parameter
- c) Sheet resistance is dimensionless quantity
- d) Sheet resistance is equal to resistivity

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Answer: b

Explanation: It is convenient to use Sheet resistance instead of resistivity because Resistivity and thickness are characteristics which cannot be controlled by the circuit designer, and it is expressed as the single sheet resistance parameter.

4. Compute the sheet resistance of a 0.17  $\mu\text{m}$  thick Cu wire if resistivity of Cu wire is 1.7  $\mu\Omega\text{-cm}$ .

- a) 0.01  $\Omega/\text{square}$
- b) 0.001  $\Omega/\text{square}$
- c) 10.0  $\Omega/\text{square}$
- d) 0.10  $\Omega/\text{square}$

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Answer: d

Explanation: Sheet resistance of copper is  $= (1.7 \times 10^{-8}) / (0.17 \times 10^{-6}) = 0.10 \Omega/\text{square}$ .

5. For semiconductors doped through diffusion or through surface peaked ion implantation we derive the sheet resistance as \_\_\_\_\_

- a) Average resistivity of semiconductor/thickness
- b) Resistivity/thickness
- c) Conductivity/thickness
- d) None of the mentioned

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Answer: a

Explanation: For semiconductors doped through diffusion or through surface peaked ion implantation we derive the sheet resistance using the average resistivity of the material.

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6. Sheet resistance of a semiconductor is \_\_\_\_\_

- a) Inherent property of the material
- b) Function of thickness of the material
- c) Also called as Specific Resistance
- d) All of the mentioned

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Answer: b

Explanation: Resistivity is the inherent property of any conducting material. It is also called Specific Resistance. Sheet resistance is function of thickness as resistivity for a material is fixed.

7. Sheet resistance of semiconductor is directly measured using \_\_\_\_\_

- a) Ohmmeter
- b) Four point probe measurement
- c) Non-contact eddy current based testing device
- d) Any of the mentioned

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Answer: b

Explanation: Sheet resistance of semiconductor is directly measured using Four point probe measurement.

8. The resistance of the semiconductor material is  $800\Omega$ . The sheet resistance if the dimensions of the material is  $0.125\mu\text{m}$  wide and 1 mm long is?

- a)  $10\ \Omega/\text{square}$
- b)  $0.01\ \Omega/\text{square}$
- c)  $0.10\ \Omega/\text{square}$
- d)  $1\ \Omega/\text{square}$

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Answer: c

Explanation: We know that  $R=Rs(L/W)$ .

Therefore  $Rs=R \times W/L$

Substituting the values of R, W and L, Rs is found to be  $0.10\ \Omega/\text{square}$ .

9. The typical values of sheet resistance for the n-well semiconductor is \_\_\_\_\_

- a) 1-5  $\text{K}\Omega/\text{square}$
- b) 10-50  $\text{K}\Omega/\text{square}$
- c) 1-5  $\Omega/\text{square}$
- d) 100-500  $\Omega/\text{square}$

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Answer: a

Explanation: The n-well semiconductors have high sheet resistance in the range of 1-5  $\text{K}\Omega/\text{square}$ .

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10. The typical values of sheet resistance for polysilicon semiconductor is?

- a) 15-30  $\Omega/\text{square}$
- b) 150-300  $\Omega/\text{square}$
- c) 1.5-3  $\text{K}\Omega/\text{square}$
- d) 0.15-0.3  $\Omega/\text{square}$

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Answer: a

Explanation: The typical values of polysilicon semiconductor is 15-30  $\Omega/\text{square}$ .

11. For ? based design, what is the standard unit of capacitance, ( $?=5\mu\text{m}$ )?

- a)  $0.01\text{pF}$
- b)  $0.0032\text{pF}$
- c)  $0.0023\text{pF}$
- d) All of the mentioned

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Answer: a

Explanation:  $5\ \mu\text{m} \times 5\ \mu\text{m} \times 4\ \text{pF} \times 10^{-4}/\mu\text{m}^2 = 0.01\text{pF}$ .

12. If standard area is  $2? \times 2?$ , then the standard capacitance of a gate of length 30? and width 6? is?

- a)  $180^\circ\text{Cg}$
- b)  $45^\circ\text{Cg}$
- c)  $90^\circ\text{Cg}$
- d)  $4^\circ\text{Cg}$

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Answer: b

Explanation:  $30? \times 6?/2? \times 2? = 45^\circ\text{Cg}$ .

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# VLSI Questions and Answers – MOS Circuits Area Capacitance and Delay Unit

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “MOS Circuits Area Capacitance and Delay Unit”.

1. Which of the following mainly constitutes the output node capacitance?  
 a) Inter electrode capacitance  
 b) Stray capacitance  
 c) Junction Parasitic capacitance  
 d) All of the mentioned

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Answer: c

Explanation: Output node capacitance mainly consists of junction parasitic capacitance.

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2. The junction parasitic capacitance are produced due to \_\_\_\_\_

- a) Source diffusion regions
- b) Gate diffusion regions
- c) Drain diffusion region
- d) All of the mentioned

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Answer: c

Explanation: The junction parasitic capacitance are produced due to drain diffusion capacitance.

3. The amount of parasitic capacitance at the output node is determined by \_\_\_\_\_

- a) Concentration of the impurity doped
- b) Size of the total drain diffusion area

- c) Charges stored in the capacitor
- d) None of the mentioned

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Answer: b

Explanation: The amount of parasitic capacitance is a linear function of drain diffusion area.

4. The dominant component of the total output capacitance in submicron technology is?

- a) Drain diffusion capacitance
- b) Gate oxide capacitance
- c) Interconnect capacitance
- d) Junction parasitic capacitance

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Answer: c

Explanation: Interconnect capacitance becomes dominant component in submicron technology.

5. Which of the following is dominant component in input capacitance?

- a) Gate diffusion capacitance
- b) Gate parasitic capacitance
- c) Gate oxide capacitance
- d) All of the mentioned

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Answer: c

Explanation: For input capacitance, gate oxide capacitance is the main component.

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6. The total load capacitance is calculated as the sum of \_\_\_\_\_

- a) Drain capacitance in series with input capacitance
- b) Drain capacitance + interconnect capacitance +input capacitance
- c) Drain capacitance + interconnect capacitance – input capacitance
- d) Drain capacitance in parallel with input capacitance

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Answer: b

Explanation: Total load capacitance = Drain capacitance + interconnect capacitance +input capacitance.

7. The interconnect capacitance is formed by \_\_\_\_\_

- a) Area between the interconnect lines
- b) Interconnect lines between the gates
- c) Inter electrode capacitance of interconnect lines
- d) None of the mentioned

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Answer: b

Explanation: Interconnect line between the gates form interconnect capacitance.

8. The amount of gate oxide capacitance is determined by \_\_\_\_\_

- a) Charges present on the gate
- b) Polarity of the gate
- c) Charges present on the substrate
- d) Area of the gate

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Answer: d

Explanation: The amount of gate oxide capacitance is determined by the area of the gate.

9. By what amount is Sidewall doping larger than substrate doping concentration.

- a) 5
- b) 2
- c) 1
- d) 10

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Answer: d

Explanation: The sidewall doping is 10 times larger.

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10. Zero bias depletion capacitance per unit length at sidewall junctions is given by, ( $C_j$  is the zero bias depletion capacitance per unit area).

- a)  $(v10).C_j.x_j$
- b)  $(v5).C_j.x_j$
- c)  $(v10).C_j.x_j^2$
- d)  $(v10).C_j.x_j^3$

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Answer: a

Explanation: Since the doping concentration is 10 times larger.

11. The typical value of capacitance in  $\text{pF} \times 10^{-4}/\mu\text{m}^2$  for gate to channel in ? based design is?

- a) 1
- b) 0.4
- c) 0.2
- d) 4

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Answer: d

Explanation: The gate to channel capacitance in ? based design is  $4 \text{ pF} \times 10^{-4}/\mu\text{m}^2$ .

12. The active capacitance is also called as \_\_\_\_\_

- a) Parasitic capacitance
- b) Interconnect capacitance
- c) Junction capacitance
- d) Diffusion capacitance

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Answer: d

Explanation: Diffusion capacitance is also called as active capacitance.

13. The value of diffusion capacitance in  $\text{pF} \times 10^{-4}/\mu\text{m}^2$  in  $2 \mu\text{m}$  design is?

- a) 1.75
- b) 4
- c) 8
- d) 16

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Answer: c

Explanation: Diffusion capacitance has a value of  $8 \text{ pF} \times 10^{-4}/\mu\text{m}^2$ .

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14. The value of standard unit of capacitance is?

- a)  $0.01\text{pF}$
- b)  $0.0032\text{pF}$
- c)  $0.0023\text{pF}$
- d) All of the mentioned

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Answer: d

Explanation: The value of standard unit of capacitance depends on the design style used.

15. The standard unit of capacitance is defined as?

- a) Capacitance of gate to channel of MOS transistor having  $W = L$  dimensions
- b) Capacitance of gate to channel of n-MOS transistor having  $W = 3L$  dimensions
- c) Capacitance of gate to channel of p-MOS transistor having  $3W = L$  dimensions
- d) Capacitance of gate to channel of n-MOS transistor having  $W = L$  dimensions and p-MOS having  $W=3L$  dimensions

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Answer: a

Explanation: Standard capacitance is capacitance of gate to channel with standard area.

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## VLSI Questions and Answers – Capacitive Loads and Wiring Capacitances

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Capacitive Loads and Wiring Capacitances”.

1. The capacitances in MOSFET occurs due to \_\_\_\_\_
  - a) Interconnects
  - b) Difference in Doping concentration
  - c) Difference in dopant materials
  - d) All of the mentioned

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Answer: d

Explanation: The on-chip capacitances found in MOS circuits are due to interconnects, difference in Doping concentration, difference in dopant materials.

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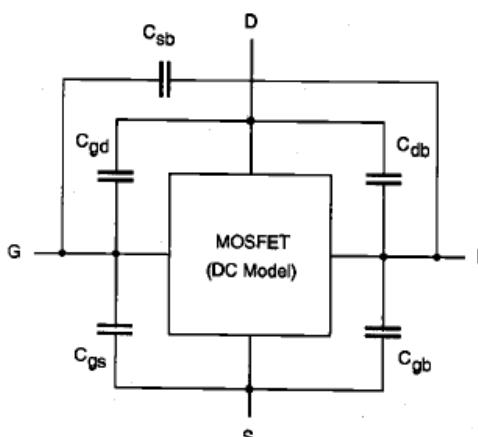
2. The parasitic capacitances found in MOSFET are \_\_\_\_\_
  - a) Oxide related capacitances
  - b) Inter electrode capacitance
  - c) Electrolytic capacitance
  - d) All of the mentioned

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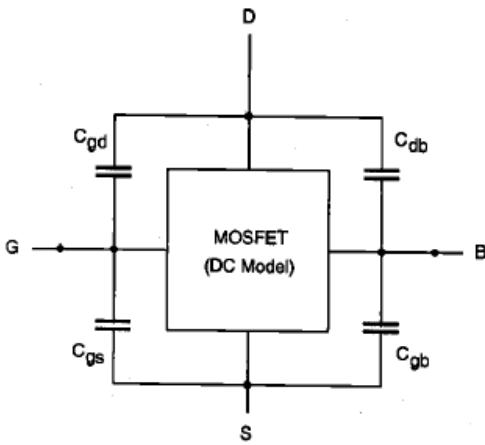
Answer: a

Explanation: The parasitic device capacitances can be classified into two major groups: oxide-related capacitances and junction capacitances.

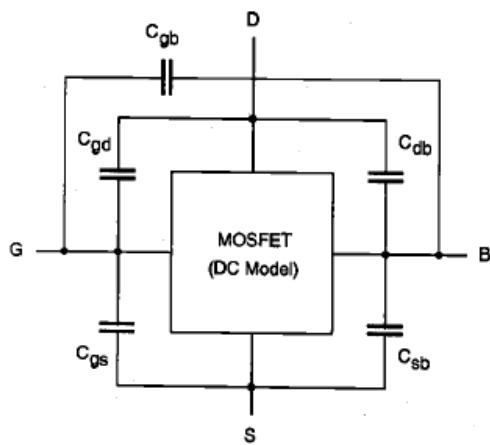
3. The proper DC model of MOSFET with capacitances is?



a)



b)



c)

- d) None of the mentioned

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Answer: c

Explanation: The capacitances exist between all the regions of the MOSFET.

4. The capacitance that exist between Gate and Bulk is called as \_\_\_\_\_

- a) Oxide parasitic capacitance  
b) Metal oxide capacitance

c) MOS capacitance

- d) None of the mentioned

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Answer: a

Explanation: The capacitance that exist between Gate and Bulk is called as an oxide parasitic capacitance.

5. In Cut-off Mode, the capacitance Cgs will be equal to \_\_\_\_\_

- a)  $2C_{gd}$   
b) 0  
c)  $C_{gb}$   
d) All of the mentioned

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Answer: b

Explanation: In cut-off mode, the conducting channel does not exist, so gate-to-source and the gate-to-drain capacitances are both equal to zero.

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6. In cut-off mode, the value of gate to substrate capacitance is equal to \_\_\_\_\_

- a)  $C_{ox} \cdot (W - L)$   
b)  $C_{ox} W/L$   
c)  $C_{ox}^* W*L$   
d) 0

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Answer: c

Explanation: In Cut-off mode, the conducting channel does not exist, so gate-to-source and the gate-to-drain capacitances are both equal to zero. Therefore, the gate to substrate capacitance is equal to  $C_{ox}^* W*L$ .

7. In linear mode operation, the parasitic capacitances that exists are \_\_\_\_\_

- a) Nonzero Gate to source capacitance  
b) Nonzero Gate to drain capacitance

c) Zero gate to substrate capacitance  
d) All of the mentioned

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Answer: d

Explanation: In linear-mode operation, the conducting channel exists, therefore there will be a finite amount of gate to source and gate to drain capacitances. Since the conducting channel exists, gate to substrate capacitance is reduced to zero.

8. In saturation mode operation, gate to drain capacitance is zero due to \_\_\_\_\_

- a) Gate and drain are interconnected
- b) Channel length is reduced
- c) Inversion layer doesn't exist
- d) Drain is connected to ground

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Answer: b

Explanation: Due to the pinched off channel, the capacitance between source to drain is reduced to zero.

9. When MOSFET is operating in saturation region, the gate to source capacitance is?

- a)  $1/2 * C_{ox} * W * L$
- b)  $2/3 * C_{ox} * W * L$
- c)  $C_{ox} * W * L$
- d)  $1/3 * C_{ox} * W * L$

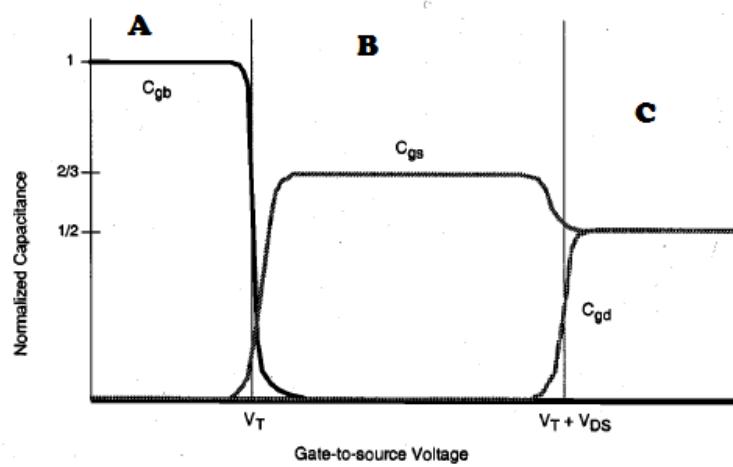
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Answer: b

Explanation: Due to the reduction in channel length, gate to drain and gate to substrate capacitance are zero, the gate to channel capacitance as seen between the gate and the source is approximately defined as  $2/3 * C_{ox} * W * L$ .

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10. In the below graph, the regions marked as A,B,C are?



- a) A : Saturation, B : Linear, C : Cut-off
- b) A :Cut-off, B : Linear, C : Saturation
- c) A : Linear, B : Saturation, C : Cut-off
- d) None of the mentioned

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Answer: b

Explanation: The gate to substrate capacitance exists only in cut-off region, and gate to drain capacitance exist only in saturation region.  
Hint: the graph can be analyzed from the gate to source voltage on x axis and regions can be determined.

11. The load capacitance is measured between \_\_\_\_\_

- a) Output node and input node
- b) Output node and V<sub>cc</sub>
- c) Output node and ground
- d) Input node and ground

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Answer: c

Explanation: The load capacitance is measured at output node and ground.

12. The load capacitance is equivalent to \_\_\_\_\_

- a) Sum of all lumped linear capacitances between input and output node
- b) Sum of all junction capacitance between V<sub>cc</sub> and ground
- c) Sum of all junction capacitance between input and output
- d) Sum of all lumped linear capacitances between output node and ground

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Answer: a

Explanation: The load capacitance is measured by sum of all lumped linear capacitances between input and output node.

13. Interconnect capacitance contributes to the load capacitance when the CMOS inverters are connected in cascade configuration.

- a) True
- b) False

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Answer: a

Explanation: In cascade configuration the load capacitance is measured by sum of all the lumped capacitances and interconnect capacitance.  
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14. Interconnect capacitance is formed due to \_\_\_\_\_

- a) Junction capacitance between gate and substrate
- b) Wire connecting the gates of 2 different inverters
- c) Parasitic capacitance existing between metal and polysilicon connection between 2 inverters
- d) All of the mentioned

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Answer: c

Explanation: Parasitic capacitance existing between metal and polysilicon connection between 2 inverters causes the interconnect capacitance.

15. Which of the following parameters are found using load capacitance?

- a) Delay time
- b) Power consumption
- c) Speed of the CMOS logic
- d) All of the mentioned

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Answer: d

Explanation: Using load capacitance, delay time, power consumption, speed of the CMOS logic can be measured.

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# VLSI Questions and Answers – Differential Amplifier

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Differential Amplifier”.

1. The difference output of the basic differential amplifier is taken at \_\_\_\_\_

- a) At X and ground
- b) At Y and ground
- c) Difference of the voltages at the gates of M1 and M2
- d) Difference of the voltages between X and Y

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Answer: d

Explanation: None.

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2. The Differential output of the difference amplifier is the amplification of \_\_\_\_\_

- a) Difference between the voltages of input signals
- b) Difference between the output of the each transistor
- c) Difference between the supply and the output of the each transistor
- d) All of the mentioned

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Answer: a

Explanation: None.

3. The inputs to the differential amplifier are applied at \_\_\_\_\_

- a) At X and Y
- b) At the gates of M1 and M2
- c) All of the mentioned
- d) None of the mentioned

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Answer: b

Explanation: None.

4. The Maximum and minimum output of the Differential amplifiers is defined as:

- a)  $V_{max} = V_{DD}$ ,  $V_{min} = -V_{DD}$
- b)  $V_{max} = V_{DD}$ ,  $V_{min} = R_d.I_{ss}$
- c)  $V_{max} = V_{DD}$ ,  $V_{min} = V_{DD} - R_d.I_{ss}$
- d) None of the mentioned

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Answer: c

Explanation: None.

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5. In Common Mode Differential Amplifier, the outputs  $V_{out1}$  and  $V_{out2}$  are related as:

- a)  $V_{out2}$  is in out of phase with  $V_{out1}$  with same amplitude
- b)  $V_{out2}$  and  $V_{out1}$  have same amplitude but the phase difference is 90 degrees
- c)  $V_{out1}$  and  $V_{out2}$  have same amplitude and are in phase with each other and their respective inputs
- d)  $V_{out1}$  and  $V_{out2}$  have same amplitude and are in phase with each other but out of phase with their respective inputs

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Answer: d

Explanation: None.

6. In a small signal differential gain vs input CM level graph, the gain decreases after  $V_2$  due to:

- a) As the input voltage increases, the output will be clipped
- b) When the input voltage to the transistors are high, the transistor enters saturation region and increases the current, which inturn decreases the output voltage =  $V_{DD} - R_d.I_{ss}$
- c) When Common Mode voltage is greater than or equal to  $V_2$ , the input transistors enter triode region, the gain begins to fall
- d) Increasing the input voltage beyond  $V_2$  causes the gate oxide to conduct and the gain is reduced

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Answer: c

Explanation: None.

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# VLSI Questions and Answers – Single Stage Amplifiers

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Single Stage Amplifiers”.

1. The input output characteristic of an amplifier is

- a) Linear function
- b) Non Linear function
- c) Sinusoidal function with change of phase
- d) None of the mentioned

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Answer: b

Explanation: The input output characteristic of an amplifier is non linear function. It is given by  $y(t) = a_0 + a_1x(t) + a_2x(t)^2 \dots$

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2. The amplifier works as a linear system for:

- a) High frequency signals
- b) Low frequency signals
- c) Small signals
- d) Large signals

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Answer: c

Explanation: The amplifier works as linear system for small signals and the output  $y(t) = a_0 + a_1x(t)$ .

3. In MOSFET amplifier, the input is applied as:

- a) Voltage across gate and source
- b) Voltage across drain and source
- c) Current at gate
- d) Current at Drain

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Answer: a

Explanation: The input to MOSFET amplifier is gate to source voltage.

4. In MOSFET amplifier, the parameter that changes due to the changes in input is:

- a) Small signal drain current
- b) Large signal drain current
- c) Voltage across substrate and source
- d) None of the mentioned

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Answer: a

Explanation: Due to the transconductance, drain current changes as input changes.

5. Input impedance of MOSFET amplifier in Common Source configuration is:

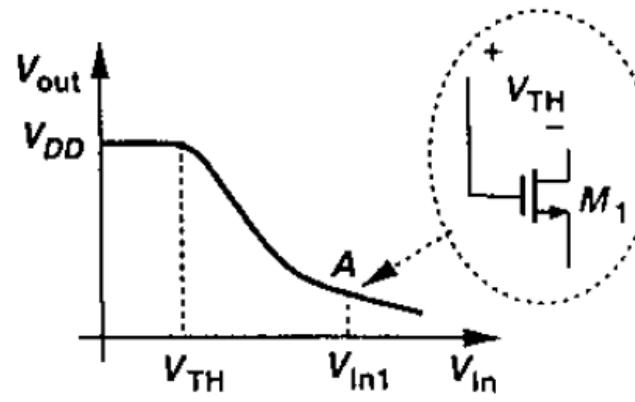
- a) Very high at high frequencies
- b) Very high at low frequencies
- c) Very low at high frequencies
- d) Very low at low frequencies

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Answer: b

Explanation: Input impedance of MOSFET amplifier in Common Source configuration is very high at low frequencies.  
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6. In the below input output characteristic of MOSFET amplifier, if  $V_{in} > V_{in1}$ , the MOSFET is said to operate in:



- a) Saturation region
- b) Cutoff region
- c) Triode region
- d) None of the mentioned

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Answer: c

Explanation: When  $V_{in} > V_{in1}$ , then the transistor is said to operate in triode region.

7. The voltage gain of the MOSFET is given by:

- a)  $A_v = -\beta R_d$
- b)  $A_v = ?R_d$
- c)  $A_v = -g_m R_d$
- d) None of the mentioned

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Answer: c

Explanation: The voltage gain is equal to negative of product of transconductance and resistance.

8. The MOSFET is said to be in diode connected configuration if:

- a) A diode is placed between supply and drain
- b) A diode is placed between source and ground
- c) Source and gate are connected
- d) Drain and gate are connected

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Answer: d

Explanation: A MOSFET connected in such a way that both gate and drain are connected to supply, then it is said to be in Diode connected condition.

9. The diode connected MOSFET acts as:

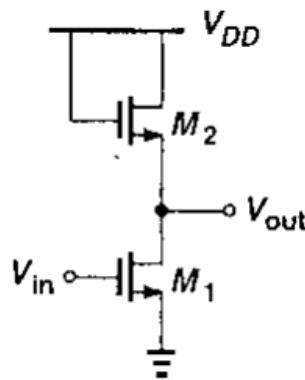
- a) Active element for amplification
- b) Voltage source
- c) Current Source
- d) Load Impedance

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Answer: d

Explanation: The diode connected configuration of MOSFET acts as Load impedance.  
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10. In the below circuit, if the levels of input and output vary, the gain is found to:



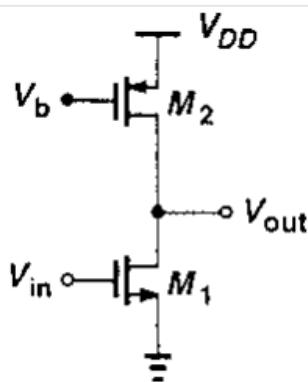
- a) Increase linearly as input level increases
- b) Decrease linearly as output level decreases
- c) Remain constant
- d) Vary non linearly

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Answer: c

Explanation: The gain remains relatively constant for variations in the input and output levels.

11. In the below circuit of Common Source amplifier, the transistor M2 operates as:



- a) Load impedance
- b) Voltage source
- c) Current Source
- d) None of the mentioned

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Answer: c

Explanation: The transistor M2 operates as current source in Common source amplifier for providing large voltage gain.

12. The advantage of using source degeneration resistor in Common source amplifier is to provide:

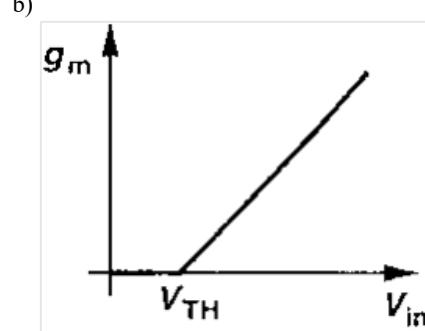
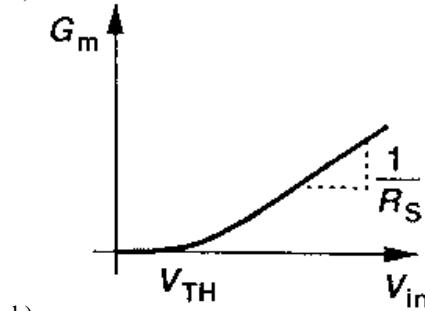
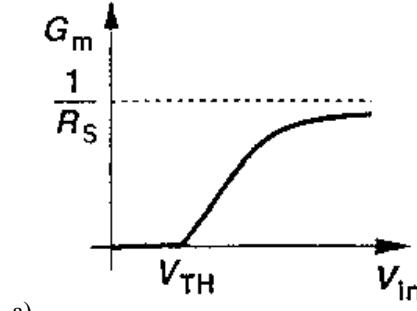
- a) Huge gain
- b) Non Linearity behaviour of amplifier
- c) Linearity behaviour of amplifier
- d) Less gain

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Answer: c

Explanation: Introducing degenerative resistor makes the amplifier to operate in linear condition.

13. The graph corresponding to Common source amplifier with source degeneration resistor is:



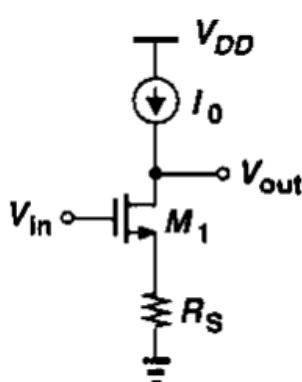
- d) None of the mentioned  
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Answer: a

Explanation: Gain remains constant in source degeneration configuration.

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14. In the below circuit if the current source is ideal, the voltage gain is:

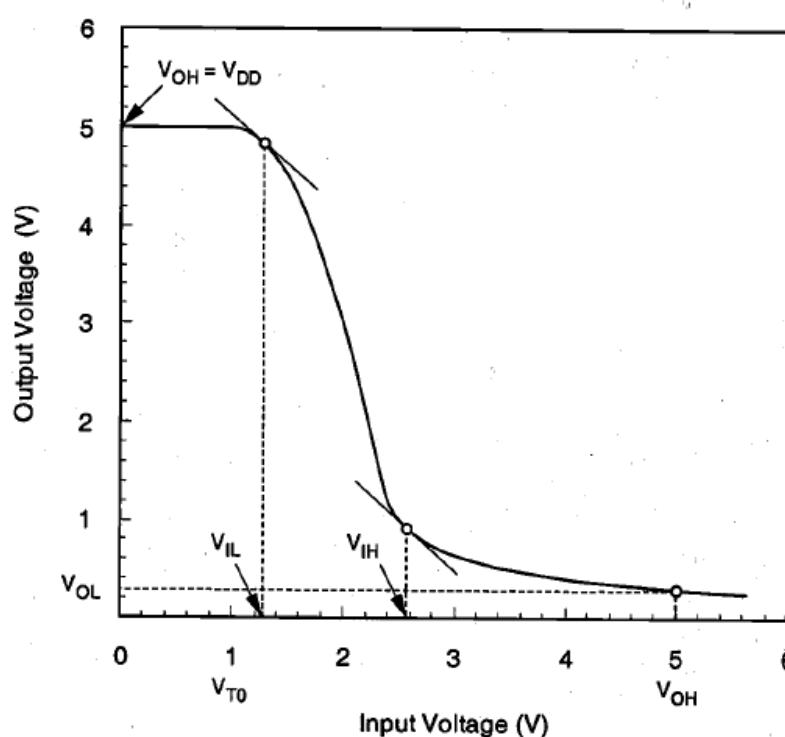
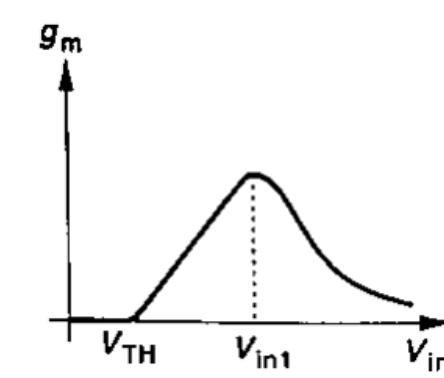
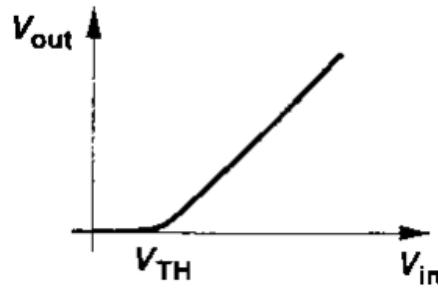


- a)  $A_v = -g_m \cdot R_s$   
b)  $A_v = -I_0 \cdot R_s$   
c)  $A_v = -g_m \cdot R_{on}$   
d) None of the mentioned  
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Answer: c

Explanation: Since the current source is ideal, current through  $R_s$  cannot change and hence small signal voltage drop across it is zero, making the gain constant and depend on  $R_{on}$ .

15. The input output characteristic of common drain amplifier is:



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# VLSI Questions and Answers – Scaling Factors -1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Scaling Factors -1”.

1. Microelectronic technology cannot be characterized by

- a) minimum feature size
- b) power dissipation
- c) production cost
- d) designing cost

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Answer: d

Explanation: Microelectronic technology can be characterized by minimum feature size, number of gates on one chip, power dissipation, die size, production cost, etc and not by designing cost.

2. Which model is used for scaling?

- a) constant electric scaling
- b) constant voltage scaling
- c) costant electric and voltage scaling
- d) costant current model

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Answer: c

Explanation: Constant electric scaling model and constant voltage scaling model is used for scaling.

3. a is used for scaling

- a) linear dimensions
- b) vdd
- c) oxide thickness
- d) non linear

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Answer: a

Explanation: a is used as the scaling factor for linear dimensions where as  $\beta$  is used for supply voltage Vdd, gate oxide thickness etc.

4. For constant voltage model,

- a)  $a = \beta$
- b)  $a = 1$
- c)  $a = 1/\beta$
- d)  $\beta = 1$

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Answer: d

Explanation: For constant voltage model,  $\beta = 1$  and  $1/\beta$  is chosen for the scaling for all voltages.

5. For constant electric field model,

- a)  $\beta = a$
- b)  $a = 1$
- c)  $a = 1/\beta$
- d)  $\beta = 1$

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Answer: a

Explanation: For constant voltage model,  $\beta = a$ .

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6. Gate area can be given as

- a)  $L/W$
- b)  $L * W$
- c)  $2L/W$
- d)  $L/2W$

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Answer: b

Explanation: Gate area  $A_g$  can be given as the product of length and the width of the channel.

7. Gate area is scaled by

- a) a
- b)  $1/a$
- c)  $1/a^2$
- d)  $a^2$

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Answer: c

Explanation: Gate area is given as the product of length and width of the channel and it can be scaled by  $1/a^2$ .

8. Gate capacitance per unit area is scaled by

- a) a
- b) 1
- c)  $1/\beta$
- d)  $\beta$

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Answer: d

Explanation: Gate capacitance per unit area is scaled by  $\beta$  and this is given by  $\epsilon_{ox}/D$ .

9. Parasitic capacitance is given by

- a)  $A_x/d$
- b)  $A_x * d$
- c)  $d/A_x$
- d)  $A_x$

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Answer: a

Explanation: Parasitic capacitance is given by  $A_x/d$  where  $A_x$  is the area of the depletion region and  $d$  is the depletion width.

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10. Parasitic capacitance is scaled by

- a)  $\beta$
- b)  $1/\beta$
- c) a
- d)  $1/a$

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Answer: d

Explanation: Parasitic capacitance is scaled by  $1/a$  because area is scaled by  $1/a^2$  and  $d$  by  $1/a$ . Thus  $(1/a^2)/(1/a)$  we will get  $1/a$ .

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# VLSI Questions and Answers – Scaling Factors -2

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This set of VLSI Interview Questions and Answers focuses on “Scaling Factors -2”.

1. Carrier density is scaled by

- a) a
- b)  $\beta$
- c) 1
- d)  $a^2$

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Answer: c

Explanation: Carrier density in channel  $Q_{on}$  is scaled by 1. Carrier density is given by  $C_0 \cdot V_{gs}$  where  $C_0$  is scaled by  $\beta$  and  $V_{gs}$  is scaled by  $1/\beta$ .

2. Channel resistance  $R_{on}$  is scaled by

- a) a
- b)  $\beta$
- c) 1
- d)  $a^2$

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Answer: c

Explanation: Channel resistance  $R_{on}$  is scaled by 1. Channel resistance is given by  $(L/W) \cdot (1/Q_{on} \mu)$ .

3. Gate delay is given by

- a)  $R_{on}/C_g$
- b)  $R_{on} \cdot C_g$
- c)  $C_g/R_{on}$
- d)  $C_g^2/R_{on}$

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Answer: b

Explanation: Gate delay  $T_d$  is given as the product of  $R_{on}$ , channel resistance and  $C_g$  the gate capacitance.

4. Maximum operating frequency is scaled by

- a)  $a/\beta$
- b)  $\beta/a$
- c)  $a^2/\beta$
- d)  $\beta^2/a$

[View Answer](#)

Answer: c

Explanation: Maximum operating frequency  $f_0$  is scaled by  $a^2/\beta$ . This is given by  $(W/L) * (\mu * C_0 * V_{dd} / C_g)$ .

5. Saturation current is scaled by

- a) a
- b)  $\beta$
- c)  $1/a$
- d)  $1/\beta$

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Answer: d

Explanation: Saturation current  $I_{dss}$  is scaled by  $1/\beta$ . This is given by  $(C_0 * \mu/2) * W/L * (V_{gs} - V_t)^2$ .  
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6.  $V_{gs}$  is scaled by

- a) a
- b)  $\beta$
- c)  $1/a$
- d)  $1/\beta$

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Answer: d

Explanation: Gate to source voltage  $V_{gs}$  is scaled by  $1/\beta$ . All voltages are scaled by  $1/\beta$ .

7. Current density J is scaled by

- a)  $a/\beta$
- b)  $\beta/a$
- c)  $a^2/\beta$
- d)  $\beta^2/a$

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Answer: c

Explanation: Current density J is scaled by  $a^2/\beta$ . Current density is given by  $I_{dss}/A$  where  $I_{dss}$  is scaled by  $1/\beta$  and area A by  $1/a^2$ .

8. Power dissipation per gate is scaled by

- a)  $1/a$
- b)  $1/\beta$
- c)  $1/a^2$
- d)  $1/\beta^2$

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Answer: d

Explanation: Power dissipation per gate is scaled by  $1/\beta^2$ . This is the sum of static component  $P_{gs}$  and dynamic component  $P_{gd}$ .

9. Power dissipation per unit area is scaled by

- a)  $1/a$
- b)  $1/\beta$
- c)  $\beta^2/a^2$
- d)  $a^2/\beta^2$

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Answer: d

Explanation: Power dissipation per unit area  $P_a$  is scaled by  $a^2/\beta^2$ . This is given by  $P_g/A_g$  where  $P_g$  is scaled by  $1/\beta^2$  and  $A_g$  by  $1/a^2$ .  
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10. In constant voltage model, the saturation current is scaled by

- a) a
- b)  $\beta$
- c) 1
- d)  $\beta^2$

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Answer: c

Explanation: Saturation current is scaled by 1 in constant voltage model. This is because saturation current is scaled by  $1/\beta$  and here in constant voltage model  $\beta$  is 1.

11. In constant field model, maximum operating frequency is scaled by

- a) a
- b)  $\beta$
- c)  $a^2$
- d)  $\beta^2$

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Answer: a

Explanation: In constant field model, maximum operating frequency is scaled by a. Maximum operating frequency is scaled by  $a^2/\beta$  and here in this model  $\beta = a$ .

12. In constant electric field model, power dissipation per unit area is scaled by

- a) a
- b)  $\beta$
- c) 1
- d)  $\beta^2$

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Answer: c

Explanation: Power dissipation per unit area is scaled by 1 in constant electric field model. This is scaled by  $a^2/\beta^2$  and here in constant electric field model  $\beta = a$ .

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## VLSI Questions and Answers – Limitations of Scaling -1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Limitations of Scaling -1”.

1. Built-in junction potential  $V_b$  depends on

- a)  $V_{dd}$
- b)  $V_{gs}$
- c) substrate doping level
- d) oxide thickness

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Answer: c

Explanation: Built-in junction potential  $V_b$  depends on the substrate doping level and this will be acceptable so long as  $V_b$  is small compared with  $V_{dd}$ .

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2. As the channel length is reduced in a MOS transistor, depletion region width must be

- a) increased
- b) decreased
- c) must not vary
- d) exponentially decreased

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Answer: b

Explanation: As the channel length is reduced in a MOS transistor, depletion width must also be scaled down to prevent the source and drain depletion regions from meeting.

3. Vdd is scaled by

- a) a
- b)  $\beta$
- c)  $1/a$
- d)  $1/\beta$

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Answer: d

Explanation: Supply voltage Vdd is scaled by  $1/\beta$ . All voltages are scaled by  $1/\beta$ .

4. If doping level of substrate Nb increases then depletion width

- a) increases
- b) decreases
- c) does not change
- d) increases and then decreases

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Answer: b

Explanation: If the substrate doping length Nb increases then depletion width decreases because depletion width is inversely proportional to Nb.

5. Maximum electric field can be given as

- a)  $V/d$
- b)  $d/V$
- c)  $2V/d$
- d)  $d/2V$

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Answer: c

Explanation: Maximum electric field can be given by  $2V/d$  and this is induced in one-sided step junction.

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6. The size of a transistor is usually defined in terms of its

- a) channel length
- b) feature size
- c) width
- d) thickness 'd'

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Answer: a

Explanation: The size of a transistor is usually defined in terms of its channel length L because feature size only gives area capacitance etc.

7. What is the minimum value of L to maintain transistor action?

- a) d
- b)  $d/2$
- c)  $2d$
- d)  $d^2$

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Answer: c

Explanation: The channel length L should be atleast  $2d$  to maintain the transistor action and to prevent punch-through.

8. L depends on

- a) substrate concentration
- b)  $V_{gs}$
- c)  $V_t$
- d)  $V_{ds}$

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Answer: a

Explanation: Channel length L depends on the supply voltage Vdd and substrate concentration Nb.

9. Drift velocity can be given as

- a)  $E/\mu$
- b)  $\mu/E$
- c)  $\mu * E$

d) E

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Answer: c

Explanation: Carrier drift velocity can be given as the product of  $\mu$  and E and the maximum carrier drift velocity is approximately equal to  $V_{sat}$  regardless of the supply voltage.

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10. The transit time can be given as

- a)  $2d$
- b)  $2d/\mu E$
- c)  $\mu E/d$
- d)  $\mu E/2d$

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Answer: b

Explanation: The transit time can be given by  $L/V_{drift}$  which is equivalent to  $2d/\mu E$  as  $L = 2d$  and  $V_{drift}$  is  $\mu E$ .

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# VLSI Questions and Answers – Limitations of Scaling -2

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This set of VLSI Questions and Answers for Experienced people focuses on “Limitations of Scaling -2”.

1. Maximum transit time occurs when the size of the transistor is

- a) minimum
- b) maximum
- c) does not depend on size
- d) double

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Answer: a

Explanation: Maximum transit time occurs when the size of the transistor is minimum when  $V_a$  is approximately 0.  
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2. The spacing of interconnect is scaled by

- a) a
- b)  $1/a$
- c)  $a^2$
- d)  $1/a^2$

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Answer: b

Explanation: Spacing of interconnect, width and thickness are scaled by  $1/a$  as they are linear dimensions.

3. Cross section area is scaled by

- a) a
- b)  $1/a$
- c)  $a^2$
- d)  $1/a^2$

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Answer: d

Explanation: Cross section area is scaled by  $1/a^2$  as area is the product of length and width which are scaled by  $1/a$ .

4. The decrease in device dimension \_\_\_\_\_ the die size.

- a) increases
- b) decreases
- c) does not affect
- d) decreases and then increases

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Answer: a

Explanation: The decrease in device dimension increases the die size and also the levels of integration.

5. The reduction in die size reduces

- a) R
- b) d
- c) L
- d) W

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Answer: a

Explanation: The reduction in die size also reduces R and C. Die size depends on both resistor and capacitor.  
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6. The propagation delay along the optical fiber interconnect can be given as

- a)  $n/Lx$
- b)  $nL/c$
- c)  $c/nL$
- d)  $nc/L$

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Answer: b

Explanation: The propagation delay along the optical fiber interconnect can be given as  $nL/c$  where n is the refractive index, L is the length of the fiber and c is the speed of light.

7. The breakdown voltage can be reduced by \_\_\_\_\_ electric field strength.

- a) increasing
- b) decreasing
- c) does not depend
- d) exponentially decreasing

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Answer: a

Explanation: The increase in electric field strength lowers the breakdown voltages. Electric field is inversely proportional to the voltage.

8. Greater the switching speed \_\_\_\_\_ is the more.

- a) low
- b) more
- c) all of the mentioned
- d) none of the mentioned

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Answer: b

Explanation: Increase in switching speed increases the noise problems. Switching speed is the rate at which the logic level varies.

9. Substrate concentration is scaled by

- a) a
- b)  $1/a$
- c)  $a^2$
- d)  $1/a^2$

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Answer: a

Explanation: Substrate concentration Nb which gives the doping level of substrate is scaled by a.

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10. The increase in operating frequency results in \_\_\_\_\_ in cross-talk noise.

- a) increase
- b) decrease
- c) no change
- d) doubling

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Answer: a

Explanation: The increase in operating frequency and reduction in rise time  $t_r$  results in the increase of cross-talk noise.

11. Flicker noise is scaled by

- a)  $1/a^2$
- b)  $a^2/\beta^2$
- c)  $1/\beta^2$
- d)  $\beta^2/a^2$

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Answer: b

Explanation: Flicker noise occurs due to fluctuations of carriers trapped in the channel by surface states. It is scaled by  $a^2/\beta^2$ .

12. Scaling affects \_\_\_\_\_ generated noise.

- a) internally
- b) externally
- c) internally and externally
- d) does not generate

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Answer: c

Explanation: Scaling affects both internally and externally generated noise and this degrades both the production yield and the reliability of high density chip layouts.

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## VLSI Questions and Answers – MOS Circuit Scaling – 1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “MOS Circuit Scaling – 1”.

1. The basic figures of merit for MOS devices are

- a) Minimum Feature size
- b) Low Power dissipation
- c) Maximum operational frequency
- d) All of the mentioned

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Answer: d

Explanation: All the mentioned are the basic figures of merit for MOS devices.

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2. For the constant field model, the scaling factors  $\beta$  and  $a$  are related as:

- a)  $\beta = a$
- b)  $a = 2\beta$
- c)  $\beta = 1$
- d)  $\beta = a = 0$

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Answer: a

Explanation: In Constant field model,  $\beta = a$ .

3. In Constant Voltage model, the scaling factors  $\beta$  and  $a$  are related as:

- a)  $\beta = a$
- b)  $a = 2\beta$
- c)  $\beta = 1$
- d)  $\beta = a = 1$

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Answer: c

Explanation: In Constant Voltage model,  $\beta = 1$ .

4. The scaling factor for the supply voltage VDD is:

- a) 1
- b) 0
- c)  $1/a$
- d)  $1/\beta$

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Answer: d

Explanation: The supply voltage VDD has the scaling factor of  $1/\beta$ .

5. The scaling factor of length and width of the channel are:

- a) 1, 1
- b)  $1/a$ ,  $1/\beta$
- c)  $1/a$ ,  $1/a$
- d)  $1/\beta$ ,  $1/\beta$

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Answer: c

Explanation: The scaling factor of length is  $1/a$ , and scaling factor for width is  $1/a$ .

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6. The third type of scaling model is:

- a) ?-based model
- b)  $\mu m$  based model
- c) combined voltage and dimension model

d) combined voltage and electric field model

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Answer: c

Explanation: The third model is known as the combined voltage and dimensions model proposed by Bergmann in 1991.

7. The scaling factor of gate area in constant voltage model is:

- a)  $1/a^2$
- b)  $1/\beta^2$
- c) 1
- d) All of the mentioned

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Answer: a

Explanation: The gate area = L.W, therefore scaling factor =  $1/a^2$ .

8. The scaling factor of Gate Capacitance per unit area is:

- a)  $1/\beta$
- b)  $1/a$
- c)  $\beta$
- d) a

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Answer: c

Explanation: Gate capacitance per unit area has the scaling factor of  $\beta$ .

9. The scaling factor of Gate capacitance is:

- a)  $1/\beta$
- b)  $1/a$
- c)  $\beta/a^2$
- d)  $a/\beta^2$

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Answer: c

Explanation: The scaling factor of Gate capacitance is  $\beta/a^2$ .

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10. In Constant voltage model the gate capacitance is scaled by a factor of:

- a)  $1/\beta^2$
- b)  $1/a^2$
- c)  $\beta/a^2$
- d)  $a/\beta^2$

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Answer: b

Explanation: Since  $\beta$  is 1.

11. The parasitic Capacitance has the scaling factor:

- a) Equal to gate capacitance
- b)  $1/a^2$
- c)  $1/a$
- d)  $1/\beta$

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Answer: c

Explanation: Parasitic capacitance is scaled by  $1/a$ .

12. The carrier density in channel in constant voltage model is scaled as:

- a)  $1/\beta$
- b) 1
- c)  $\beta$
- d) All of the mentioned

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Answer: d

Explanation: Carrier density is scaled as 1, since in constant voltage model  $\beta = 1$ , therefore all are correct.

13. Carrier density is measured as:

- a) Average charge per unit area in the channel in 'OFF' state
- b) Average charge per unit area in the channel in 'ON' state
- c) Average charge per unit area in the gate oxide
- d) None of the mentioned

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Answer: b

Explanation: Carrier density is the Average charge per unit area in the channel in ‘ON’ state.  
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14. Channel resistance is scaled as:

- a)  $1/a^2$
- b)  $1/\beta$
- c)  $1/a$
- d) 1

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Answer: d

Explanation: Channel resistance is scaled by the factor of 1.

15. The scaling factor of Gate delay in Constant field model is:

- a)  $1/a^2$
- b) 1
- c)  $1/a$
- d)  $\beta/a$

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Answer: c

Explanation: In Constant field model the scaling factor of gate delay is  $1/a$ .

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## VLSI Questions and Answers – MOS Circuit Scaling – 2

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “MOS Circuit Scaling – 2”.

1. The gate delay is proportional to:

- a)  $R_{on} \cdot C_g$
- b)  $R_s \cdot C_{ds}$
- c)  $R_d \cdot C_{gs}$
- d)  $R_{on} \cdot C_{ox}$

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Answer: a

Explanation: The gate delay is proportional to channel resistance and gate capacitance  
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2. The maximum operating frequency is scaled by:

- a)  $1/a^2$
- b)  $\beta/a^2$
- c)  $a^2/\beta$
- d) 1

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Answer: c

Explanation: Maximum operating frequency is inversely proportional to the gate delay. It is scaled by  $a^2/\beta$

3. The saturation current is scaled by the factor of:

- a) 1
- b)  $1/a^2$
- c)  $1/\beta$
- d)  $1/a$

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Answer: c

Explanation: The saturation current is scaled by the factor of  $1/\beta$

4. The scaling factor of current density in constant voltage model is:

- a)  $1/a^2$
- b) 1
- c)  $a^2$
- d)  $a^2/\beta$

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Answer: c

Explanation: Current density is scaled by a factor of  $a^2/\beta$  and since it is in Constant voltage model,  $\beta = 1$ , therefore  $a^2$  is correct answer

5. Switching energy per gate is scaled by the factor of:

- a) 1
- b)  $a^2/\beta$
- c)  $1/\beta \cdot a^2$
- d)  $a^2$

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Answer: c

Explanation: Switching energy per gate is scaled by a factor of  $1/\beta \cdot a^2$

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6. In Constant field model, the scaling factor of switching energy per gate would be:

- a)  $1/\beta \cdot a^2$
- b)  $1/a^3$
- c)  $1/a^2$
- d) All of the mentioned

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Answer: b

Explanation: Since in constant field model  $a = \beta$

7. The power dissipation per gate is scaled as:

- a) 1
- b)  $1/\beta \cdot a^2$
- c)  $a^2/\beta$
- d)  $1/\beta^2$

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Answer: d

Explanation: Power dissipation per gate is scaled by the factor of  $1/\beta^2$

8. The dynamic component of power dissipation is given by:

- a)  $P = I^2 \cdot R_d$
- b)  $P = V_{dd}^2 / R_d$
- c)  $P = E_g \cdot f_o$
- d) All of the mentioned

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Answer: c

Explanation: The dynamic component is the product of energy per gate and maximum operating frequency.

9. The static component of power dissipation is given by:

- a)  $P = I^2 \cdot R_d$
- b)  $P = V_{dd}^2 / R_{on}$
- c)  $P = E_g \cdot f_o$
- d) All of the mentioned

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Answer: b

Explanation: The static component is the power dissipated across transistor when it is in ON state  
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10. The scaling factor of power dissipation per unit area is:

- a) 1
- b)  $1/a^2$
- c)  $1/\beta \cdot a^2$
- d)  $a^2/\beta^2$

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Answer: d

Explanation: The scaling factor of power dissipation per unit area is  $a^2/\beta^2$

11. The power speed product has the scaling factor of:

- a) 1
- b)  $1/a^2$
- c)  $1/\beta \cdot a^2$
- d) None of the mentioned

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Answer: c

Explanation: The power speed product has the scaling factor of  $1/\beta \cdot a^2$

12. The scaling factor of power dissipation per unit area in constant field model is:

- a) 1
- b)  $1/a^2$
- c)  $1/\beta \cdot a^2$
- d)  $a^2/\beta^2$

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Answer: a

Explanation: In constant field model  $a = \beta$

13. The scaling factor of Logic Level 1 in constant field model is:

- a) 1
- b)  $1/\beta$
- c)  $1/a$
- d)  $a/\beta$

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Answer: c

Explanation: The logic level 1 is scaled as  $1/\beta$ . Since we are using constant field model, the scaling factor will be  $1/a$   
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14. The scaling factor similar to scaling factor of power speed product is:

- a) Power dissipation per unit area
- b) Switching Energy
- c) Power dissipation per gate
- d) All of the mentioned

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Answer: b

Explanation: Switching energy has the same scaling factor as that of power speed products.

15. The parameter which is not scaled to any factor is:

- a) Power speed product
- b) Switching energy
- c) Channel resistance
- d) All of the mentioned

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Answer: c

Explanation: Channel resistance is scaled by 1. Therefore there are no factors like a or  $\beta$ .

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Switch Logic”.

1. The subsystem of the circuits should have \_\_\_\_\_ interdependence.

- a) minimum
- b) maximum
- c) no
- d) more

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Answer: a

Explanation: The subsystem of the circuit or system to be designed should have minimum interdependence and complexity.

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2. Switch logic is based on

- a) pass transistors
- b) transmission gates
- c) pass transistors and transmission gates

d) design rules  
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Answer: c  
Explanation: Switch logic is based on pass transistors or transmission gates. Pass transistor describes several logic families used in the design of integrated circuits. This logic reduces the count of transistors used to make different logic gates, by eliminating redundant transistors.

3. The switch logic approach takes \_\_\_\_\_ static current.

- a) low
- b) more
- c) no
- d) very less

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Answer: c

Explanation: The switch logic approach takes no static current from the supply rails and is faster for small arrays.

4. Power dissipation in switch logic is

- a) less
- b) more
- c) high
- d) very less

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Answer: a

Explanation: Power dissipation is small in switch logic approach since current only flows on switching.

5. Features of switch logic approach

- a) occupies more area
- b) no undesirable threshold voltage
- c) low power dissipation
- d) all of the mentioned

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Answer: d

Explanation: Some of the features of switch logic approach are that it occupies more area, eliminates undesirable threshold voltage and has low power dissipation.

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6. Pass transistor can be driven through \_\_\_\_\_ pass transistors.

- a) one
- b) no
- c) more
- d) two

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Answer: b

Explanation: Pass transistor input should not be driven through any other pass transistors because there occurs loss in logic levels.

7. Basic AND and OR gate combinations are used in switch logic.

- a) true
- b) false

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Answer: a

Explanation: Basic AND and OR combination of switches are possible and are used in switch logic. It is simple to design and easier.

8. When one pass transistor is driven using another, threshold voltage

- a) affects
- b) does not affect
- c) all of the mentioned
- d) none of the mentioned

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Answer: a

Explanation: When logic levels are propagated through pass transistors are degraded by threshold voltage.

9. Switch logic approach is fast for

- a) large arrays
- b) small arrays
- c) very large arrays
- d) not at all fast for any type

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Answer: b

Explanation: Switch logic approach is fast for smaller arrays and as the arrays becomes larger more switches and gates are required which makes it a bit slower and complex.

10. Switch logic is designed using

- a) complementary switches
- b) silicon plates
- c) conductors
- d) resistors

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Answer: a

Explanation: Switch logic is designed using n or p pass transistors or from complementary switches.

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## VLSI Questions and Answers – Gate Logic

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Gate Logic”.

1. Gate logic is also called as

- a) transistor logic
- b) switch logic
- c) complementary logic
- d) restoring logic

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Answer: d

Explanation: Gate logic is also called as restoring logic. This is a logic circuitry designed so that even with an imperfect input pulse a standard output occurs at the exit of each successive logic gate.

2. Both NAND and NOR gates can be used in gate logic.

- a) true

b) false  
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Answer: a

Explanation: Both NAND and NOR gates can be used in gate logic along with CMOS and AND and OR logic can be used in switch logic.

3. The CMOS inverter has \_\_\_\_\_ power dissipation.

- a) low
- b) more
- c) no
- d) very less

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Answer: c

Explanation: The CMOS inverter has no static current and no power dissipation. Static charge remains until it is able to move away by means of electric discharge.

4. As the number of inputs increases, the NAND gate delay

- a) increases
- b) decreases
- c) does not vary
- d) exponentially decreases

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Answer: a

Explanation: As the number of inputs increases, the NAND gate delay also increases because computation considering or using each input additional time is needed.

5. NAND gate delay can be given as

- a)  $T_{int}$
- b)  $T_{int}/n$
- c)  $n*T_{int}$
- d)  $2n*T_{int}$

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Answer: c

Explanation: NAND gate delay can be given as the product of number of inputs n and the nMOS inverter delay  $T_{int}$ .

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6. In CMOS NAND gate, p transistors are connected in

- a) series
- b) parallel
- c) cascade
- d) random

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Answer: b

Explanation: In CMOS NAND gate, p transistors are connected in parallel but once again the geometries may require thought when several inputs are required.

7. BiCMOS is used for \_\_\_\_\_ fan-out.

- a) less
- b) more
- c) no
- d) very less

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Answer: b

Explanation: BiCMOS NAND can be used when large fan-out is necessary. Fan-out is a term that defines the maximum number of digital inputs that the output of a single logic gate can feed.

8. Which can handle high capacitance load?

- a) NAND
- b) nMOS NAND
- c) CMOS NAND
- d) BiCMOS NAND

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Answer: d

Explanation: BiCMOS NAND can handle high capacitance load. It is more complex and it can handle high capacitance load such as in the I/O region of a chip.

9. Which gate is faster?

- a) AND
- b) NAND
- c) NOR
- d) OR

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Answer: c

Explanation: NOR gate is faster. NAND is more complex than NOR and thus NOR is faster and efficient.  
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10. For a pseudo nMOS design the impedance of pull up and pull down ratio is

- a) 4:1
- b) 1:4
- c) 3:1
- d) 1:3

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Answer: c

Explanation: For a pseudo nMOS design, the ratio of Z<sub>p.u.</sub> and Z<sub>p.d.</sub> is 3:1.

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# VLSI Questions and Answers – CMOS Logics

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “CMOS Logics”.

1. In Pseudo-nMOS logic, n transistor operates in

- a) cut off region
- b) saturation region
- c) resistive region
- d) non saturation region

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Answer: b

Explanation: In Pseudo-nMOS logic, n transistor operates in a saturation region and p transistor operates in resistive region.

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2. The power dissipation in Pseudo-nMOS is reduced to about \_\_\_\_\_ compared to nMOS device.

- a) 50%
- b) 30%
- c) 60%
- d) 70%

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Answer: c

Explanation: The power dissipation in Pseudo-nMOS is reduced to about 60% compared to nMOS device.

3. Pseudo-nMOS has higher pull-up resistance than nMOS device.

- a) true
- b) false

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Answer: a

Explanation: Pseudo-nMOS has higher pull-up resistance than nMOS device and thus inverter pair delay is larger.

4. In dynamic CMOS logic \_\_\_\_\_ is used.

- a) two phase clock
- b) three phase clock
- c) one phase clock
- d) four phase clock

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Answer: d

Explanation: In dynamic CMOS logic, four phase clock is used in which actual signals are used to derive the clocks.

5. In clocked CMOS logic, output is evaluated in

- a) on period
- b) off period
- c) both periods
- d) half of on period

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Answer: a

Explanation: In clocked CMOS logic, the logic is evaluated only in the on period of the clock. And owing to the extra transistor in series, slower rise time and fall times are expected.

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6. In clocked CMOS logic, rise time and fall time are

- a) faster
- b) slower
- c) faster first and then slows down
- d) slower first and then speeds up

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Answer: b

Explanation: In clocked CMOS logic, rise time and fall time are slower because of more number of transistors in series.

7. In CMOS domino logic \_\_\_\_\_ is used.

- a) two phase clock
- b) three phase clock
- c) one phase clock
- d) four phase clock

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Answer: c

Explanation: In CMOS domino logic, single phase clock is used. Clock signals distributed on one wire is called as single or one phase clock.

8. CMOS domino logic is same as \_\_\_\_\_ with inverter at the output line.

- a) clocked CMOS logic
- b) dynamic CMOS logic
- c) gate logic
- d) switch logic

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Answer: b

Explanation: CMOS domino logic is same as that of the dynamic CMOS logic with inverter at the output line.

9. CMOS domino logic occupies

- a) smaller area
- b) larger area
- c) smaller & larger area
- d) none of the mentioned

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Answer: a  
Explanation: CMOS domino logic structure occupies smaller area than conventional CMOS logic as only n-block is used.  
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10. CMOS domino logic has
- a) smaller parasitic capacitance
  - b) larger parasitic capacitance
  - c) low operating speed
  - d) very large parasitic capacitance

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Answer: a

Explanation: CMOS domino logic has smaller parasitic capacitance and higher operating speed.

11. In CMOS domino logic \_\_\_\_\_ is possible.

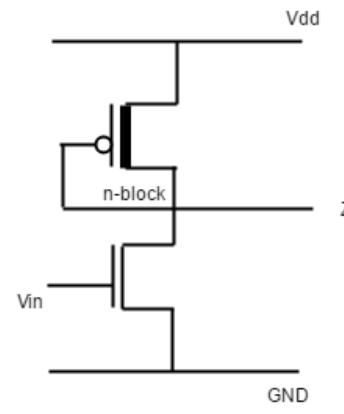
- a) inverting structure
- b) non inverting structure
- c) inverting and non inverting structure
- d) very complex design

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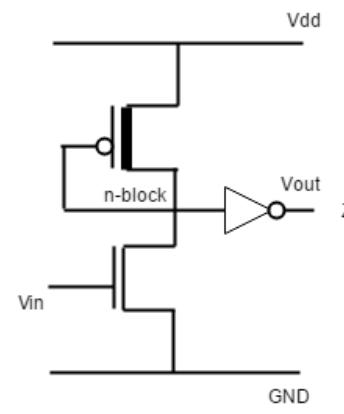
Answer: b

Explanation: In CMOS domino logic, only non inverting structures are possible because of the presence of the inverting buffer.

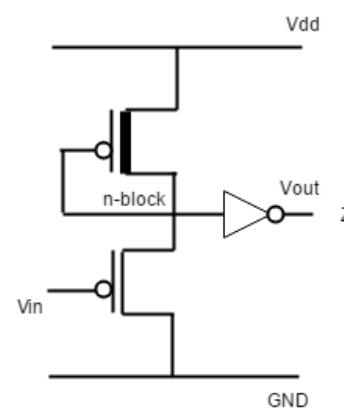
12. CMOS domino logic can be expressed diagrammatically as



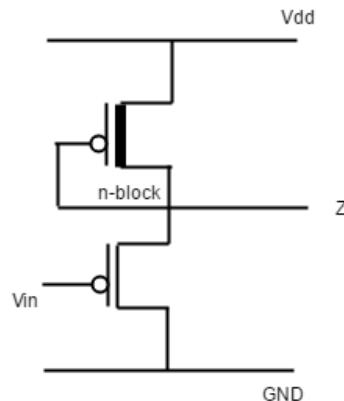
a)



b)



c)



d)  
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Answer: a

Explanation: The correct form of CMOS domino logic representation is as given in the answer.

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## VLSI Questions and Answers – Clocked Sequential Circuits

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Clocked Sequential Circuits”.

1. Clocked sequential circuits are
  - a) two phase overlapping clock
  - b) two phase non overlapping clock
  - c) four phase overlapping clock

d) four phase non overlapping clock

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Answer: b

Explanation: Clocked sequential circuits are two phase non overlapping clock signals. Clock signals are distributed in two wires and it is non overlapping.  
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2. Which are easier to design?

- a) clocked circuits
- b) asynchronous sequential circuits
- c) clocked circuits with buffer
- d) asynchronous sequential circuits with buffers

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Answer: a

Explanation: Clocked circuitry are easier to design than the asynchronous sequential circuits. But it is slower than the asynchronous sequential circuit.

3. \_\_\_\_\_ is used to drive high capacitance load.

- a) single polar capability
- b) bipolar capability
- c) tripolar capability
- d) bi and tri polar capability

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Answer: b

Explanation: Bipolar capability is used to drive high capacitance load. It can handle high loads as it is done by BiCMOS NAND gate logic.

4. As the temperature is increased, storage time \_\_\_\_\_

- a) halved
- b) doubled
- c) does not change
- d) tripled

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Answer: a

Explanation: As the temperature is increased, storage time is halved. It is inversely proportional to the storage time.

5. Inverting dynamic register element consists of \_\_\_\_\_ transistors for nMOS and \_\_\_\_\_ for CMOS.

- a) two, three
- b) three, two
- c) three, four
- d) four, three

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Answer: c

Explanation: Dynamic register element consists of three transistors for nMOS and four for CMOS.

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6. Non inverting dynamic register storage cell consists of \_\_\_\_\_ transistors for nMOS and \_\_\_\_\_ for CMOS.

- a) six, eight
- b) eight, six
- c) five, six
- d) six, five

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Answer: a

Explanation: Non inverting dynamic register storage cell consists of six transistors for nMOS and eight for CMOS.

7. Register cell consists of

- a) inverter
- b) pass transistor
- c) inverter & pass transistor
- d) none of the mentioned

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Answer: c

Explanation: Register cell consists of an inverter and a pass transistor or a transmission gate. Dynamic register cell consists of stick/circuit notation.

8. In a four bit dynamic shift register basic nMOS transistor or inverters are connected in

- a) series
- b) cascade
- c) parallel
- d) series and parallel

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Answer: b

Explanation: The basic inverters or nMOS transistors are connected in cascade to obtain four bit dynamic shift register.

9. In four bit dynamic shift register output is obtained

- a) parallel output at inverters 1, 3, 5, 7
- b) parallel output at inverters 1, 5, 8
- c) parallel output at all inverters
- d) parallel output at inverter 2, 4, 6, 8

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Answer: d

Explanation: In four bit dynamic shift register, output is obtained parallelly at inverters 2, 4, 6, 8.

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10. For signals which are updated frequently \_\_\_\_\_ is used.

- a) static storage
- b) dynamic storage
- c) static and dynamic storage
- d) buffer

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Answer: b

Explanation: For signals which are updated frequently dynamic storage elements are used. It can be done at < 0.25 msec interval.

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# VLSI Questions and Answers – System Considerations

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “System Considerations”.

1. Clock line drivers has \_\_\_\_\_ source of drive.

- a) one
- b) two
- c) three

d) none  
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Answer: a  
Explanation: Clock line drivers have one source of drive. The speed of bipolar drivers is not fully realized with bus lines.  
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2. Bus structures carry \_\_\_\_\_

- a) data signals
- b) control signals
- c) data and control signals
- d) in and out signals

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Answer: c

Explanation: Bus structures carry both data and control signals. They are generally long and connected to and through a significant number of circuits and subsystems.

3. Bus has \_\_\_\_\_ different classes.

- a) two
- b) three
- c) four
- d) five

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Answer: b

Explanation: Bus has three different classes and those are passive, active and precharged.

4. In passive bus, drivers are connected through

- a) series switches
- b) parallel switches
- c) cascade switches
- d) wires

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Answer: a

Explanation: In passive bus, drivers are connected through series switches. It is a floating rail to which signals may be connected from drivers through series switches.

5. The bus rail in active bus has \_\_\_\_\_

- a) NAND connection
- b) AND connection
- c) NOR connection
- d) OR connection

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Answer: c

Explanation: The bus rail in active bus has NOR connection which has a common pull up and ntype pull down transistors.  
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6. Low L:W ratio results in \_\_\_\_ transistors.

- a) smaller
- b) bigger
- c) size doesnt depend on ratio
- d) less effective

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Answer: b

Explanation: The size of the transistor can be made large by small L:W ratio and thus it has a low resistance.

7. Features which does not affect bus design are \_\_\_\_\_

- a) cross-talk
- b) delay factors
- c) non delay factors
- d) cross talk and delay factors

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Answer: c

Explanation: Cross-talk and delay factors are of significance in bus design. This occurs when many signals on chip is propogated.

8. Which device is frequency dependent?

- a) nMOS
- b) CMOS
- c) BiCMOS
- d) pMOS

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Answer: b  
Explanation: CMOS is frequency dependent whereas BiCMOS is not and it exhibits constant value for power dissipation.

9. If the current density exceeds a threshold value then metal atoms moves in

- a) direction of the current
- b) opposite direction of the current
- c) doesn't depend on direction of current
- d) direction of the voltage

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Answer: a

Explanation: If the current density exceeds a threshold value then metal atoms starts to move in the direction of current.  
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10. At narrowing or constriction point current density is \_\_\_\_\_

- a) minimum
- b) maximum
- c) remains low after going to high point
- d) becomes high from low

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Answer: b

Explanation: At narrowing or constriction point, current density is at its highest. At these points, metal is transported from the constricted regions become even more constricted and eventually may blow like a fuse.

11. During relaxation effect, electron flow occurs in

- a) short pulses
- b) at steady state level
- c) large pulses
- d) very large pulses

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Answer: a

Explanation: During relaxation effect, electron flow occurs in short pulses rather than at steady state level.

12. Line impedance is given by

- a)  $(L/C)^2$
- b)  $(C/L)^2$
- c)  $(L/C)^{1/2}$
- d)  $(C/L)^{1/2}$

[View Answer](#)

Answer: c

Explanation: The line impedance  $Z_0$  is given by  $(L/C)^{1/2}$  where L and C are values per unit length of the bus.

13. IR drops brings \_\_\_\_\_ in noise margin.

- a) increase
- b) decrease
- c) does not affect
- d) stabilisation

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Answer: b

Explanation: IR drops bring about deterioration in noise margins. Transient voltages induced in either Vdd or Vss rail may lead to noise margin problems.  
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## VLSI Questions and Answers – CMOS Logic Gates

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “CMOS Logic Gates”.

1. In negative logic convention, the Boolean Logic [1] is equivalent to:

- a) +VDD
- b) 0 V
- c) -VDD
- d) None of the mentioned

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Answer: b

Explanation: In negative logic convention, the Boolean Logic [1] is equivalent to 0 V and Logic ‘0’ is equivalent to +VDD.  
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2. In positive logic convention, the true state is represented as:

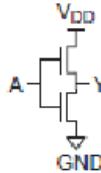
- a) 1
- b) 0
- c) -1
- d) -0

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Answer: a

Explanation: In positive logic convention, the Boolean logic ‘1’ is known to be representing true state.

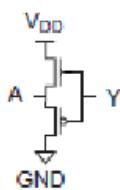
3. The CMOS gate circuit of NOT gate is:



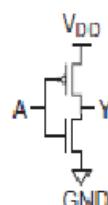
a)



b)



c)

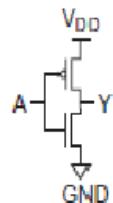


d)

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Answer: d

Explanation: The CMOS logic circuit for NOT gate has a p-MOS as a pull up transistor and n-MOS as driver transistor which is represented accurately in the



below figure

4. The truth table which accurately explains the operation of CMOS not gate is:

	Input	pMOS	nMOS	Output
a)	0	OFF	ON	1
	1	OFF	ON	0

	Input	pMOS	nMOS	Output
b)	0	ON	OFF	1
	1	ON	OFF	0

	Input	pMOS	nMOS	Output
c)	0	ON	ON	1
	1	OFF	OFF	0

	Input	pMOS	nMOS	Output
d)	0	ON	OFF	1
	1	OFF	ON	0

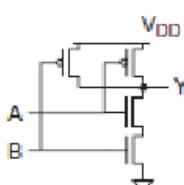
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Answer: d

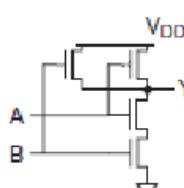
Explanation: The output of CMOS depends on the state of nMOS and pMOS transistor. The correct truth table is:

	Input	pMOS	nMOS	Output
	0	ON	OFF	1
	1	OFF	ON	0

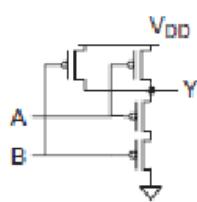
5. The CMOS logic circuit for NAND gate is:



a)

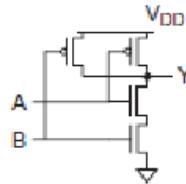


b)



- c)  
d) None of the mentioned  
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Answer: a



Explanation: The accurate CMOS logic circuit for NAND gate is:

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6. In CMOS logic circuit the n-MOS transistor acts as:

- a) Load  
b) Pull up network  
c) Pull down network  
d) Not used in CMOS circuits

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Answer: c

Explanation: A static CMOS gate has an nMOS pull-down network to connect the output to 0 (GND).

7. In CMOS logic circuit the p-MOS transistor acts as:

- a) Pull down network  
b) Pull up network  
c) Load  
d) Short to ground

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Answer: b

Explanation: A static CMOS gate has a pMOS pull-up network to connect the output to VDD (1).

8. In CMOS logic circuit, the switching operation occurs because:

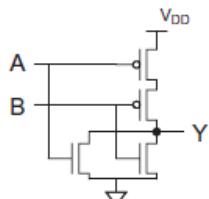
- a) Both n-MOSFET and p-MOSFET turns OFF simultaneously for input '0' and turns ON simultaneously for input '1'  
b) Both n-MOSFET and p-MOSFET turns ON simultaneously for input '0' and turns OFF simultaneously for input '1'  
c) N-MOSFET transistor turns ON, and p-MOSFET transistor turns OFF for input '1' and N-MOS transistor turns OFF, and p-MOS transistor turns ON for input '0'  
d) None of the mentioned

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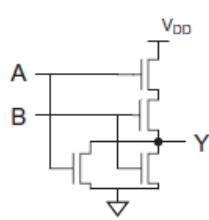
Answer: c

Explanation: In CMOS logic circuit, the switching operation occurs because N-MOS transistor turns ON, and p-MOS transistor turns OFF for input '1' and N-MOS transistor turns OFF, and p-MOS transistor turns ON for input '0'. The networks are arranged such that one is ON and the other OFF for any input pattern.

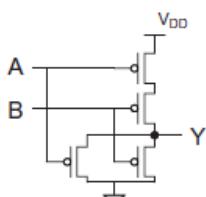
9. The CMOS logic circuit for NOR gate is:



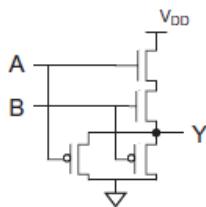
a)



b)



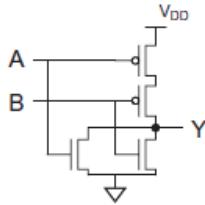
c)



d)

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Answer: a



Explanation:

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10. When both nMOS and pMOS transistors of CMOS logic design are in OFF condition, the output is:

- a) 1 or Vdd or HIGH state
- b) 0 or ground or LOW state
- c) High impedance or floating(Z)
- d) None of the mentioned

[View Answer](#)

Answer: c

Explanation: When both pull up and pull down transistors are OFF, the high impedance for floating Z output state results.

11. When both nMOS and pMOS transistors of CMOS logic gates are ON, the output is:

- a) 1 or Vdd or HIGH state
- b) 0 or ground or LOW state
- c) Crowbarred or Contention(X)
- d) None of the mentioned

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Answer: c

Explanation: The crowbarred (or contention) X level exists when both pull up and pull down transistors are simultaneously turned ON. Contention between the two networks results in an indeterminate output level and dissipates static power.

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## VLSI Questions and Answers – Phase Lock Loop

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Phase Lock Loop”.

1. The PLL device is:
  - a) Feedback system that compares output frequency and input frequency
  - b) Feedback system that compares output phase and input phase
  - c) Linear system that compares output resistance and input resistance
  - d) Non Linear system that compares output current and input current

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Answer: b

Explanation: The PLL device is a feedback system that compares output phase and input phase.

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2. The Logic gate that works similar to phase detector is:

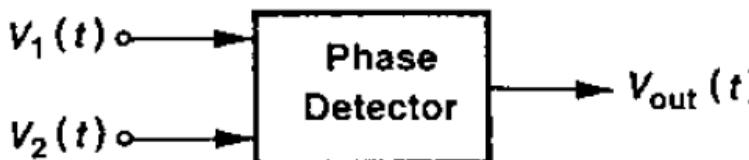
- a) AND gate
- b) OR gate
- c) XOR gate
- d) NOT gate

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Answer: c

Explanation: 2 input XOR gate works similar to Phase detector.

3. What is the input at the phase detector?



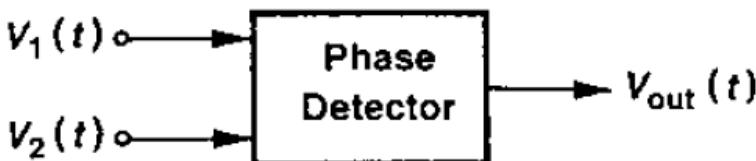
- a)  $V_1(t) - V_2(t)$
- b)  $\text{Phase}(V_1) + \text{Phase}(V_2)$
- c)  $\text{Phase}(V_1) - \text{Phase}(V_2)$
- d)  $V_1(t) + V_2(t)$

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Answer: c

Explanation: None.

4. What is the relation between input and output in the following circuit?



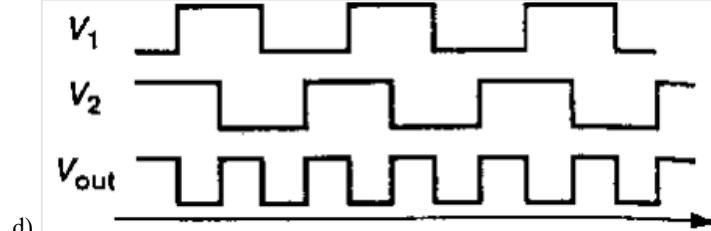
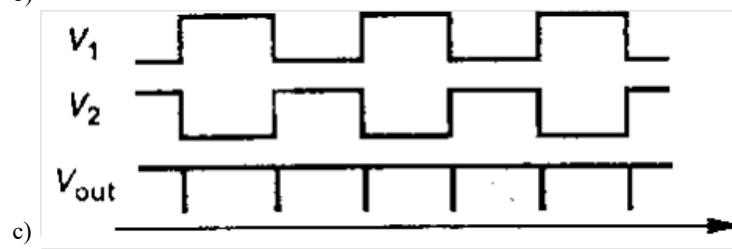
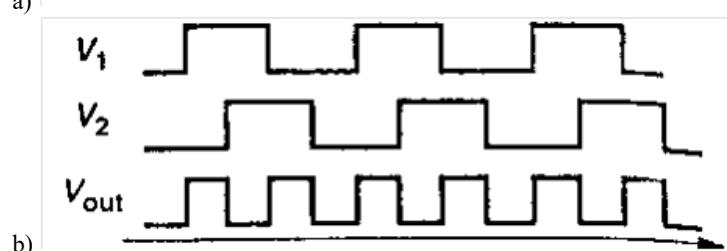
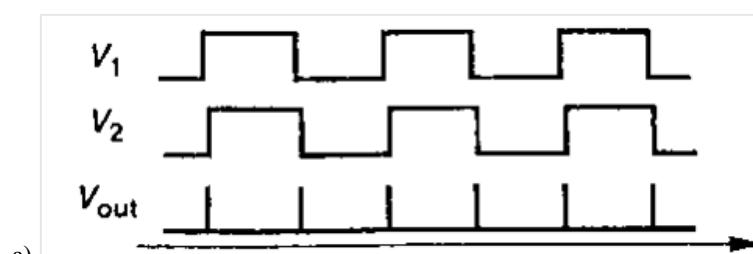
- a) Exponential
- b) Linear
- c) Sinusoidal
- d) None of the mentioned

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Answer: b

Explanation: None.

5. The correct input output waveform when the phase difference between 2 input voltages is 90 degrees



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Answer: b

Explanation: None.

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6. The aligning of output phase of voltage controlled oscillator with reference is called:

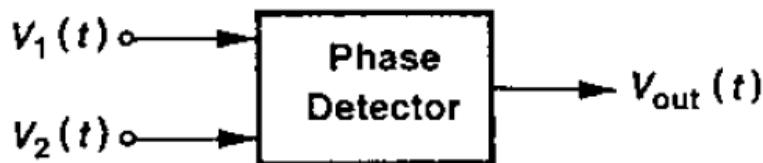
- a) Phase compensation
- b) Phase alignment
- c) Phase Locking
- d) Phase detecting

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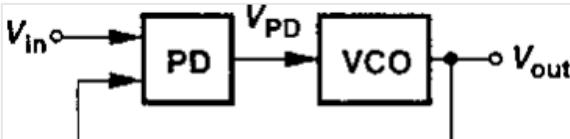
Answer: c

Explanation: The aligning of output phase of voltage controlled oscillator with reference is called Phase Locking.

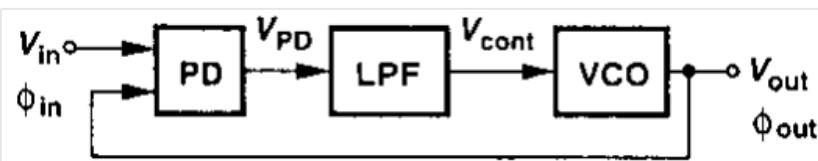
7. The block diagram of basic PLL consists of:



a)



b)



c)

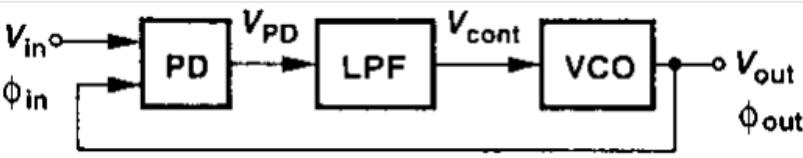
- d) None of the Mentioned

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Answer: c

Explanation: None.

8. What is the function of LPF in the following block diagram?



- a) Suppress high frequency components of VCO output and presenting low frequency AC signal to PD

- b) Suppress high frequency components of PD output and presenting low frequency AC signal to VCO

- c) Suppress high frequency components of PD output and presenting DC signal to VCO

- d) None of the mentioned

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Answer: c

Explanation: The function of LPF in PLL is to suppress high frequency components of PD output and presenting DC signal to VCO.

9. Instead of Phase detection, if Frequency detector is used the drawback PLL would face is:

- a) Finite difference between input and output frequency

- b) Equality cannot be established if PLL compared input and output frequency rather than pulses

- c) Error between Vin and Vout cannot be removed

- d) All of the mentioned

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Answer: d

Explanation: None.

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10. If the input of type 1 PLL is a frequency step of  $\omega$  at  $t = 0$ , the change in phase at  $t = \infty$  is:

- a)  $\omega$

- b)  $\omega/K_{pd}$

- c)  $\omega/K_{pd}K_{vco}$

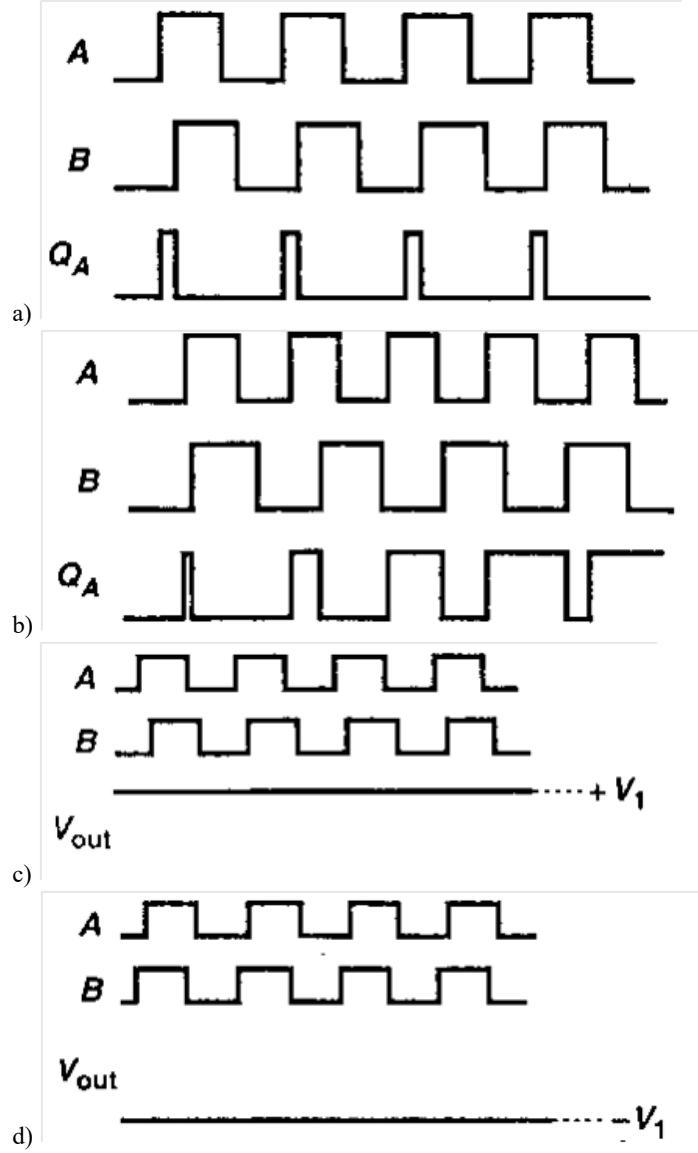
- d) None of the mentioned

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Answer: c

Explanation: None.

11. The correct input-output waveforms of Frequency detector:

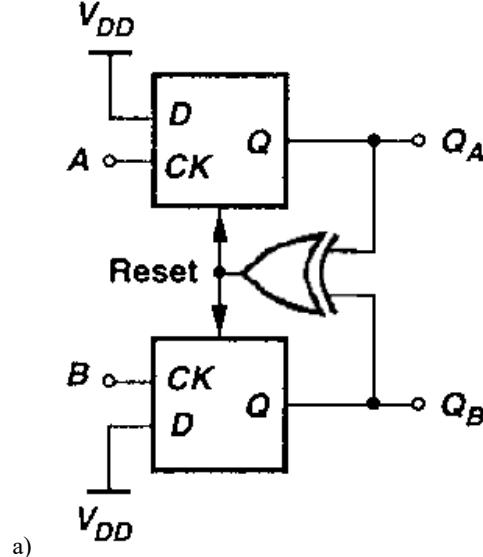


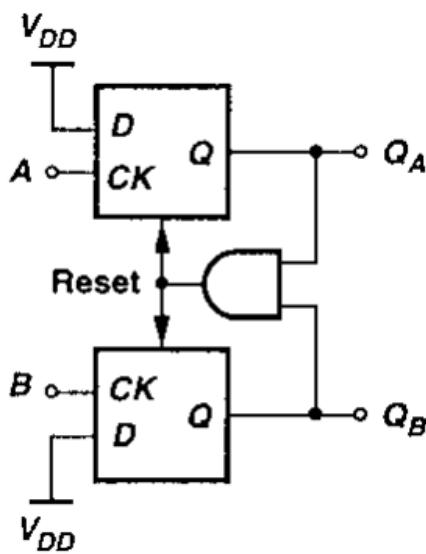
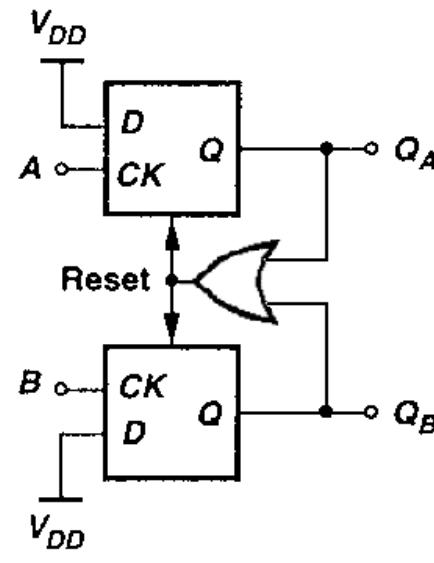
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Answer: b

Explanation: None.

12. The D Flip Flop implementation for PFD is:





- c)  
d) None of the mentioned  
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Answer: c  
Explanation: None.

13. If high pass filter is used instead of Low pass filter in the PLL the response of PLL would be:

- a) Output Voltage is not a square wave
- b) Output Voltage contains many high frequency waves
- c) VCO will be unstable due to variations in control voltage
- d) All of the mentioned

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Answer: b  
Explanation: None.

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14. Number of poles in Type 1 PLL is:

- a) 0
- b) 1
- c) 2
- d) None of the mentioned

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Answer: c  
Explanation: None.

15. The transfer function of PD is :

- a) Constant
- b) Varies with frequency
- c) Varies with voltage
- d) None of the Mentioned

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Answer: a  
Explanation: None.

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# VLSI Questions and Answers – Design Processes

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Design Processes”.

1. Microprocessor has \_\_\_\_\_ major architectural blocks.  
a) two  
b) three  
c) four  
d) five

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Answer: c

Explanation: Microprocessor has four major architectural blocks – ALU, control unit, I/O unit and memory.

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2. High level of system integration \_\_\_\_\_ interconnections.  
a) reduces  
b) increases  
c) does not affect  
d) doubles

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Answer: a

Explanation: High level of system integration usually greatly reduces interconnections which is a weak spot in any system.

3. Some important features of system are  
a) lower weight

- b) lower volume
- c) lower power dissipation
- d) all of the mentioned

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Answer: d

Explanation: Lower power dissipation, lower weight, lower volume are some of the important features of system.

4. Performance is better if power speed product is

- a) low
- b) high
- c) very low
- d) very high

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Answer: b

Explanation: Performance is better if power speed product is high. Performance is analysed using this speed power product.

5. VLSI design is done in \_\_\_\_\_ approach.

- a) top-down
- b) bottom-up
- c) random
- d) semi random

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Answer: a

Explanation: VLSI design is done in top-down manner with adequate computer aided tools to do the job. Partitioning, generating or building and verification is done.

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6. Components operating in high frequency should be

- a) far apart
- b) closely spaced
- c) randomly spaced
- d) can be placed in straight manner

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Answer: b

Explanation: Components operating in high frequency should be at physically proximate, since one may pay severe penalties for long, high bandwidth interconnects.

7. Approach used for design process are

- a) circuit symbols
- b) logic symbols
- c) stick diagrams
- d) all of the mentioned

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Answer: d

Explanation: Several approaches used for design process are conventional circuit symbols, logic symbols, stick diagrams, mask layouts, architectural block diagrams and floor plans.

8. Which approach is used to show the relative disposition of subunits?

- a) architectural block diagram
- b) stick diagram
- c) layout diagram
- d) floor plan

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Answer: d

Explanation: Floor plan is used to show the planned relative disposition of the subunits on the chip and thus on mask layouts.

9. When polysilicon crosses a diffusion \_\_\_\_\_ will be formed.

- a) via
- b) transistor
- c) switch
- d) short circuit

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Answer: b

Explanation: When and where ever the polysilicon crosses the diffusion, transistor will be formed.

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10. Two metal layers can be joined by using

- a) contact cut
- b) wire
- c) via

d) glass  
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Answer: c

Explanation: The first metal layer can be joined with the second one using via. Via is an electrical connection between layers in a physical electronic circuit.

11. The bottom subfunction is called as

- a) lower function
- b) low cell
- c) leaf cell
- d) bottom cell

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Answer: c

Explanation: The complex function is divided into many subfunctions and the bottom level of these sub functions are called as leaf cells.

12. Which must be given the highest priority in design process?

- a) architecture
- b) communication
- c) colour
- d) thickness

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Answer: b

Explanation: Communication must be given highest priority in the design process as interconnections pose the most acute problems in the design of large systems.

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## VLSI Questions and Answers – Design of ALU Subsystem

1. Design gives a detailed

- a) logic circuit design
- b) topology of communication
- c) colour codes of the layers
- d) functions of layers

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Answer: b

Explanation: Design is largely a matter of topology of communication rather than the detailed logic circuit design.  
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2. To minimize the design effort, regularity should be

- a) low
- b) high
- c) very low
- d) very high

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Answer: b

Explanation: Regularity is a qualitative parameter and it should be high as possible to minimize the design effort required for any system.

3. Regularity is the ratio of

- a) total transistors in the chip to total transistors that must be designed in detail
- b) total transistors that must be designed in detail to total transistors in a chip
- c) total transistors to total components
- d) total charge storage components to charge dissipating components

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Answer: a

Explanation: Regularity is the ratio of total transistors in the chip to total transistors that must be designed in detail.

4. Good design system has regularity in the range of

- a) 25-50
- b) 50-75
- c) 50-100
- d) 25-50

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Answer: c

Explanation: Good design system must have regularity in the range of 50 to 100 or more and regular structures such as memories achieve very high figures.

5. In the adder, sum is stored in

- a) series
- b) cascade
- c) parallel
- d) registers

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Answer: c

Explanation: The sum is stored in parallel at the output of the adder from where it may be fed through the shifter and back to the register array.  
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6. The shifter must be connected to

- a) 2-shift data line
- b) 2-shift control line
- c) 4-shift data line
- d) 4-shift control line

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Answer: d

Explanation: The shifter is unclocked but must be connected to 4 shift control lines. Carry out and Carry in signal must also be connected.

7. What is the sum and carry if the two bit number is 1 1 and the previous carry is 0?

- a) 0, 0
- b) 0, 1
- c) 1, 0
- d) 1, 1

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Answer: b

Explanation: If the two bit number is 1 1 and the previous carry is 0 the sum is 0 and carry is 1. This can be obtained by first adding the two numbers 1 and 1. Sum will be 0 and carry is 1. Later add the previous carry 0 to it. Now the sum is finally 0 and final carry will be 1.

8. Which design is preferred in n-bit adder?

- a) many pass transistors in series

- b) many pass transistors with suitable buffer
- c) many pass transistors without suitable buffer
- d) many pass transistors in parallel

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Answer: b

Explanation: In n-bit adder, n adder elements must be cascaded with carry out connecting to carry in. This carry chain will have more pass transistors connected in series which will give slow response. Thus suitable buffer can be used in between.

9. In adders, the previous carry can also be given by

- a) propagate signal pk
- b) generate signal gk
- c) pk and gk
- d) sk

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Answer: c

Explanation: In adders, the previous carry signal can also be given using propagate signal pk which is ex-or of two bits ak and bk and also using generate signal gk which is 'and' of ak and bk.

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10. Adder using \_\_\_\_\_ technology can be used for speed improvement.

- a) CMOS
- b) BiCMOS
- c) nMOS
- d) pMOS

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Answer: b

Explanation: Using BiCMOS technology, speed improvement can be obtained by a factor of two over CMOS technology. This arrangement works will lower input voltage swings to achieve higher speed.

11. For carry skip adder, the minimum total propagation delay can be obtained when m is

- a)  $\sqrt{nk_1/k_2}$
- b)  $\sqrt{2nk_1/k_2}$
- c)  $\sqrt{2k_1/nk_2}$
- d)  $\sqrt{nk_1k_2/2}$

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Answer: b

Explanation: For carry skip adder the total propagation delay T is given by  $2((n/M)-1)k_1 + (M-2)k_2$ . The minimum value of T can be obtained when m is  $\sqrt{2nk_1/k_2}$ .

12. Multiple output domino logic has

- a) two cell manchester carry chain
- b) three cell manchester carry chain
- c) four cell manchester carry chain
- d) four cell manchester carry look ahead

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Answer: c

Explanation: To reduce the complexity of the carry look ahead adder, a dynamic logic technique called multiple output domino logic is used. This approach consists of four cell manchester carry chain.

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## VLSI Questions and Answers – Multiplier Systems

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Multiplier Systems”.

1. Multipliers are built using
  - a) binary adders
  - b) binary subtractors
  - c) dividers
  - d) multiplexers

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Answer: a

Explanation: A multiplier is an electronic circuit used to multiply two binary numbers. It is built using binary adders that are full adders.

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2. Which method uses reduced number of partial products?

- a) Baugh-wooley algorithm
- b) Wallace trees
- c) Dadda multipliers
- d) Modified booth encoding

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Answer: d

Explanation: Multiplication in multipliers is done by obtaining partial products and then summing it up. Modified booth encoding reduces the number of partial products that must be summed.

3. Which method is easier to manipulate accumulator content?

- a) left shifting
- b) right shifting
- c) serial shifting
- d) parallel shifting

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Answer: b

Explanation: It is easier to right shift the contents of the accumulator than to left shift. This can be used to eliminate the least significant bits of the product.

4. Which multiplier is very well suited for twos-complement numbers?

- a) Baugh-wooley algorithm
- b) Wallace trees
- c) Dadda multipliers
- d) Modified booth encoding

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Answer: a

Explanation: Baugh-wooley method is used to design multipliers that are regular in structure and is very well suited for twos complement numbers.

5. What is the delay required to perform a single operation in a pipelined structure?

- a)  $2n$
- b)  $3n$
- c)  $4n$

d) n  
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Answer: b

Explanation: The delay of one operation through the pipeline is  $3n$  that is it takes  $3n$  clock cycles to obtain a product after X and Y are input.  
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6. Latches choosen are  
a) static shift registers  
b) any flipflop  
c) dynamic shift register  
d) multiplexers

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Answer: c

Explanation: The latches choosen are dynamic shift register as the structure will be continuously clocked.

7. Which method reduces number of cycles of operation?

- a) Baugh-wooley algorithm  
b) Wallace trees  
c) Dadda multipliers  
d) Modified booth encoding

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Answer: d

Explanation: Modified booth encoding algorithm avoids many idle cells in a cellular multiplier as well as reduces the number of cycles compared with the serial-parallel multiplier.

8. The completion time for multiplication time in baugh-wooley method is

- a) n  
b)  $2n$   
c)  $3n$   
d)  $4n$

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Answer: b

Explanation: The completion time for multiplication in Braun or Baugh-wooley is proportional to  $2n$  where as completion time in Wallace tree method is proportional to  $\log(\text{base } 2)(n)$ .

9. In which method minimum number of adder cells are used?

- a) Baugh-wooley algorithm  
b) Wallace trees  
c) Dadda multipliers  
d) Modified booth encoding

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Answer: c

Explanation: Dadda multipliers are similar to Wallace trees but it has a reduced number of adder cells. This is a technique developed from Wallace tree but with an improvement.

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10. Which method is suitable for larger operands?

- a) Baugh-wooley algorithm  
b) Wallace trees  
c) Dadda multipliers  
d) Modified booth encoding

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Answer: b

Explanation: Wallace tree multipliers should be used for larger operands and where the performance is critical.

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## VLSI Questions and Answers – Storage Elements-1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Storage Elements-1”.

1. Which clock is preferred in storage devices?

- a) single phase overlapping clock signal
- b) single phase non overlapping clock signal
- c) two phase overlapping clock signal
- d) two phase non overlapping clock signal

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Answer: d

Explanation: Two phase non-overlapping clock signal is easily available and works better and effectively and this clock will be used throughout storage system.

2. Clock signal F2 is to

- a) write data
- b) read data
- c) refresh data
- d) store data

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Answer: c

Explanation: Bits or data written into storage elements may be assumed to be settled before the immediately following signal F2 refreshes stored data where appropriate.

3. Data is read

- a) before F1
- b) after F1
- c) before F2
- d) after F2

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Answer: b

Explanation: Bits or data may be read from storage elements on the next of F1 clock signal that is read signals RD are Anded with F1.

4. Factor for assessment of storage elements are

- a) volatility
- b) non volatility
- c) number of bits
- d) data repeatability

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Answer: a

Explanation: Some of the comparative assessment factor for storage elements are area requirement, estimated dissipation per bit stored and volatility.

5. Which occupies lesser area?

- a) nMOS
- b) pMOS
- c) CMOS
- d) BiCMOS

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Answer: a

Explanation: nMOS design with buried contacts needs lesser area than CMOS design and this can be estimated by calculating space stored by each bit in register cell.

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6. In which design, dissipation is less?

- a) nMOS
- b) pMOS
- c) CMOS
- d) BiCMOS

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Answer: c

Explanation: In CMOS design, static dissipation is very small since only the switching dissipation will be significant particularly at high speeds.

7. The impedance of pull down transistor in nMOS can be given as

- a)  $2R_s$
- b)  $4R_s$
- c)  $\frac{1}{2} R_s$
- d)  $\frac{1}{4} R_s$

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Answer: c

Explanation: Each inverter stage has 8:1 ratio and in nMOS register cell, atleast one inverter should always be on and  $Z_p.u.$  is given as  $4R_s$  and  $Z_p.d.$  is given as  $\frac{1}{2}R_s.$

8. Data storage time is

- a) 1 milli second
- b) 1 second
- c) 1 minute
- d) 10 seconds

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Answer: a

Explanation: Data is stored by the charge on the gate capacitance of each inverter stage, so that data storage time is limited to 1 msec or less.

9. A bit is read at T1 when

- a) RD is low, WR is low
- b) RD is high, WR is low
- c) RD is low, WR is high
- d) RD is high, WR is high

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Answer: c

Explanation: With RD control line low, a bit can be read through clock period T1 when WR is made high. After reading the bit WR is made low.

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10. A bit can be stored when

- a) RD is low, WR is low
- b) RD is high, WR is low
- c) RD is low, WR is high
- d) RD is high, WR is high

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Answer: a

Explanation: A bit value is stored for some time by Cg of time period T2 while both RD and WR are made low.

11. Current flows only when

- a) RD is low
- b) RD is high
- c) RD raises exponentially high
- d) RD comes exponentially down

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Answer: b

Explanation: Current flows only when RD is high and 1 is stored. Thus static dissipating is nil.

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# VLSI Questions and Answers – Storage Elements-2

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This set of VLSI Interview Questions and Answers for Experienced people focuses on “Storage Elements-2”.

1. Overhead bits are used for sensing.

- a) true
- b) false

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Answer: a

Explanation: Overhead bits are used for sensing. Some amount of over head bits are used in one transistor dynamic memory cell.

2. Reading a cell is a \_\_\_\_\_ operation.

- a) constructive
- b) destructive
- c) semi constructive
- d) semi destructive

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Answer: b

Explanation: Reading a cell is a destructive operation and the stored bit must be rewritten everytime it is read.

3. RAM is a \_\_\_\_\_ cell.

- a) dynamic
- b) partially dynamic
- c) static
- d) pseudo static

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Answer: d

Explanation: RAM is a pseudo static cell. It stores data indefinitely and refreshing is not necessary.

4. Pseudo static RAM cell is built using

- a) one inverter
- b) two inverters
- c) three inverters
- d) four inverters

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Answer: b

Explanation: Pseudo static RAM cell is built using two inverters and data can be stored in these two inverters by connecting it in parallel and using feedback.

5. Cells must be non stackable in RAM storage cell.

- a) true
- b) false

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Answer: b

Explanation: Cells must be stackable, both side by side and from top to bottom. This must be carefully considered when layout is made.  
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6. Which cell is non volatile?

- a) one transistor dynamic cell
- b) two transistor dymanic cell
- c) four transistor dynamic cell
- d) pseudo static RAM cell

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Answer: d

Explanation: Pseudo static RAM cell is a non volatile cell. It is used for long time storage. Non volatile memory is also called as long term memory.

7. In RAM arrays, the transistor is of

- a) minimum size
- b) maximum size
- c) of any size
- d) size doesn't play a role

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Answer: a

Explanation: In RAM arrays, the transistor is of minimum size and thus it is incapable of sinking large charges quickly.

8. Which implementation is slower?

- a) NAND gate
- b) NOR gate
- c) AND gate
- d) OR gate

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Answer: b

Explanation: NOR gate implementation is slower even though both NAND and NOR gate implementation is suitable for CMOS.

9. FOR nMOS which implementation is not suitable?

- a) NAND gate
- b) NOR gate
- c) AND gate
- d) OR gate

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Answer: a

Explanation: In nMOS, NAND gate implementation is impractical because of the large number of gate requiring three or more inputs.  
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10. Realization of JK flipflop is based on

- a) n-pass transistor
- b) p-pass transistor
- c) CMOS
- d) BiCMOS

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Answer: a

Explanation: The realization of JK flip flop is based on n-pass transistor and on inverters only.

11. Static RAM uses \_\_\_\_\_ transistors.

- a) four
- b) five
- c) six
- d) seven

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Answer: c  
Explanation: Static RAM uses six transistors. In this RAM cell, read and write operations use the same port.

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## VLSI Questions and Answers – Memory Cells

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Memory Cells”.

1. Which method is used to determine structural defects?

- a) deterministic test pattern
- b) algorithmic test pattern
- c) random test pattern
- d) exhaustive test pattern

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Answer: a

Explanation: Deterministic test patterns are used to detect specific faults or structural faults for a circuit under test.

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2. Which is known as the stored test pattern method?

- a) deterministic test pattern
- b) algorithmic test pattern
- c) random test pattern
- d) exhaustive test pattern

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Answer: a

Explanation: Deterministic test pattern method is also known as the stored test pattern method in the context of BIST applications.

3. Which method uses finite state machine for developing the test pattern?

- a) deterministic test pattern
- b) algorithmic test pattern
- c) random test pattern
- d) exhaustive test pattern

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Answer: b

Explanation: Algorithmic test pattern method uses the hardware finite state machine for generating algorithmic test vectors for the circuit under test.

4. A n-bit counter produces \_\_\_\_\_ number of total input combinations.

- a)  $2^{(n-1)}$
- b)  $2^{(n+1)}$
- c)  $2^n$
- d)  $2n$

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Answer: c

Explanation: A n-bit counter produces totally  $2^n$  number of all possible input combinations for testing the circuit under test and it is called an exhaustive test pattern method.

5. Exhaustive test pattern determines

- a) gate level faults
- b) logic level faults
- c) functional faults
- d) structural faults

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Answer: a

Explanation: Exhaustive test pattern method detects all gate level stuck-at fault and also bridging fault.

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6. Exhaustive test pattern also detects delay faults.

- a) true
- b) false

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Answer: b

Explanation: Exhaustive test pattern method does not detect all transistor level faults or delay faults since those faults needs specific ordering.

7. Which is not suitable for circuits having large N values?

- a) exhaustive test pattern method
- b) pseudo-exhaustive test pattern method
- c) random test pattern method
- d) deterministic test pattern method

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Answer: a

Explanation: Exhaustive test pattern method is not suitable for circuit having large N values since there is a limit for fault coverage.

8. Which method needs fault simulation?

- a) exhaustive test pattern method
- b) pseudo-exhaustive test pattern method
- c) random test pattern method
- d) deterministic test pattern method

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Answer: a

Explanation: Exhaustive test pattern method needs fault simulation for determining fault coverage where as pseudo-exhaustive test pattern method does not need fault simulation.

9. In which method sequences are repeatable?

- a) exhaustive test pattern method
- b) pseudo-exhaustive test pattern method
- c) random test pattern method
- d) pseudo-random test pattern method

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Answer: d

Explanation: Pseudo-random test pattern method have properties similar to random pattern sequence but the sequence are repeatable.

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10. Which method is used for external functional testing?

- a) exhaustive test pattern method
- b) pseudo-exhaustive test pattern method
- c) random test pattern method

d) pseudo-random test pattern method

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Answer: c

Explanation: Random test pattern method is used for external functional testing of microprocessors as well as in ATPG software.

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## VLSI Questions and Answers – Flash memory

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Flash memory “.

1. Flash memory is a non-volatile storage device in which data

- a) can be erased physically
- b) can be erased magnetically
- c) can be erased electrically
- d) cannot be erased

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Answer: c

Explanation: Flash memory is an electronic, solid state, non-volatile memory storage device which can be electrically erased and reprogrammed.

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2. NOR type flash allows \_\_\_\_\_ to be read or written independently.

- a) one machine cycle
- b) one machine word
- c) one machine sentence
- d) one bit

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Answer: b

Explanation: NOR type flash allows a single machine word that is one byte to be written to an erased location or read independently.

3. NAND type flash memories are used in

- a) Memory cards
- b) USB
- c) Solid state drivers
- d) All of the mentioned

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Answer: d

Explanation: NAND type flash memories operates primarily in memory cards, USB flash drives and solid state drivers.

4. Which is a comparatively slower device?

- a) ROM
- b) RAM
- c) flash memory
- d) SRAM

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Answer: c

Explanation: Flash memory has fast read access time, but static RAM or ROM are comparatively faster than flash memory.

5. Floating gate transistor in flash memory has

- a) two gates
- b) one gate
- c) two sources
- d) two drains

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Answer: a

Explanation: Floating gate transistor in flash memory has two gates. These two gates are – floating gate and control gate.

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6. In NOR type flash memory, each cell has one end connected to

- a) source
- b) drain
- c) gate
- d) ground

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Answer: d

Explanation: In NOR type flash memory, each cell has one end connected directly to ground and other end connected to the bit line.

7. In NOR type flash memory, data is erased

- a) bitwise
- b) bytewise
- c) blockwise
- d) sentence wise

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Answer: c

Explanation: In NOR type flash memory the data can be erased only blockwise basis. all the cells in an erase segment must be erased together.

8. The transistors in NAND type flash are connected in

- a) series
- b) parallel
- c) cascade
- d) randomly

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Answer: a

Explanation: The NAND type flash memory also uses floating gate transistors and it is connected to form NAND gate. The transistors are connected in series.

9. In NAND type flash, memory can be addressed bit-wise.

- a) true
- b) false

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Answer: a

Explanation: In NAND type flash, memory can be addressed by word, page or even bit wise. In NOR type flash, memory can be addressed by page then a word.

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10. The program erase cycle in flash memory is

- a) finite
- b) infinite
- c) all of the mentioned
- d) none of the mentioned

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Answer: a

Explanation: One disadvantage of flash memory is that it has finite number of program-erase cycles. This limits the usage of flash memory.

11. NOR type flash needs error correcting code.

- a) true
- b) false

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Answer: b

Explanation: NOR flash memory is a storage device. It has slow write speed compared to NAND type flash. Typical NOR type flash does not need error correcting codes.

12. Which allows random access to read?

- a) NOR type flash
- b) NAND type flash
- c) all of the mentioned
- d) none of the mentioned

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Answer: a

Explanation: The interface provided for reading and writing is different. NOR type flash provides random access for reading whereas NAND type flash provides page access.

13. Which has high storage capacity?

- a) NOR type flash
- b) NAND type flash
- c) all of the mentioned
- d) none of the mentioned

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Answer: b

Explanation: NAND type flash memory has different connections and interface when compared to NOR type flash. Storage capacity is more in NAND type flash than NOR type flash memory.

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# VLSI Questions and Answers – Optimization of Inverters-1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Optimization of Inverters-1”.

1. Reduction in power dissipation can be brought by

- a) increasing transistor area
- b) decreasing transistor area
- c) increasing transistor feature size
- d) decreasing transistor feature size

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Answer: a

Explanation: The 3:1 reduction in power dissipation can be brought at the expense of increasing the transistor area by 50%.

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2. When does the longest delay occur in 8:1 inverters?

- a) during 1 to 0 transition
- b) during 0 to 1 transition
- c) during faster speed
- d) delays are always short

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Answer: b

Explanation: In 8:1 inverters, the longest delay will occur when the output of the first stage is changing from logic 0 to 1 and capacitance must charge through pull-up resistance.

3. In inverter during logic 1 to 0 transition, capacitance discharges at

- a) pull-up resistance
- b) pull-down resistance
- c) both pull-up and pull-down
- d) at gate

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Answer: b

Explanation: During the logic 1 to 0 transition, the capacitance which is charged through pull-up must always discharge through pull-down transistor at first stage.

4. In minimum size nMOS 8:1 inverter, the logic 0 to 1 transition delay is given as

- a) 5T
- b) 20T
- c) 40T
- d) 50T

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Answer: c

Explanation: For minimum pull-down feature size nMOS 8:1 inverter, the logic 0 to 1 transition delay can be given as  $8R_s \times 5 \text{ square } C_g$  which gives 40T.

5. In minimum size nMOS 8:1 inverter, the logic 1 to 0 transition delay is given as

- a) 5T
- b) 20T
- c) 40T
- d) 50T

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Answer: a

Explanation: 8:1 nMOS inverter allows stray and wiring capacitance and the logic 1 to 0 transition delay can be given as  $1R_s \times 5 \text{ square } C_g$  which gives 5T.

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6. For a regular 8:1 inverter, the transition delay is given as

- a) 10T
- b) 20T
- c) 21T
- d) 25T

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Answer: c

Explanation: For 8:1 inverter the logic 0 to 1 transition delay can be given as 21T and logic 1 to 0 transition delay can be given as  $2(1/3)T$ .

7. The area of CMOS inverter is proportional to

- a) area of n device
- b) area of p device

- c) total area of n and p device
- d) square of minimum feature size

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Answer: c

Explanation: The area of a basic CMOS inverter is proportional to the total area occupied by the p and n devices ( $W_p L_p + W_n L_n$ ).

8. The ratio of  $W_p/W_n$  can be given as

- a) 1:2
- b) 2:1
- c) 1:1
- d) 2:2

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Answer: c

Explanation: Minimum area can be achieved by choosing minimum dimensions for  $W_p$ ,  $W_n$ ,  $L_p$ ,  $L_n$  which is 2? and the ratio of  $W_p/W_n$  can be given as 1:1.

9. Switching power dissipation can be given as

- a)  $C_l \times V_{dd} \times f$
- b)  $V_{dd}^2 \times f$
- c)  $C_l \times V_{dd}^2$
- d)  $C_l \times V_{dd}^2 \times f$

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Answer: d

Explanation: Switching power dissipation  $P_{sd}$  can be given as  $C_l \times V_{dd}^2 \times f$  where  $C_l$  is load capacitance,  $V_{dd}$  is power supply voltage and  $f$  is the frequency of switching.

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10. Load capacitance can be minimized by

- a) increasing A
- b) decreasing A
- c) increasing  $P_{sd}$
- d) does not depend on A

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Answer: b

Explanation: For fixed  $V_{dd}$  and  $f$ , minimizing  $P_{sd}$  requires minimizing  $C_l$  which can be minimized by decreasing area A as it is directly proportional to gate area.

11. Rise time and fall time can be equalized by

- a)  $\beta_n = \beta_p$
- b)  $\beta_n = 2\beta_p$
- c)  $\beta_p = 2\beta_n$
- d)  $\beta_n = 1/2\beta_p$

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Answer: a

Explanation: Rise time  $t_r$  and fall time  $t_f$  can be equalized by using  $\beta_n = \beta_p$ , which requires  $(W_p/L_p) = (\mu_n/\mu_p)(W_n/L_n)$ .

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## VLSI Questions and Answers – Optimization of Inverters-2

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This set of VLSI test focuses on “Optimization of Inverters-2”.

1. Rise time and fall time can be also equalized by

- a)  $L_p = L_n = ?$
- b)  $L_p = L_n = ?/2$
- c)  $L_p = L_n = 2?$
- d)  $2L_p = L_n = ?$

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Answer: c

Explanation: Rise time and fall time can be equalized by taking  $L_p = L_n = 2?$  which implies  $W_p/W_n = 2$  and also  $\mu_n/\mu_p = 2$ .  
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2. Equalizing of rise time and fall time is possible in

- a) nMOS
- b) pseudo nMOS
- c) CMOS
- d) pMOS

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Answer: c

Explanation: Equalizing of rise time and fall time is possible only in CMOS and not possible in nMOS and pseudo nMOS because of the ratio requirement.

3. High and low noise margins can be equalized by

- a)  $\beta_n = \beta_p$
- b)  $\beta_n$  greater than  $\beta_p$
- c)  $\beta_n$  lesser than  $\beta_p$
- d)  $L_p = 2L_n$

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Answer: a

Explanation: High and low noise margins can be equalized by choosing  $\beta_n = \beta_p$ , also  $L_n = L_p$  which implies  $W_p/W_n = 2$ .

4. Inverter pair delay D is given as equal to

- a)  $t_r$
- b)  $t_f$
- c)  $t_r-t_f$
- d)  $t_r+t_f$

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Answer: d

Explanation: Inverter pair delay D is given as the sum of rise time and fall time. This is proportional to  $(R_p+R_n)Cl$  where  $R_p$  and  $R_n$  are average resistances.

5. For minimum D consider

- a)  $L_n = L_p = 2?$
- b)  $L_n$  greater than  $L_p = 2?$
- c)  $L_p$  greater than  $L_n$
- d)  $L_p = 2L_n$

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Answer: a

Explanation: D increases with  $L_n$  and  $L_p$  so for minimum D we have to choose  $L_n=L_p=2?$ . D does not vary significantly with (1) lesser than  $(W_n/W_p)$  lesser

than (2).

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6. Different parameter optimization is easily achievable in

- a) nMOS
- b) pMOS
- c) pseudo nMOS
- d) CMOS

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Answer: d

Explanation: Different parameter optimizations like noise margins equalization, rise time fall time equalization can be easily achievable in CMOS.

7. Minimizing A with respect to  $W_p \cdot d$ . gives

- a)  $W_p \cdot d = 2?$
- b)  $W_p \cdot d = ?/2$
- c)  $W_p \cdot d = (k)^{1/2} \times 2?$
- d)  $W_p \cdot d = k \times (?)^{1/2} \times 2$

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Answer: c

Explanation: Minimizing A with respect to  $W_p \cdot d$  yields a solution as  $W_p \cdot d = (k)^{1/2} \times W_p \cdot u = (k)^{1/2} \times 2?$ .

8. Using  $Z_p \cdot u / Z_p \cdot d = k$ ,  $L_p \cdot u$ . can be obtained as

- a)  $k \times 2?$
- b)  $k \times ?$
- c)  $(k)^{1/2} \times 2?$
- d)  $k \times 2 \times (?)^{1/2}$

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Answer: c

Explanation: Using this ratio  $Z_p \cdot u / Z_p \cdot d = k$ , we obtain  $L_p \cdot u = (k)^{1/2} \times L_p \cdot d = (k)^{1/2} \times 2?$ .

9. Minimum area can be given as

- a)  $4 \times A_o \times ? \times (k)^{1/2}$
- b)  $4 \times A_o \times ? \times k$
- c)  $8 \times A_o \times ?^2 \times (k)^{1/2}$
- d)  $8 \times A_o \times ? \times (k)^{1/2}$

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Answer: c

Explanation: Minimum area A can be given as  $8 \times A_o \times ?^2 \times (k)^{1/2}$  which implies  $Z_p \cdot u = (k)^{1/2}$  and  $Z_p \cdot d = 1/(k)^{1/2}$ .

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10. When  $Z_p \cdot d$  or  $Z_p \cdot u$ . increases, delay

- a) increases
- b) decreases
- c) remains the same
- d) delay becomes zero

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Answer: a

Explanation: Pd is minimized by increasing  $Z_p \cdot d$ . Large  $Z_p \cdot d$ . requires large  $Z_p \cdot u$ . which results in increase in delay D of the inverter pair.

11. For minimum D which relation is chosen?

- a)  $Z_p \cdot u = 1/2k$
- b)  $Z_p \cdot u = k$
- c)  $Z_p \cdot d = 1/k$
- d)  $Z_p \cdot d = 1$

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Answer: c

Explanation: For minimum D,  $Z_p \cdot u$ . is 1 and  $Z_p \cdot d$ . is equal to  $1/k$  with  $W_p \cdot u = 2?$  and  $W_p \cdot d = k \times 2?$ .

12. Noise margin measures the changing strength of

- a) input voltage
- b) output voltage
- c) threshold voltage
- d) supply voltage

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Answer: a

Explanation: Noise margin measures by how much the input voltage can change without disturbing the present logic output state.

13. Which has better noise margins?

- a) nMOS
- b) pMOS
- c) CMOS
- d) BiCMOS

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Answer: c

Explanation: CMOS has better noise margins than nMOS especially at low conditions because ratio adjustment is easier in CMOS.

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# VLSI Questions and Answers – Floor Layout

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Floor Layout”.

1. A 4-bit processor has two buses which are

- a) unidirectional
- b) bidirectional
- c) one unidirectional and one bidirectional
- d) more than two buses

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Answer: c

Explanation: A 4-bit processor has two buses one is bidirectional to carry operand and output to shifter and register array and another bus unidirectional to carry input.

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2. The IN and OUT bus lines relative positions are interchanged to

- a) match height
- b) match length

- c) match width
- d) match thickness

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Answer: a

Explanation: The IN and OUT bus line's relative positions are interchanged to make the cell stretchable and to match the height of the block and spacings.

3. The IN and OUT bus lines should be in

- a) metal
- b) polysilicon
- c) diffusion
- d) silicon

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Answer: a

Explanation: The IN and OUT bus lines should be in metal rather than diffusion or polysilicon to mate with the bus structures of other blocks.

4. Extensions are

- a) vertical
- b) horizontal
- c) diagonal
- d) haphazard

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Answer: b

Explanation: Extensions are horizontal or parallel to the stratified unit and rifts are described as extension zones.

5. Rifts and extensions should be placed in

- a) minimum amount of geometry
- b) maximum amount of geometry
- c) in slopes
- d) anywhere in the layout

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Answer: a

Explanation: Rifts and extensions should be placed where they cut a minimum amount of simple geometry, one in polysilicon and one in diffusion.  
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6. Rifts are used for smooth flow through buses.

- a) true
- b) false

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Answer: a

Explanation: Rifts are used for smooth flow through buses as suggested and hence one in used in polysilicon and other in diffusion.

7. Input and output pads are made up of

- a) polysilicon
- b) metal
- c) silicon
- d) carbon

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Answer: b

Explanation: Input and output pads are made up of metal and it used to connect chips from one circuitry to another.

8. Bonding pads are placed

- a) in the chip
- b) exactly at the centre of chip
- c) edge of the chip
- d) above the chip

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Answer: c

Explanation: Bonding pads are positioned near to the edge of the chips although there will be a Vdd bus between bonding pads and chip boundary.

9. Which pad contains Schmitt trigger circuitry?

- a) Vdd pads
- b) Vss pads
- c) input pads
- d) output pads

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Answer: c

Explanation: Input pad contains over voltage protection features and also contains inverting circuitry or Schmitt trigger circuitry.

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10. Which occupies lesser area?

- a) Vdd pads
- b) Vss pads
- c) input pads
- d) output pads

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Answer: d

Explanation: Output pads provide large current for off-wiring and also inputs to other devices. But these pads uses minimum space.

11. Buffers are needed to drive

- a) small capacitance
- b) large capacitance
- c) small resistance
- d) large resistance

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Answer: b

Explanation: Buffers are necessary in environments on and off chip. It is used to drive relatively large capacitances associated with circuits off the chip.

12. Pads must be placed generally in the periphery of the chip area.

- a) true
- b) false

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Answer: a

Explanation: Usually pads must be placed in the periphery of the chip area otherwise bonding difficulties may be encountered.

13. How much area should be allocated for pads?

- a) one third
- b) two third
- c) half
- d) three fourth

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Answer: a

Explanation: According to a thumb rule, the small system designer should allow one third of the chip area for pads.

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# VLSI Questions and Answers – System Delays

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “System Delays”.

1. Which provides large capacitance?

- a) load capacitance
- b) bus wiring capacitance
- c) sheet capacitance
- d) area capacitance

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Answer: b

Explanation: Bus wiring capacitance Cbus provides the largest capacitance for a typical bus system for example for small chips this can be as high as 0.8pF.  
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2. Bus wiring capacitance is driven through

- a) one transistor
- b) two transistors
- c) three transistors
- d) no transistors

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Answer: a

Explanation: Bus wiring capacitance is driven through pull-up and pull-down transistors and through atleast one pass transistor or transmission gate in the series.

3. What is the delay of input pads?

- a) 5T
- b) 10T
- c) 40T
- d) 30T

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Answer: d

Explanation: Input pad always contains over voltage protection circuitry and Schmitt trigger circuitry. Its total delay is 30T.

4. The total delay for the select register circuit is

- a) 33T
- b) 60T
- c) 55T
- d) 73T

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Answer: d

Explanation: The total delay for the select register is 73T. It is the sum of delays of input pad, three pass transistors and driver inverter pair.

5. Delay for data propagation is

- a) 10 nsec
- b) 50 nsec
- c) 100 nsec
- d) 150 nsec

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Answer: c

Explanation: Data is propagated through bus. Bus can be bidirectional but at data can be propagated through bus only at one direction at a time. The delay for this data propagation is 100nsec.

6. Which is the longest delay in adder process?

- a) sum delay
- b) carry delay
- c) propagation delay
- d) inverter delay

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Answer: b

Explanation: The longest delay in the adder process is the carry chain delay. This is the process of forming carry out which propagates through all bits of the adder.

7. The total delay for the adder process is

- a) 100 nsec
- b) 200 nsec
- c) 220 nsec
- d) 250 nsec

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Answer: c

Explanation: The total delay for the adder process is 220 nsec. The total delay is the sum of select register delay, bus delays and carry chain delays.

8. The refreshing clock period should propagate through

- a) memory cell
- b) wiring
- c) carry chain
- d) any sub unit

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Answer: b

Explanation: The clock 2 which is the refreshing clock should propagate through wiring and finite rise and fall time must be allowed.

9. The value of T for 5 micron technology is always constant.

- a) true
- b) false

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Answer: b

Explanation: The range of value of T for 5 micron technology was calculated to be 0.1 to 0.3 nsec but it may vary upto 0.6 nsec.

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10. The total clock period for adder process is

- a) 100 nsec
- b) 150 nsec
- c) 200 nsec
- d) 250 nsec

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Answer: d

Explanation: The total clock period of the adder process is 250 nsec which is the sum of all the delay (220 nsec) and the period of different phases of the process.

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## VLSI Questions and Answers – Rules for Proper Design

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Rules for Proper Design”.

1. The Z<sub>p.u.</sub>/Z<sub>p.d.</sub> ratio for nMOS inverter is

- a) 4:1
- b) 3:1
- c) 1:4
- d) 1:3

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Answer: a

Explanation: For nMOS inverters the Z<sub>p.u.</sub>/Z<sub>p.d.</sub> ratio is 4:1 when driven from another inverter and 8:1 when driven through one or more pass transistors.

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2. The impedance ratio for pseudo-nMOS is

- a) 4:1
- b) 3:1
- c) 1:4
- d) 1:3

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Answer: b

Explanation: For pseudo-nMOS, the Z<sub>p.u.</sub>/Z<sub>p.d.</sub> ratio is 3:1 and for CMOS 1:1 ratio is required for minimum area.

3. What is the value for peripheral capacitance for 5 micron technology?

- a)  $4 \times 10^{-4}$  pf/ $\mu\text{m}^2$
- b)  $5 \times 10^{-4}$  pf/ $\mu\text{m}^2$
- c)  $8 \times 10^{-4}$  pf/ $\mu\text{m}^2$
- d)  $12 \times 10^{-4}$  pf/ $\mu\text{m}^2$

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Answer: c

Explanation: Peripheral capacitance is the side wall capacitance. Peripheral capacitance of 5 micron technology is  $8 \times 10^{-4}$  pf/ $\mu\text{m}^2$ .

4. 1 square C<sub>g</sub> is \_\_\_\_\_ of MOS transistor.

- a) gate to source capacitance
- b) gate to drain capacitance
- c) source to drain capacitance
- d) gate to channel capacitance

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Answer: d

Explanation: 1 square C<sub>g</sub> is defined as the gate to channel capacitance of a MOS transistor having standard feature size (W=L).

5. What is the delay value T for 1.2 micron technology?

- a) 0.1 nsec
- b) 0.12 nsec
- c) 0.046 nsec
- d) 0.064 nsec

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Answer: c

Explanation: The delay T is the time constant and for 1.2 micron technology its value is 0.046 nsec.

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6. Which is used to increase T?

- a) parasitic capacitance
- b) peripheral capacitance
- c) area capacitance
- d) load capacitance

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Answer: a

Explanation: Circuit wiring and parasitic capacitance must be allowed to increase the value of T by the factor of 2 or 3.

7. The inverter pair delay is given by

- a)  $(Z_{p.u.}/Z_{p.d.})T$
- b)  $(1 + Z_{p.u.}/Z_{p.d.})T$
- c)  $(1 + Z_{p.u.}/Z_{p.d.})T$
- d)  $(1 + T)Z_{p.u.}/Z_{p.d.}$

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Answer: b

Explanation: The inverter delay is given by  $(1 + Z_{p.u.}/Z_{p.d.})T$ . The inverter pair delay for CMOS is  $7T$ .

8. The number of stages N is given by

- a)  $\ln(y)/\ln(f)$
- b)  $\ln(f)/\ln(y)$
- c)  $\ln(2y)/\ln(f)$
- d)  $\ln(y)/\ln(2f)$

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Answer: a

Explanation: To calculate the value for N, where N inverters are cascaded, each one of which is larger than the preceding stage by a width factor f the formula used is  $\ln(y)/\ln(f)$ .

9. If f assumes the value e then delay is

- a) maximized
- b) minimized
- c) does not change
- d) doubled

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Answer: b

Explanation: Total delay is minimized if f assumes the value of e which is the base of the natural logarithm. This applies to both nMOS and CMOS.

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10. Propogation delay is given by

- a)  $nrcT$
- b)  $n^2rcT$
- c)  $nr^2cT$
- d)  $n^2cT$

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Answer: b

Explanation: Propogation delay through cascaded pass transistors or transmission gate can be given as  $n^2rcT$ .

11. Using \_\_\_\_\_ long wires are possible.

- a) silicide
- b) metal
- c) polysilicon
- d) diffusion

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Answer: a

Explanation: Using silicide, reasonable long wires are possible. It is a modest RC product. Silicides are used in place of polysilicon in some nMOS processes.

12. One pass transistor can be driven through output of another.

- a) true
- b) false

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Answer: b

Explanation: No pass transistor gate must be driven through the output of one or more pass transistors since logic 1 levels are degraded by the threshold voltage.

13. Pass transistors are allowed to be constructed under

- a) diffusion layer
- b) polysilicon layer
- c) metal layer
- d) silicon layer

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Answer: c

Explanation: Pass transistors are allowed to be constructed under metal layers to save space and is more convenient.

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14. Maximum allowable current density in aluminium is

- a)  $0.1 \text{ mA}/\mu\text{m}^2$
- b)  $0.5 \text{ mA}/\mu\text{m}^2$
- c)  $2 \text{ mA}/\mu\text{m}^2$

d)  $1 \text{ mA}/\mu\text{m}^2$   
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Answer: d

Explanation: The maximum allowable current density in aluminium wire is  $1 \text{ mA}/\mu\text{m}^2$ . Otherwise metal migration may occur.

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## VLSI Questions and Answers – Design Styles

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Design Styles”.

1. In which design all circuitry and all interconnections are designed?

- a) full custom design
- b) semi-custom design
- c) gate array design
- d) transistor design

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Answer: a

Explanation: Full custom design is the complete design for the implementation. It contains all circuitry and all interconnections/communication paths.

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2. Which design contains only the interconnections designed?

- a) full custom design
- b) semi-custom design
- c) gate array design
- d) transistor design

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Answer: c

Explanation: Gate array design which is also known as uncommitted logic array design has the design of only the interconnections/communication paths.

3. In which method regularity is used to reduce complexity?

- a) random approach
- b) hierarchical approach
- c) algorithmic approach
- d) semi-design approach

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Answer: b

Explanation: Hierarchical approach is in the one in which principles of iteration or regularity can be used to reduce the complexity of the design task.

4. Size of the die is determined using

- a) transistor size
- b) inverter size
- c) area of the circuitry
- d) length of the circuitry

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Answer: c

Explanation: Size of the die is determined by the area occupied by the circuitry. Large die sizes are associated with poor yields and high costs.

5. Which design is faster?

- a) full custom design
- b) semi-custom design
- c) gate array design
- d) transistor design

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Answer: c

Explanation: Gate array design is faster than a prototype full-custom design and the final custom designs must be carefully optimized.

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6. Which has relatively low-level capabilities?

- a) hand-crafted designs
- b) computer assisted textual entry
- c) computer assisted graphical entry
- d) silicon compiler-based design

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Answer: b

Explanation: Computer-assisted textual entry has programs which may be relatively low-level capabilities and it allows the entry of rectangular boxes, wires, etc.

7. Computer-assisted graphical entry is done through

- a) monochrome
- b) grayscale graphics
- c) bichrome
- d) trichrome

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Answer: a

Explanation: Computer-assisted graphical entry of mask geometry is through either monochrome or color graphics terminal.

8. Which method is used for verification along with generation?

- a) hand-crafted designs
- b) computer assisted textual entry
- c) computer assisted graphical entry
- d) silicon compiler-based design

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Answer: c

Explanation: Computer-assisted graphical entry method encourages regularity and are generally used with a generate then verify design philosophy.

9. Which method uses high level programming language?

- a) hand-crafted designs
- b) computer assisted textual entry
- c) computer assisted graphical entry
- d) silicon compiler-based design

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Answer: d

Explanation: Silicon compiler-based design uses high level approach and uses special languages like high level language compilers.

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10. The set of design rules does not give

- a) widths
- b) spacing
- c) colors
- d) overlaps

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Answer: c

Explanation: Communication between the fabrication house and the designer takes the form of a set of design rules with gives clearance, widths, spacing, overlaps, etc.

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## VLSI Questions and Answers – Design Using CIF Code

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Design Using CIF Code”.

1. Caltech intermediate form code is a

- a) low-level graphic language
- b) low-level textual language
- c) high-level graphic language
- d) high-level textual language

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Answer: a

Explanation: Caltech intermediate form code is a low-level graphic language used to specify geometry of integrated circuits.

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2. CIF generates code which are

- a) high-level language
- b) assembly level language
- c) machine readable language

d) very high-level language

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Answer: c

Explanation: CIF code is to communicate chip geometry in a standard machine readable form for mask-making.

3. CIF code is compatible with

- a) low system geometry
- b) large system geometry
- c) both low and large system geometry
- d) medium system geometry

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Answer: c

Explanation: CIF code is reasonable compact and can cope with both low and large system geometry. It is easily readable.

4. Design through CIF is done using

- a) color codes
- b) geometric shapes
- c) different layer thickness
- d) transistors

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Answer: b

Explanation: In Caltech intermediate form code, the design is given using geometric shapes. Boxes, polygons and wires are readily defined.

5. The CIF dimensions are given in the form of

- a) X,Y coordinates
- b) lambda form
- c) millimeter form
- d) alpha form

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Answer: a

Explanation: The CIF dimensions and positions are given in X, Y coordinate form but are in absolute dimension units and not in lambda form.  
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6. Polygons in CIF are specified in terms of

- a) length
- b) width
- c) vertices
- d) angles

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Answer: c

Explanation: In CIF, polygons(P) are specified in terms of vertices in order. An n-sided polygon needs n vertices and a connection between first and last.

7. Wires are specified in terms of

- a) vertices
- b) width
- c) angles
- d) lengths

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Answer: b

Explanation: Wires(W) are specified in terms of their width followed by the center line's coordinates of the wire's path.

8. CIF can also accommodate rotations and translations.

- a) true
- b) false

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Answer: a

Explanation: CIF also accommodates cells and rotations and translations etc along with geometrical shaped designs.

9. If vector coordinate is (1,0) it indicates that

- a) length is parallel to y-axis
- b) length is parallel to x-axis
- c) width is parallel to y-axis
- d) width is parallel to x-axis

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Answer: b

Explanation: If the vector coordinate is (1,0), it denotes that the length will be parallel to the x-axis. The direction is always assumed parallel to the length.

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10. In which layer the geometrical structures exist?

- a) metal
- b) silicon
- c) silicide
- d) diffusion

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Answer: b

Explanation: In CIF design is done using geometrical structures like boxes, polygons, etc and these boxes exist in the silicon layer.

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# VLSI Questions and Answers – Design Using CAD Tools

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Design Using CAD Tools”.

1. Physical verification tools in design process include

- a) circuit extractors
- b) textual entry
- c) graphical entry
- d) simulation

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Answer: a

Explanation: Physical verification tools in design process includes design rule checking, circuit extractors, ratio rule and other static checks.

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2. Behavioral tools contain

- a) graphical entry
- b) design check
- c) performance check

d) simulation  
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Answer: d

Explanation: Behavioral tools contain simulation at various levels. It will be required to check out the design before turning out the design in silicon.

3. Simulators are available for

- a) transistor level logic
- b) switch level logic
- c) gate level logic
- d) design level logic

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Answer: b

Explanation: Simulators are available for switch level logic and timing simulation. This is used to check out the design.

4. Selection and placement is done using

- a) cursor
- b) shapes
- c) textual
- d) graphical

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Answer: a

Explanation: Selection and placement geometric shapes are done using some form of cursor and it may also allow selection of menu items.

5. Cursor position is controlled using

- a) mouse
- b) bitpad digitizer
- c) mouse and bitpad digitizer
- d) keyboard

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Answer: c

Explanation: Positioning of cursor may be affected from keyboard and cursor position is controlled from a bitpad digitizer or a mouse.

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6. CIF code is a \_\_\_\_\_ layout language.

- a) mask level
- b) floor level
- c) design level
- d) transistor level

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Answer: a

Explanation: CIF is an example of mask level layout language, which are well suited to physical layout description but not for capturing the design intent.

7. Which verification capture's design intent and not physical layout?

- a) mask level layout language
- b) transistor level layout language
- c) circuit description language
- d) switch level layout language

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Answer: c

Explanation: Circuit description language where the primitives are circuit elements such as transistors, wires and nodes. It captures the design intent and not directly the physical layout.

8. All possible errors in mask layout can be eliminated after mask making proceeds.

- a) true
- b) false

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Answer: b

Explanation: The cost in time and the facilities in mask-making is such that all the possible errors must be eliminated before mask making proceeds.

9. The nature of physical layout verification software depends on

- a) absolute design rules
- b) fixed layout
- c) virtual grid layout
- d) all of the mentioned

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Answer: d

Explanation: The nature of physical layout verification design rule checking software depends on whether the design rules are absolute or lambda-based or on whether or not the layout is on a fixed or virtual grid.

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10. Which is used to interpret physical layout in circuit terms?

- a) circuit converter
- b) layout converter
- c) circuit extractor
- d) layout extractor

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Answer: c

Explanation: Circuit extractor is used to convert the design information which is in the form of physical layout data to circuit terms.

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## VLSI Questions and Answers – Simulators

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Simulators”.

1. Simulator converts circuit information to

- a) design plan
- b) does verification
- c) set of equations
- d) floor plan

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Answer: c

Explanation: The circuit description contains information about circuit components and interconnections. This is transformed using a simulator to a set of equations from which predictions of behaviour are made.

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2. The electrical behaviour of a circuit is given using

- a) design rules
- b) floor plan
- c) structures and layouts

d) mathematical modelling

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Answer: d

Explanation: The electrical behaviour is defined by mathematical modelling and its accuracy is measured using the accuracy of simulation and computing power and time for simulation.

3. Which gives the main electrical behaviour of various parts of the circuit?

- a) circuit simulator
- b) timing simulator
- c) logic level simulator
- d) functional simulator

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Answer: a

Explanation: Circuit simulators are concerned with the electrical behaviour of the various parts of the circuit to be implemented in silicon.

4. Which takes lots of simulating time?

- a) circuit simulator
- b) timing simulator
- c) logic level simulator
- d) functional simulator

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Answer: a

Explanation: Circuit simulators takes lot of computing time to simulate even small section of system and are completely impractical for circuits of any real magnitude.

5. Timing simulator concentrates on

- a) quiescent nodes
- b) active nodes
- c) passive nodes
- d) electrical nodes

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Answer: b

Explanation: Timing simulator concentrates on active nodes and ignores the quiescent nodes in simulation and improves the design accordingly.

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6. The accuracy of simulation depends on accuracy of

- a) fabrication house parameters
- b) electrical parameters
- c) active parameters
- d) functional parameters

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Answer: a

Explanation: The accuracy of simulation depends on accuracy of fabrication house parameters which must be fed into the simulator which is in the range of 20% or better.

7. Which is important during the design phase?

- a) circuit simulator
- b) timing simulator
- c) logic level simulator
- d) functional simulator

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Answer: b

Explanation: Timing simulators are increasingly important during the design phase because of their speed and consequent interactive qualities.

8. Run times are \_\_\_\_\_ to number of devices and nodes.

- a) linearly related
- b) inversely related
- c) exponentially equal
- d) does not relate

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Answer: a

Explanation: Run time is linearly related to the number of devices and nodes being simulated. The structure of timing simulator tools ensure this relationship.

9. Improvement of transistor modelling includes

- a) body effect
- b) channel length modulation
- c) carrier velocity saturation
- d) all of the mentioned

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Answer: d

Explanation: To improve the transistor modelling it is possible to include body effect, channel length modulation and carrier velocity saturation.  
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10. Channel length modulation is for voltages

- a) exceeding threshold
- b) exceeding onset of saturation
- c) exceeding power supply
- d) exceeding onset of non saturation

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Answer: b

Explanation: Channel length modulation is for voltages exceeding the onset of saturation there is an effective decrease in channel length of a short channel transistor.

11. The charge carriers reach \_\_\_\_\_ scattering limited velocity before pinch off.

- a) maximum
- b) minimum
- c) less
- d) equal

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Answer: a

Explanation: Velocity saturation occurs when the drain to source voltage of a short channel transistor exceeds a critical value, the charge reach their maximum scattering limited velocity before pinch off.

12. Less current is available from

- a) short channel transistor
- b) large channel transistor
- c) very large channel transistor
- d) does not depend on channel transistor

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Answer: a

Explanation: Less current is available from a short channel transistor than from a long channel transistor with similar width to length ratio and processing.

13. Which can cope up with large sections of layout?

- a) circuit simulator
- b) timing simulator
- c) logic level simulator
- d) functional simulator

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Answer: c

Explanation: Logic level simulator can cope with large section of the layout at one time but the performance is assumed in terms of logic levels with no or little timing information.

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14. Logic simulators can be replaced by simulators which operate at transistor level.

- a) true
- b) false

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Answer: b

Explanation: Logic simulators may be replaced by simulators which operate at the register transfer level.

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## VLSI Questions and Answers – Test and Testability

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Test and Testability”.

1. Circuit nodes cannot be probed for monitoring or excitation.

- a) true
- b) false

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Answer: a

Explanation: The entire surface of the chip other than the pads are sealed by an overglass layers and thus circuit nodes cannot be probed for monitoring and excitation.

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2. The circuit should be tested at

- a) design level
- b) chip level
- c) transistor level
- d) switch level

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Answer: b

Explanation: Chip design mistakes can be very costly both in terms of time and money. The circuit should be tested at chip level itself. Design for testability is essential for good design.

3. \_\_\_\_\_ of the area is dedicated for testability.

- a) 20%
- b) 10%
- c) 30%
- d) 25%

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Answer: c

Explanation: Design for testability is an essential process for good design. Thus the designers dedicate around 30% or more of chip area for testing.

4. Partitioning into subsystems are done at

- a) design stage
- b) prototype stage
- c) testing stage
- d) fabrication stage

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Answer: b

Explanation: At the prototype stage, partitioning into subsystems are done to solve all the complexity problem. Each of these subsystems are self contained and independent.

5. In prototype testing, the circuits are

- a) open circuited
- b) short circuited
- c) tested as a whole circuit

d) programmed  
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Answer: a

Explanation: The connections are made open circuited so that one system can be divorced from another as a last resort in prototype testing.  
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6. The number of test vectors for exhaustive testing is calculated by

- a)  $2^{(m+n)}$
- b)  $2^{((m+n)/2)}$
- c)  $2^{(m-n)}$
- d)  $2^{2(m+n)}$

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Answer: a

Explanation: The total number of test vectors for exhaustive testing is given by  $2^{(m+n)}$ . For example if m is 20 and n is 24, the resultant number of test vectors for exhaustive testing is  $2^{44}$ .

7. After partitioning, number of vectors is given by

- a)  $2^{(m+n)}$
- b)  $2^{((m+n)/2)}$
- c)  $2^n + 2^m$
- d)  $2^2(m+n)$

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Answer: c

Explanation: If the system is partitioned for testing, exhaustive testing can be reduced to  $2^n + 2^m$  a much more reasonable proportion.

8. What are the dominant faults in diffusion layers?

- a) short circuit faults
- b) open circuit faults
- c) short and open circuit faults
- d) power supply faults

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Answer: a

Explanation: In MOS circuits, short circuit and open circuit in metal layer and short circuit in diffusion layer are the dominant fault experienced.

9. Test pattern generation is assisted using

- a) automatic test pattern generator
- b) exhaustive pattern generator
- c) repeated pattern generator
- d) loop pattern generator

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Answer: a

Explanation: Test pattern generation is assisted using automatic test pattern generators but they are complicated to use properly and ATPG costs tend to rise rapidly with circuit size.

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10. \_\_\_\_\_ of faults are easier to detect.

- a) 50%
- b) 60%
- c) 70%
- d) 80%

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Answer: d

Explanation: It is relatively easy to detect the first 80% of faults using various classical test strategies.

11. Hot carrier injection causes

- a) threshold voltage shift
- b) transconductance degradation
- c) threshold voltage shift & transconductance degradation
- d) none of the mentioned

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Answer: c

Explanation: Hot carrier injection causes both threshold voltage shift and transconductance degradation due to charge accumulation in the gate oxide.

12. Oxide breakdown occurs due to

- a) electrostatic charge
- b) threshold voltage
- c) voltage shift

d) poor input/output pad circuitry

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Answer: d

Explanation: Oxide breakdown occurs due to inadequate protection against electrostatic discharge and also due to defect or poor design in input/output pad circuitry.

13. Which model is used for pc board testing?

- a) stuck at
- b) stuck in
- c) stuck on
- d) stuck through

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Answer: a

Explanation: The stuck at model is used in the testing of pc boards and is not sufficient to test actual VLSI CMOS circuits.

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# VLSI Questions and Answers – Testing Combinational Logic

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Testing Combinational Logic”.

1. The input signal combination in exhaustive testing is given as

- a)  $2^N$
- b)  $2^{1/N}$
- c)  $2^{(M+N)}$
- d)  $1/2^N$

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Answer: a  
Explanation: For testing an N input circuit using exhaustive testing, the total number of input combinations can be given as  $2^N$ .  
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2. Observability is the process of  
a) checking all inputs  
b) checking all outputs  
c) checking all possible inputs  
d) checking errors and performance

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Answer: b

Explanation: Observability is the process of observing outputs for all the input combinations.

3. Exhaustive testing is suitable when N is

- a) small  
b) large  
c) any value for N  
d) very large

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Answer: a

Explanation: Exhaustive testing is the process where all possible input combinations are used. This is suitable when N is relatively small.

4. Test vectors in sensitized path-based testing is generated

- a) before enumerating faults  
b) after enumerating faults  
c) after designing  
d) before designing

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Answer: b

Explanation: In sensitized path-based testing, test vectors are generated after enumerating the possible faults because many patterns may not occur during the application of the circuit.

5. To propagate the fault along the selected path to primary output, setting \_\_\_\_\_ is done.

- a) AND to 1  
b) OR to 1  
c) NOR to 1  
d) NAND to 0

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Answer: a

Explanation: Inputs of another gate is determined so as to propagate the fault signal along the selected path to primary output of the circuit. This is done by setting AND/NAND to 1 and OR/NOR to 0.

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6. In consistency/ justification, tracking is done

- a) forward from gate input to primary input  
b) backwards from gate input to primary output  
c) backwards from gate input to primary input  
d) forward from gate output to primary output

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Answer: c

Explanation: Consistency step finds the input patterns to realize all the necessary values. This is done by tracking backwards from gate input to primary input of the logic.

7. In D-algorithm, a particular \_\_\_\_\_ fault is detected by examining the \_\_\_\_\_ conditions.

- a) internal, output  
b) internal, input  
c) external, output  
d) external, input

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Answer: a

Explanation: In a circuit comprising combinational logic, D-algorithm aims at detecting a particular internal fault by examining the output conditions.

8. D-algorithm is based on

- a) existence of one fault machine  
b) existence of one good machine  
c) existence of one fault and one good machine  
d) existence of two fault machines alone

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Answer: c

Explanation: D-algorithm is based on the hypothesis of the existence of two machines – one good machine and one faulty machine.

9. The existence of fault in faulty machine causes discrepancy in behaviour of the circuit for all values on inputs.

- a) true
- b) false

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Answer: b

Explanation: The existence of fault in faulty machine causes discrepancy in its behaviour and that of the good machine for some particular values of inputs.

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10. In D-algorithm, the discrepancy is driven to \_\_\_\_\_ and observed and thus detected.

- a) all inputs
- b) particular inputs
- c) output
- d) end of the circuit

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Answer: c

Explanation: In D-algorithm, a systematic means is provided to drive the discrepancy to output and it is observed and detected.

11. D-algorithm is time intensive for large circuits.

- a) true
- b) false

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Answer: a

Explanation: D-algorithm is extremely time intensive and computing intensive for large circuits and many modifications and improvements are done.

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# VLSI Questions and Answers – Testing Sequential Logic

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Testing Sequential Logic”.

1. Sequential circuits are represented as

- a) finite state machine
- b) infinite state machine
- c) finite synchronous circuit
- d) infinite asynchronous circuit

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Answer: a

Explanation: Sequential circuits are represented as finite state machine and may be modelled as combinational logic.

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2. Sequential circuit includes

- a) delays
- b) feedback
- c) delays and feedback from input to output
- d) delays and feedback from output to input

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Answer: d

Explanation: Sequential circuit includes a set of delays and feedback from output to input and it is known as finite state machine.

3. Which constitutes the test vectors in sequential circuits?

- a) feedback variables
- b) delay factors
- c) test patterns
- d) all input combinations

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Answer: a

Explanation: The ‘m’ feedback variables constitute the state vector and determine the maximum number of finite states which may be assumed by the circuit.

4. Outputs are functions of

- a) present state
- b) previous state
- c) next state
- d) present and next state

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Answer: a

Explanation: Next state and output are both functions of present state and the independent inputs.

5. Which is the delay elements for clocked system?

- a) AND gates
- b) OR gates
- c) Flip-flops
- d) Multiplexers

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Answer: c

Explanation: In clocked systems, the basic delay elements are flip-flops and in asynchronous circuits, the delays may be contributed by circuit propagation delays.

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6. Which contributes to the necessary delay element?

- a) flip-flops
- b) circuit propagation elements
- c) negative feedback path
- d) shift registers

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Answer: b

Explanation: The circuit propagation delays contribute to the necessary delay elements. The delay in the feedback path may be non-existence.

7. In an OR gate, if A and B are two inputs and there is stuck at 1 fault in B path, then output will be

- a) A
- b) 0
- c) 1
- d) B'

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Answer: c

Explanation: In an OR gate, if struck at 1 fault in present in B path then output will always be 1.

8. Iterative test generation method suits for circuits with

- a) no feedback loops
- b) few feedback loops
- c) more feedback loops
- d) negative feedback loops only

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Answer: b

Explanation: The iterative test generation methods are best suited to logic with few feedback loops as in control logic for example.

9. Which method is very time consuming?

- a) D-algorithm
- b) iterative test generation
- c) pseudo exhaustive method
- d) test generation pattern

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Answer: b

Explanation: Iterative test generation method is time consuming for circuits of any complexity. It is necessary to describe the initial states of the circuit, which is also time consuming.

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10. In this technique, a simple fault manifests into multiple N faults.

- a) true
- b) false

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Answer: a

Explanation: The main problem in this iterative test generation technique is that a simple fault in the sequential machine is manifest as N multiple faults during test.

11. In this iterative test generation method, sequential logic is

- a) used in the same pattern
- b) converted to test logic
- c) converted to combinational logic
- d) converted to asynchronous logic

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Answer: c

Explanation: In this iterative test generation method, the main approach of testing is sequential logic is converted into combinational logic by cutting the feedback lines, thus creating pesudo inputs and outputs.

12. For a NAND gate, struck-at 1 fault in second input line cannot be detected if

- a) Q is 1
- b) Q is 0
- c) Q changes from 1 to 0
- d) Q changes from 0 to 1

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Answer: b

Explanation: In a NAND gate, struck-at 1 fault in the second input line cannot be detected if the output Q is reset ( $Q=0$ ) prior to applying the test sequence.

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## VLSI Questions and Answers – Guidelines for Testability -1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Guidelines for Testability -1”.

1. Practical guidelines for testability aims at

- a) facilitating test generation
- b) facilitating test application
- c) avoiding timing problems
- d) all of the mentioned

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Answer: d

Explanation: Practical guidelines for testability should aim to facilitate test process in three main ways – facilitate test generation, facilitate test application and avoid timing problems.

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2. When a node is difficult to access

- a) sub nodes are formed
- b) internal pads are added
- c) external pads are added
- d) circuit is sub divided

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Answer: b

Explanation: When a node is difficult to access from primary input or output pads, then a very effective method is to add additional internal pads to access the desired point.

3. The additional pads are accessed using

- a) probers
- b) selectors
- c) multiplexers
- d) buffers

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Answer: a

Explanation: The additional pads which are added for the access of nodes, can be accessed using probers.

4. Which provides links between blocks of a circuit?

- a) combiners
- b) wires
- c) pads
- d) nodes

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Answer: d

Explanation: A node provides the link between blocks of a circuit and the attributes provide the control of the blocks.

5. To improve controllability and observability \_\_\_\_\_ is used.

- a) three pads
- b) eight transistors

- c) three pads and eight transistors
  - d) four pads and eight transistors
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Answer: c

Explanation: In CMOS environment, three pads and eight transistors are required to improve controllability and observability.

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6. The addition of \_\_\_\_\_ improves the observability.

- a) adders
- b) multiplexers
- c) multipliers
- d) demultiplexers

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Answer: d

Explanation: The addition of demultiplexers also improves observability. This arrangement allows bypassing of blocks.

7. How to reduce test time?

- a) by reducing multiplexers
- b) by reducing adders
- c) by dividing circuit into subcircuits
- d) by using the whole circuit as a single system

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Answer: c

Explanation: Partitioning large circuits into smaller subcircuits is an effective way of reducing test generation complexity and test time.

8. Test generation effort for n gate circuit is proportional to

- a) n
- b)  $n^2$
- c)  $n^3$
- d)  $n^2$  and  $n^3$

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Answer: d

Explanation: Test generation effort for a n gate general purpose logic circuit is proportional to  $n^2$  and  $n^3$ .

9. Partitioning should be made on a

- a) logical basis
- b) functional basis
- c) time basis
- d) structural basis

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Answer: a

Explanation: Partitioning should be made on logical basis into recognizable and sensible subfunctions and can be done physically by incorporating clock line isolation and power supply lines.

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10. Isolation and control is achieved using

- a) adders
- b) buffers
- c) multiplexers
- d) multipliers

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Answer: c

Explanation: Isolation and control are better and readily achieved through the use of multiplexers.

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## VLSI Questions and Answers – Guidelines for Testability -2

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This set of VLSI Quiz focuses on “Guidelines for Testability -2”.

1. \_\_\_\_\_ is used to start the initial sequence correctly.

- a) preset
- b) clear
- c) preset and clear
- d) clock

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Answer: c

Explanation: The sequential logic testing arises at power-up time. To solve this problem and to start the initial sequence correctly, preset and clear are used.

2. Preset and clear is used to

- a) initialize only first sequence
- b) correct first two sequences
- c) correct first and last sequence
- d) correct alternative sequences

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Answer: a

Explanation: Preset and clear is used to initialize only the first sequence as these are very space consuming.

3. How can over-riding the normal initialization state be achieved?

- a) by adding preset
- b) by adding reset
- c) by adding gating in initialize control line
- d) by adding sourcing in initialize control line

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Answer: c

Explanation: The tester should be able to over-ride the normal initialization state of the logic and this can be achieved by the addition of gating in initialize control line.

4. Asynchronous logic is driven by

- a) clock
- b) gating circuit
- c) self-clock
- d) self timing

[View Answer](#)

Answer: d

Explanation: Asynchronous logic is driven by self-timing state transition in response to changes of the primary input.

5. Which is better in terms of memory storage?

- a) synchronous circuits
- b) asynchronous circuits
- c) sequential circuits
- d) clocked circuits

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Answer: a

Explanation: Synchronous circuits are better when compared to memory storage. Asynchronous circuits have a timing problems and also memory effects and problems.

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6. Which circuits are faster?

- a) synchronous circuits
- b) asynchronous circuits
- c) sequential circuits
- d) clocked circuits

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Answer: b

Explanation: Asynchronous circuits are inherently faster than clocked logic but it has other disadvantages like difficult testing, non deterministic behaviour, prone to races, etc.

7. Which is more sensitive logic?

- a) synchronous circuits
- b) asynchronous circuits
- c) sequential circuits
- d) clocked circuits

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Answer: b

Explanation: Asynchronous circuits are more sensitive to tester skews and it is also prone to races and other hazards.

8. Which logic are difficult to design?

- a) synchronous circuits
- b) asynchronous circuits
- c) sequential circuits
- d) clocked circuits

[View Answer](#)

Answer: b

Explanation: Asynchronous circuit designs are difficult than synchronous logic and must be approached with care, taking the account of critical race and other hazard-generating conditions.

9. Automatic test pattern generators depend on

- a) map design
- b) layout design
- c) logic domain
- d) testing domain

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Answer: c

Explanation: Automatic test pattern generators work in logic domain and view delay-dependent logic as redundant combinational logic.

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10. When a clock signal is gated with another signal like load signal, output is not affected.

- a) true
- b) false

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Answer: b

Explanation: When a clock signal is gated with another signal such as load signal, then any skew on that signal can cause the erroneous output from associated logic.

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## VLSI Questions and Answers – Guidelines for Testability -3

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This set of VLSI Mcqs focuses on “Guidelines for Testability -3”.

1. Counters are
  - a) sequential circuits
  - b) synchronous circuits
  - c) asynchronous circuits
  - d) buffer circuits

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Answer: a

Explanation: Counters are sequential circuits and need a large number of input vectors to be fully tested.

2. Wrong readings are recorded due to reset input being

- a) dependent of clock signal
- b) independent of clock signal
- c) dependent of gate signal
- d) independent of gate signal

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Answer: b

Explanation: Since reset input is independent of system clock signal, erroneous readings are being read by the tester.

3. To avoid self resetting, the tester can be over ridden by adding

- a) an AND gate
- b) an OR gate
- c) an EX-OR gate
- d) shift registers

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Answer: b

Explanation: Self resetting can be avoided by adding an OR gate which over rides the tester.

4. Partitioning technique is not suitable for microprocessor like circuits.

- a) true
- b) false

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Answer: b

Explanation: Partitioning technique is very widely used for microprocessor like circuits and using bus structures is related to partitioning technique.

5. The fast rise and fall times give cross-talk problems if

- a) they are in close proximity
- b) if they are far away
- c) it always gives rise to cross-talk problems
- d) does not allow cross-talk problems

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Answer: a

Explanation: The fast rise and fall times of digital signals can give rise to cross-talk problems in analog signal lines if they are in close proximity.

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6. To route digital signals near analog signals \_\_\_\_\_ must be done.

- a) balancing
- b) shielding digital signals
- c) balancing and shielding
- d) crossing

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Answer: c

Explanation: To route digital signals near analog signals, balancing and shielding of digital signals must be done.

7. To access directly another system \_\_\_\_\_ is done.

- a) skipping
- b) alternating
- c) by-passing
- d) by-setting

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Answer: c

Explanation: To directly access another sub-system to be tested from one subsystem, by-passing must be performed.

8. With partitioning, bypassing is performed using

- a) buffers
- b) multiplexers
- c) multipliers
- d) dividers

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Answer: b

Explanation: With partitioning, to directly access a sub-system for testing, bypassing must be done and this is achieved using multiplexers.

9. Bypassing technique works well with

- a) dividers
- b) counters
- c) RAM
- d) all of the mentioned

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Answer: d

Explanation: Bypassing technique works well with counters, dividers, RAM, ROM, PLAs, sequential blocks, analog circuits and internal clocks.

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10. In the bypassing approach, subsystem can be tested

- a) exhaustively
- b) pseudo-exhaustively
- c) repeatedly
- d) selectively

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Answer: a

Explanation: In the bypassing approach, subsystem can be tested exhaustively by controlling the multiplexers based interconnections in the system.

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# VLSI Questions and Answers – Scan Design Techniques-1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Scan Design Techniques-1”.

1. The major difficulty in sequential circuit testing is in

- a) determining output
- b) determining internal state
- c) determining external state
- d) determining input combinations

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Answer: b

Explanation: The major difficulty in sequential circuit testing is in determining the internal state of the circuit.

2. The design technique helps in improving

- a) controllability
- b) observability
- c) controllability and observability
- d) overall performance

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Answer: c

Explanation: The design technique are directed at improving the controllability and observability of the internal states.

3. A sequential circuit contains combinational logic and storage elements in

- a) feedback path
- b) output node
- c) input node
- d) non feedback path

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Answer: a

Explanation: A sequential circuit contains combinational logic and storage elements in feedback path.

4. Storage elements in scan design technique is reconfigured to form

- a) RAM
- b) shift registers
- c) buffers
- d) amplifiers

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Answer: b

Explanation: Storage elements in the scan design technique is reconfigured to form a shift register known as the scan path.

5. Storage elements used are

- a) D flipflops
- b) JK flipflops
- c) RS flipflops
- d) All of the mentioned

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Answer: d

Explanation: Storage elements are usually D, JK and RS flipflop elements with the classical structure being modified by the addition of a two-way multiplexer on the data inputs.

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6. The sequential circuit operates in \_\_\_\_\_ mode/modes of operation.

- a) only one
- b) two
- c) three
- d) four

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Answer: b

Explanation: The sequential circuit containing the scan paths has two modes of operation a normal and a test mode.

7. The efficiency of the test pattern generation is improved by

- a) adding buffers
- b) adding multipliers
- c) partitioning
- d) adding power dividers

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Answer: c

Explanation: The efficiency of the test pattern generation for the overall combinational logic circuit is improved by partitioning since its depth is reduced.

8. The scan path shift register is verified by

- a) shifting in all zeroes first
- b) shifting in all ones first
- c) adding all ones
- d) adding all zeroes

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Answer: b

Explanation: Before applying test patterns, the scan path shift register is verified by shifting all ones then all zeroes.

9. In level sensitive aspect, when an input change occurs, the response is

- a) dependent of components
- b) dependent on wiring delays
- c) independent of wiring delays
- d) independent of input combinations

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Answer: c

Explanation: In level sensitive aspect, when an input change occurs the response is independent of the component and wiring delays within the network.

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10. In test mode, storage elements are connected as

- a) parallel shift registers
- b) serial shift register
- c) combiners
- d) buffers

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Answer: b

Explanation: In the test mode, storage elements are connected as a long serial shift register.

11. Which has more number of I/O pins?

- a) lssd
- b) partial scan
- c) scan/set
- d) random access scan

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Answer: d

Explanation: Random access scan method's major disadvantage is that it has more number of I/O pins and no shift registers with flipflop are used.

12. Scan/set method has no interruption to normal operation.

- a) true
- b) false

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Answer: a

Explanation: Scan/set method has separate shift registers and has no interruption to normal operation.

13. Which method has high overhead cost?

- a) lssd
- b) partial scan
- c) scan/set
- d) random access scan

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Answer: c

Explanation: Scan/set method has high overhead cost in terms of additional input/output pins.

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# VLSI Questions and Answers – Scan Design Techniques-2

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This set of VLSI Multiple Choice Questions & Answers focuses on “Scan Design Techniques-2”.

1. The serial shift register is driven using

- a) one over-lapping clock
- b) two over-lapping clock
- c) one non over-lapping clock
- d) two non over-lapping clock

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Answer: d

Explanation: The serial shift register is driven using two non over-lapping clocks which can be controlled by primary inputs of the circuit.

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2. Which is used to control the scan path movement?

- a) clock signals
- b) input signals
- c) output signals
- d) delay signals

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Answer: a

Explanation: Two clock signals are used to control the scan path movements through the shift register latches.

3. The circuit operation is independent of

- a) rise time
- b) fall time
- c) propagation delays
- d) all of the mentioned

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Answer: d

Explanation: The circuit operation is independent of dynamic characteristics of the logic elements like rise time, fall time and propagation delays.

4. Which is not the function of LSSD method?

- a) eliminates hazards
- b) eliminates races
- c) simplifies fault generation
- d) stores the data

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Answer: d

Explanation: The advantages of LSSD are that it eliminates races and hazards, simplifies fault generation and fault simulation.

5. Boundary scan test is used to test

- a) pins
- b) multipliers
- c) boards
- d) wires

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Answer: c

Explanation: Boundary scan test involves scan path and self-testing to resolve the problems associated with boards carrying VLSI circuits.

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6. The boundary scan path is provided with

- a) serial input pads
- b) parallel input pads
- c) parallel output pads
- d) buffer pads

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Answer: a

Explanation: The boundary scan path is provided with serial input and output pads and with appropriate clock pads.

7. The boundary scan path tests the

- a) input nodes
- b) output nodes
- c) buffer nodes
- d) interconnection points

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Answer: d

Explanation: The boundary scan path test the interconnection between the various chips on the board.

8. Boundary scan method takes lesser time on test pattern generation.

- a) true
- b) false

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Answer: a

Explanation: Boundary scan method takes lesser time on test pattern generation and application.

9. The disadvantage of boundary scan method is that the fault coverage is less.

- a) true
- b) false

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Answer: b

Explanation: The boundary scan test method is simplified and efficient and also its fault coverage is increased.

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10. Which occupies a lesser area?

- a) lssd
- b) boundary scan test
- c) serial scan
- d) partial scan

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Answer: d

Explanation: Partial scan is derived from scan path technique and it consumes very less area.

11. The partial scan approach scan

- a) all input node faults
- b) all output node faults
- c) faults not detected by designer functional vector
- d) all faults

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Answer: c

Explanation: The partial scan approach detects faults which are not detected by the designer's functional vectors.

12. In scan/set method \_\_\_\_\_ is used to implement a scan path.

- a) serial registers
- b) storage elements
- c) parallel registers
- d) separate register

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Answer: d

Explanation: In scan/set method, storage elements are not used to implement a scan path. A separate register is added to scan test data in and out.

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# VLSI Questions and Answers – Built-in Self Test

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Built-in Self Test”.

1. Built-in self test aims to

- a) reduce test pattern generation cost
- b) reduce volume of test data
- c) reduce test time
- d) all of the mentioned

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Answer: d

Explanation: Built-in self test objectives are to reduce test pattern generation cost, to reduce volume of test data and to reduce test time.  
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2. In data compression technique, comparison is done on

- a) test response
- b) entire test data
- c) data inputs
- d) output sequences

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Answer: a

Explanation: In data compression technique, comparison is made on compacted test response instead on entire test data.

3. Signature analysis performs

- a) addition
- b) multiplication
- c) polynomial division
- d) amplifies

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Answer: c

Explanation: Signature analysis performs polynomial division that is division of data out of the device under test.

4. The signature analysis method can be represented mathematically as

- a)  $R(x) = P(x) * C(x)$
- b)  $R(x) = P(x) / C(x)$
- c)  $R(x) = C(x) / P(x)$
- d)  $R(x) = C(x) * P(x)$

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Answer: b

Explanation: The signature analysis method is represented mathematically as  $R(x) = P(x) / C(x)$  where  $R(x)$  is the signature,  $C(x)$  is characteristic polynomial.

5. Transition counting does the count of transition only in one specific direction at a time.

- a) true
- b) false

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Answer: a

Explanation: Transition counting does the count of transition in specified direction (0 to 1 or 1 to 0).  
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6. BILBO uses only the signature analysis.

- a) true
- b) false

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Answer: b

Explanation: Built-in logic block observer method uses signature analysis in conjunction with a scan path.

7. In which mode, storage elements are used independently?

- a) normal mode
- b) test 1 mode
- c) test 2 mode
- d) final mode

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Answer: a

Explanation: In normal mode, storage elements are used independently and in this mode signal  $B1=B2=1$ .

8. Storage elements are connected as a serial shift register when

- a)  $B1=B2=1$

- b) B1=B2=0
- c) B1=0, B2=1
- d) B1=1, B2=0

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Answer: b

Explanation: When B1=B2=0 storage elements are configured as scan path, they are connected as serial shift register.

9. The circuit is configured as LFSR, when

- a) B1=B2=1
- b) B1=B2=0
- c) B1=0, B2=1
- d) B1=1, B2=0

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Answer: d

Explanation: When B1=1 and B2=0 the circuit is configured as LFSR mode and can be used as either polynomial divider or random test pattern generator.  
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10. The BILBO is reset, when

- a) B1=B2=1
- b) B1=B2=0
- c) B1=0, B2=1
- d) B1=1, B2=0

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Answer: c

Explanation: When B1=0 and B2=1 in the final mode, the BILBO is reset.

11. Self-checking technique consists of

- a) supplying coded input data
- b) receiving coded output data
- c) supplying all possible input sequence
- d) all of the mentioned

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Answer: a

Explanation: Self-checking technique consists of supplying coded input data to the logic block under test and comparing the output.

12. The type of error in self-checking technique are

- a) simple error
- b) unidirectional error
- c) multiple error
- d) all of the mentioned

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Answer: d

Explanation: The type of error in self-checking techniques are simple errors, unidirectional errors and multiple errors.

13. The parity check detection is done using

- a) OR gate
- b) AND gate
- c) XOR gate
- d) NOR gate

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Answer: c

Explanation: The parity check detects simple errors using XOR gates and for each type of error, the approximate coding technique is used.  
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14. Which errors are detected using duplication codes?

- a) single errors
- b) unidirectional errors
- c) bidirectional errors
- d) multiple errors

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Answer: d

Explanation: Multiple errors are detected using duplication codes which consist of duplicating the information.

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# VLSI Questions and Answers – LFSR-1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “LFSR-1”.

1. Linear feedback shift register occupies more area.

- a) true
- b) false

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Answer: b

Explanation: Linear feedback shift register method is more area efficient than counters and other methods and requires less combinational logic.

2. In external feedback LFSR, shift registers and feedback paths are combined using

- a) OR gates
- b) AND gates
- c) EX-OR gates
- d) NAND gates

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Answer: c

Explanation: In the external feedback linear feedback shift register method, the shift registers and the feedback path are linearly combined via EX-OR gates.

3. Which uses the highest operating frequency?

- a) internal feedback LFSR
- b) external feedback LFSR
- c) both internal and external LFSR
- d) counters

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Answer: a

Explanation: Internal feedback LFSR provides implementation with highest operating frequency for use in high performance application.

4. Which method has more uniformity?

- a) internal feedback LFSR
- b) external feedback LFSR
- c) all of the mentioned

d) none of the mentioned

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Answer: b

Explanation: External feedback LFSR has more uniformity of the shift register and this is its main advantage.

5. The initial state in LFSR must be initialized to zero.

- a) true
- b) false

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Answer: b

Explanation: The initial state in LFSR must be initialized to any state other than zero so that it goes through all possible states except all 0's before repeating the sequence.

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6. For n-bit LFSR, the longest possible sequence is given by

- a)  $2^n$
- b)  $2^n + 1$
- c)  $2^n - 1$
- d)  $1/2^n$

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Answer: c

Explanation: For n-bit LFSR, the longest possible sequence of patterns is given by  $2^n - 1$ .

7. \_\_\_\_\_ determines the position of EX-OR gate with respect to flip-flops.

- a) maximal length sequence
- b) value of n
- c) number of flip-flops
- d) characteristic equation

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Answer: d

Explanation: The placement of EX-OR gates with respect to the flip-flops in LFSR is determined using the characteristic polynomial equation.

8. The zero coefficient terms determines the number of EX-OR gates to be used.

- a) true
- b) false

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Answer: b

Explanation: The non-zero coefficient in the characteristic polynomial expresses the EX-OR gate in the feedback network.

9. LFSR has \_\_\_\_\_

- a) EX-OR gates
- b) AND gates
- c) OR gates
- d) EX-OR and AND gates

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Answer: a

Explanation: LFSR has flip-flops and EX-OR gates and counters has one EX-OR gate and AND gate per flip-flop.

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10. Primitive polynomials are those

- a) which has intial state zero
- b) which gives maximal length sequence
- c) which does not give maximal length sequence
- d) which has AND gate per flip-flop

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Answer: b

Explanation: Primitive polynomials are those which give maximal length sequence and those which do not give maximal length sequence are called as non-primitive polynomial.

11. In LFSR, the test patterns are repeatable.

- a) true
- b) false

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Answer: a

Explanation: In linear feedback shift register used to produce pseudo random patterns, the patterns are deterministically generated and are repeatable.

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# VLSI Questions and Answers – LFSR-2

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This set of VLSI online test focuses on “LFSR-2”.

1. Primitive polynomial should have a minimum number of zero coefficient.

- a) true
- b) false

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Answer: a

Explanation: Primitive polynomials with a minimum number of zero coefficients are the desired characteristic polynomial for the LFSR.

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2. The minimum number of EX-OR gates used is in between

- a) 0 to 2
- b) 1 to 3
- c) 2 to 5
- d) 3 to 7

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Answer: b

Explanation: The minimum number of EX-OR gates used for the linear feedback shift register is in between 1 and 3.

3. The LFSR takes reasonable time if the n value is

- a) below 50
- b) below 100
- c) below 10
- d) below 25

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Answer: d

Explanation: The LFSR's degree value is limited to 22 to 25 for producing maximal length sequence in reasonable amount of time.

4. Which is used to initialize the LFSRs?

- a) zeroes
- b) ones
- c) preset of flip-flop
- d) EX-OR gate

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Answer: c

Explanation: The preset of each flip-flop in LFSR is used to initialize the LFSRs and initial non-zero coefficient or state ensures maximal length sequence is obtained.

5. The beginning and end of the maximal length sequence can be determined using

- a) AND gate
- b) NAND gate
- c) AND or NAND gate
- d) Both AND and NAND gate

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Answer: c

Explanation: The beginning and end of the maximal length sequence of the LFSR can be determined using AND gate or NAND gate.  
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6. Preloading different starting value for the LFSR is called as

- a) seeding
- b) reseeding
- c) deseeding
- d) pre-seeding

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Answer: b

Explanation: Initializing with a specific value to the LFSR is called as seeding and preloading different starting value is called as reseeding.

7. The primitive polynomial has a property according to which the runs of 1s \_\_\_\_\_ to runs of 0s.

- a) equal
- b) greater
- c) lesser
- d) not related

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Answer: a

Explanation: The primitive polynomial has a property of randomness according to which the runs of 1s equal to runs of 0s.

8. The total number of runs is given mathematically as

- a)  $2^n$
- b)  $2^{(n-1)}$
- c)  $2^{(n+1)}$
- d)  $2^n - 1$

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Answer: b

Explanation: The total number of runs is given as  $2^{(n-1)}$  which is the total number of transitions from 1 to 0 or from 0 to 1.

9. \_\_\_\_\_ of the runs will have a length of 1.

- a) one third
- b) one fourth
- c) half
- d) one eighth

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Answer: c

Explanation: The length of the runs are distributed as – half of the runs have length 1, quarter with length 2, a eighth length 3 and a sixteenth length 4 and so on.  
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10. The length of the runs is dependent on whether the LFSR is internal or external feedback.

- a) true
- b) false

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Answer: b

Explanation: The length of the run is independent of whether the LFSR is internal or external feedback and LFSR is also known as pseudo random pattern generator.

11. Which process is used to develop the LFSR method?

- a) random method
- b) gaussian method
- c) deterministic method
- d) bernoulli method

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Answer: d

Explanation: Bernoulli method is used in modelling the linear feedback shift register testing method and this is called as random pattern generation method.

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## VLSI Questions and Answers – Cellular Automata

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Cellular Automata”.

1. Cellular automata produce

- a) exhaustive patterns
- b) exhaustive pseudo random patterns
- c) random patterns
- d) pseudo random patterns

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Answer: d

Explanation: Cellular automata is similar to linear feedback shift register and it generates pseudo-random patterns.

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2. In which method the effect of bit shifting is not observed or visible?

- a) internal feedback LFSR
- b) external feedback LFSR

- c) cellular automata
  - d) counters
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Answer: c

Explanation: The effect of bit shifting is not observed in cellular automata as it is done in linear feedback shift register.

3. The patterns produced using \_\_\_\_\_ is less random.

- a) LFSR
- b) Cellular automata
- c) NAND gates
- d) Shift registers

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Answer: a

Explanation: The patterns produced by cellular automata is more random in nature than those produced using LFSR.

4. Which method needs more number of EX-OR gates?

- a) internal feedback LFSR
- b) counters
- c) external feedback LFSR
- d) cellular automata

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Answer: d

Explanation: The construction of cellular automata is not as simple as LFSR and thus cellular automata needs more number of EX-OR gates.

5. The construction of CA register is based on

- a) logical relationship of flip-flop
- b) EX-OR gate
- c) primitive polynomial
- d) degree of the polynomial

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Answer: a

Explanation: The construction of cellular automata is based on the logical relationship of each flip-flop to its two neighbours.

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6. The next state for rule 150 is obtained by

- a)  $x(t)$
- b)  $x(t+1)+x(t)+x(t-1)$
- c)  $x(t+1)+x(t-1)$
- d)  $x(t)+x(t-1)$

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Answer: b

Explanation: The next state for rule 150 is obtained by exploring three current state values – itself, previous flip-flop and next flip-flop.

7. The next state for rule 90 is obtained by

- a)  $x(t)$
- b)  $x(t+1)+x(t)+x(t-1)$
- c)  $x(t+1)+x(t-1)$
- d)  $x(t)+x(t-1)$

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Answer: c

Explanation: The next state for rule 90 is obtained by exploring two current values – the state value of previous and the next flip-flop.

8. Which occupies lesser area?

- a) internal feedback LFSR
- b) external feedback LFSR
- c) null condition CA
- d) cyclic boundary CA

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Answer: d

Explanation: The area occupied by null boundary cellular automata is comparatively lesser than that used by cyclic boundary CA.

9. The maximal length sequence is given by

- a)  $2^n$
- b)  $2^n + 1$
- c)  $2^n - 1$
- d)  $2n$

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Answer: c

Explanation: The maximal length sequence is given by  $2^n - 1$  in null condition boundary cellular automata.

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10. Rule 90 CA minimizes area when compared to rule 150.

- a) true
- b) false

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Answer: a

Explanation: Maximizing the use of rule 90 cellular automata minimizes area overhead when compared to using rule 150 cellular automata.

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# VLSI Questions and Answers – Test Patterns

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Test Patterns”.

1. Which method is used to determine structural defects?

- a) deterministic test pattern
- b) algorithmic test pattern
- c) random test pattern
- d) exhaustive test pattern

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Answer: a

Explanation: Deterministic test patterns are used to detect specific faults or structural faults for a circuit under test.

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2. Which is known as the stored test pattern method?

- a) deterministic test pattern
- b) algorithmic test pattern

- c) random test pattern
  - d) exhaustive test pattern
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Answer: a

Explanation: Deterministic test pattern method is also known as stored test pattern method in the context of BIST applications.

3. Which method uses finite state machine for developing the test pattern?

- a) deterministic test pattern
- b) algorithmic test pattern
- c) random test pattern
- d) exhaustive test pattern

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Answer: b

Explanation: Algorithmic test pattern method uses the hardware finite state machine for generating algorithmic test vectors for the circuit under test.

4. A n-bit counter produces \_\_\_\_\_ number of total input combinations.

- a)  $2^{(n-1)}$
- b)  $2^{(n+1)}$
- c)  $2^n$
- d)  $2n$

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Answer: c

Explanation: A n-bit counter produces totally  $2^n$  number of all possible input combinations for testing the circuit under test and it is called as exhaustive test pattern method.

5. Exhaustive test pattern determines

- a) gate level faults
- b) logic level faults
- c) functional faults
- d) structural faults

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Answer: a

Explanation: Exhaustive test pattern method detects all gate level stuck-at fault and also bridging fault.

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6. Exhaustive test pattern also detects delay faults.

- a) true
- b) false

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Answer: b

Explanation: Exhaustive test pattern method does not detect all transistor level faults or delay faults since those faults needs specific ordering.

7. Which is not suitable for circuits having large N values?

- a) exhaustive test pattern method
- b) pseudo-exhaustive test pattern method
- c) random test pattern method
- d) deterministic test pattern method

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Answer: a

Explanation: Exhaustive test pattern method is not suitable for circuit having large N values since there is a limit for fault coverage.

8. Which method needs fault simulation?

- a) exhaustive test pattern method
- b) pseudo-exhaustive test pattern method
- c) random test pattern method
- d) deterministic test pattern method

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Answer: a

Explanation: Exhaustive test pattern method needs fault simulation for determining fault coverage where as pseudo-exhaustive test pattern method does not need fault simulation.

9. In which method sequences are repeatable?

- a) exhaustive test pattern method
- b) pseudo-exhaustive test pattern method
- c) random test pattern method
- d) pseudo-random test pattern method

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Answer: d

Explanation: Pseudo-random test pattern method have properties similar to random pattern sequence but the sequence are repeatable.  
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10. Which method is used for external functional testing?

- a) exhaustive test pattern method
- b) pseudo-exhaustive test pattern method
- c) random test pattern method
- d) pseudo-random test pattern method

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Answer: c

Explanation: Random test pattern method is used for external functional testing of microprocessors as well as in ATPG software.

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# VLSI Questions and Answers – Counters and Finite State Machines

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Counters and Finite State Machines”.

1. Counters detect only bridging faults.

- a) true
- b) false

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Answer: b

Explanation: Counters detect gate level stuck-at faults and bridging faults of the circuit under test.

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2. How many test patterns are required to test the circuit using counters?

- a)  $2^n$

b)  $2^{(n-1)}$

c)  $2^n - 1$

d)  $2^n + 1$

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Answer: a

Explanation: A n-bit counter, generates  $2^n$  possible test patterns which is sufficient to completely test n-bit combinational logic circuit with no feedback.

3. The desired N value for counters is

a) less than 50

b) less than 10

c) less than 25

d) less than 70

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Answer: c

Explanation: The testing using counter method is practical for lesser value of N such as within 22 to 25 since for higher values of N more number of clock cycles are necessary.

4. The least significant bit toggles for

a) every clock cycle

b) every alternate clock cycle

c) every two clock cycles

d) every four clock cycles

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Answer: a

Explanation: The least significant bit toggles every clock cycle and the most significant bit toggles every half way through and at the end of the count sequence.

5. Finite state machines are used for

a) deterministic test patterns

b) algorithmic test patterns

c) random test patterns

d) pseudo random test patterns

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Answer: b

Explanation: Finite state machines are used for algorithmic test pattern generation testing for the circuit under test.

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6. Address ordering minimizes the logic of finite state machines.

a) true

b) false

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Answer: a

Explanation: Address ordering either ascending or descending order in the first and last loop minimizes the logic of finite state machines.

7. In finite state machine the data in and data out are

a) in same ports

b) different ports

c) same register

d) different register

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Answer: b

Explanation: In finite state machine, there are separate ports for DATA IN and DATA OUT and this is a typical RAM structure.

8. \_\_\_\_\_ is used to control the read and write operations.

a) active low synchronous reset

b) active high synchronous reset

c) active low synchronous preset

d) active high synchronous preset

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Answer: b

Explanation: With the use of active high synchronous reset (clear) read and write operations in a finite state machine can be done.

9. Finite state machine will initially set to all zeroes.

a) true

b) false

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Answer: a

Explanation: Finite state machine has initial state initialized with all 0's whereas LFSR and CA has initial state with any state other than all 0's.

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10. Fault coverage is \_\_\_\_\_ in finite state machines.

- a) less
- b) more
- c) equal
- d) none of the mentioned

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Answer: b

Explanation: The fault coverage and area overhead is better when the initial state is initialized to all 0's in finite state machine.

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## VLSI Questions and Answers – Pseudo-Random Test Patterns-1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Pseudo-Random Test Patterns-1”.

1. Which exhibits low fault coverage?

- a) random test pattern
- b) pseudo random test pattern
- c) deterministic test pattern
- d) algorithmic test pattern

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Answer: b

Explanation: The circuit under test exhibits low fault coverage when tested with pseudo random test generation method.

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2. Large AND function will produce \_\_\_\_\_ infrequently.

- a) logic 0
- b) logic 0 and logic 1
- c) logic 1

d) neither logic 0 or 1

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Answer: c

Explanation: Large AND function produces logic 1 infrequently due to its equally likelihood of more 0's whereas large OR function produces logic 0 infrequently.

3. The circuit which incorporates \_\_\_\_\_ can be tested with weighted pseudo-random test pattern.

- a) preset
- b) reset
- c) clear
- d) break

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Answer: a

Explanation: The circuit under test which incorporates global reset or preset can be tested with pseudo-random test pattern method.

4. Circuits with global reset have fault coverage in the range of

- a) 5% to 10%
- b) 11% to 15%
- c) 15% to 20%
- d) 6% to 8%

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Answer: b

Explanation: The circuit under test with global reset has fault coverage as low as 11% to 15% due to its fault detection blocking effect.

5. The probability of given bit in LFSR being logic 0 is

- a) 0
- b) 1
- c) 0.25
- d) 0.5

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Answer: d

Explanation: The probability of given bit in LFSR being logic 0 is approximately 0.5 and NANDing two bits of LFSR gives probability as 0.25.  
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6. Initialization of the test pattern generator to all 1's generate

- a) global reset
- b) clear
- c) toggle
- d) buffer

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Answer: a

Explanation: The initialization of the test pattern generator to all 1's generates a global reset or preset during the first test vector for the initialization of circuit under test.

7. Reset signal weight is given as

- a)  $2^m$
- b)  $2^{(-m)}$
- c)  $2m$
- d)  $2(-m)$

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Answer: b

Explanation: The rule of thumb is to make the reset signal weight as  $2^{(-m)}$  where m is chosen to be greater than the sequential depth of the circuit under test.

8. The sequential depth is the number of

- a) OR gates
- b) AND gates
- c) flip flops
- d) EX-OR gates

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Answer: c

Explanation: The sequential depth of the circuit under test is the number of flip flops in the longest path between primary input and output.

9. AND gate is used to ensure whether the test patterns have sufficient clock cycles.

- a) true
- b) false

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Answer: b

Explanation: NAND gate or NOR gate helps to ensure whether the test patterns have sufficient clock cycles to propagate through the circuit under test before

10. Which method has more area overhead?

- a) random test pattern
- b) pseudo random test pattern
- c) algorithmic test pattern
- d) deterministic test pattern

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Answer: b

Explanation: The pseudo random test pattern method has more area overhead along with increased design time. These are the limitations of this method.

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## VLSI Questions and Answers – Pseudo-Random Test Patterns-2

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This set of VLSI online quiz focuses on “Pseudo-Random Test Patterns-2”.

1. Pseudo random testing can determine the test length.

- a) true
- b) false

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Answer: a

Explanation: Pseudo random testing can also determine the relationship between test confidence, fault coverage, fault detectability and test length can also be determined.

2. The pseudo-random testing has

- a) high cost
- b) less development time

- c) low cost but more testing time
- d) low cost and less testing time

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Answer: b

Explanation: Pseudo random testing method has less development time and low development cost. This can be balanced with increased test length.

3. In pseudo-random testing, the test length should be \_\_\_\_\_ the exhaustive test.

- a) lesser than
- b) greater than
- c) more than
- d) none of the mentioned

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Answer: a

Explanation: In pseudo-random testing, the test length should be less than that of the exhaustive test (its upper bound) or the test length will be prohibited for most circuits. This makes the pseudo-random testing practical.

4. Pseudo-random testing method involves

- a) homogeneous bernoulli process
- b) non homogeneous bernoulli process
- c) repeatable bernoulli process
- d) non repeatable bernoulli process

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Answer: b

Explanation: The most accurate method involved in test pattern generation is non homogeneous bernoulli process. This is called as pseudo random testing method.

5. Which method is more accurate?

- a) pseudo-random testing
- b) random testing
- c) LFSR
- d) cellular automata

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Answer: a

Explanation: Pseudo-random testing method gives more accurate results than random testing method. Its test length estimation is smaller and test quality is better.

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6. The fault coverage in a pseudo random test is determined using

- a) fault detection
- b) fault removal
- c) fault simulation
- d) fault distribution

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Answer: c

Explanation: The fault coverage in a pseudo random test can be determined by using fault simulation. The fault coverage is the measure used to rate the algorithmically generated test set.

7. Faults causing largest loss of coverage is those with

- a) smallest detectability
- b) largest detectability
- c) all of the mentioned
- d) none of the mentioned

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Answer: a

Explanation: Faults causing largest loss of coverage is those with smallest detectability. These faults are counted in the initial nonzero elements of the detectability profile.

8. With a test sequence of length zero, fault coverage is

- a) maximum
- b) 1
- c) 0
- d) cannot be determined

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Answer: c

Explanation: With test sequence of length zero, the fault coverage is 0 and each fault is responsible for fault coverage loss regardless of its detectability.

9. Upper bound fault is the fault with detectability

- a) 0
- b) 1

- c) maximum
- d) minimum

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Answer: b

Explanation: Upper bound fault is the fault with detectability  $k=1$  and it is used where the detectability profile of the circuit under test is unknown.

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10. To reduce the size mismatch, test length is minimized.

- a) true
- b) false

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Answer: a

Explanation: If the size of pseudo-random test generator does not match with the size of the circuit under test, size mismatch occurs. This can be compromised by reducing the test length.

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# VLSI Questions and Answers – Test Pattern Generators

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Test Pattern Generators”.

1. The test pattern generator which uses a shift register along with LFSR is of \_\_\_\_\_ bits.

- a) N
- b) M
- c) N+M
- d) N\*M

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Answer: c

Explanation: The test pattern generator which uses a M-bit shift register with N-bit LFSR, the test pattern generator is of N+M bits.

2. The N+M bit test pattern generator has \_\_\_\_\_ different patterns produced.

- a)  $2^{N+M}$
- b)  $2^N + M$
- c)  $2^{N^M}$
- d)  $2^{M+N}$

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Answer: b

Explanation: The N+M bit test pattern generator can produce a maximum of  $2^{N+M}$  possible different patterns during its first cycle.

3. Which property can prevent high fault coverage?

- a) fault limit
- b) clock fault
- c) linear interloading
- d) linear dependencies

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Answer: d

Explanation: The test pattern generated in this method will contain an additional property called linear dependencies that can prevent high fault coverage in some circuits.

4. \_\_\_\_\_ are used along with flip-flops to build accumulators.

- a) adders
- b) multipliers
- c) buffers
- d) AND gates

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Answer: a

Explanation: Adders can be used in conjunction with the flip-flops to construct an accumulator that functions in test pattern generators.

5. What is the desirable constant value to be used with the initial values?

- a) 0
- b) 1
- c) N
- d) M

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Answer: b

Explanation: The constant value 1 can always be used with any initial value for a register to ensure that the accumulator increments through all combinations of test patterns.

6. Which can be used to check the working of accumulator?

- a) adder
- b) shifter
- c) multiplier
- d) counter

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Answer: d

Explanation: Counter would be more area efficient in testing whether accumulator increments through all combinations.

7. Test patterns produced by \_\_\_\_\_ have both high and least toggle rates.

- a) random pattern generator
- b) counters
- c) LFSR
- d) CA

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Answer: b

Explanation: Test patterns generated by counters have least and high toggle rates of the least and most significant bits respectively.

8. Which method does not have carry out?

- a) LFSR
- b) CA
- c) Counters
- d) Random sequence generator

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Answer: c

Explanation: The counter is a 8-bit binary up counter with active high count enable but with no carry out.

9. Which method is easiest to test?

- a) LFSR
- b) Counter
- c) CA
- d) Weighted LFSR

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Answer: a

Explanation: LFSR method is the most area efficient method and is also the easiest method to test. This is its most important advantage.

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10. Which requires more number of cycles for 100% fault coverage?

- a) internal feedback LFSR
- b) external feedback LFSR
- c) weighted LFSR
- d) ca

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Answer: b

Explanation: External feedback LFSR takes more number of cycles for 100% fault coverage than internal feedback LFSR and CA methods.

11. The detectability profile can be determined using

- a) D algorithm
- b) Cellular automata
- c) LFSR
- d) Random testing

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Answer: a

Explanation: The detectability of every fault in the circuit fault is needed for better testing. To determine this detectability profile, D algorithm is used which gives accurate results.

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# VLSI Questions and Answers – Automatic Test Pattern Generation

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Automatic Test Pattern Generation”.

1. Automatic test pattern generator detects only the fault and not its cause.

- a) true
- b) false

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Answer: b

Explanation: The test patterns generated using automatic test pattern generator is used to detect the faults and in some cases it assists in finding the cause of the failure too.

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2. The automatic test pattern generator method has \_\_\_\_\_ phases.

- a) two
- b) three
- c) four
- d) five

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Answer: a

Explanation: The automatic test pattern generator method has two phases – fault activation and fault propagation phase.

3. Faults which produce same faulty behaviour are known as

- a) similar faults
- b) equivalent faults
- c) correlative faults
- d) ambiguous faults

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Answer: b

Explanation: Two or more faults may produce same faulty behaviour for all input patterns and these faults are known as equivalent faults.

4. The process of removing equivalent faults is called as

- a) equivalent removing
- b) bulk damaging
- c) fault collapsing
- d) fault reduction

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Answer: c

Explanation: The process of removing equivalent faults from the entire set of faults is called as fault collapsing. Any single fault from the whole set of equivalent faults can represent it.

5. ‘n’ signal lines can potentially have \_\_\_\_\_ stuck-at faults.

- a)  $n^2$
- b)  $2n$
- c)  $n$
- d)  $n/2$

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Answer: b

Explanation: If a circuit has n signal lines, then potentially it can have  $2n$  stuck-at faults defined on the circuit.

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6. The stuck-at model is a \_\_\_\_\_ fault model.

- a) recurring
- b) equivalent
- c) simple
- d) logical

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Answer: d

Explanation: The stuck-at model is a logical fault model because no delay information is associated with the fault definition.

7. Stuck-at fault is an example of \_\_\_\_\_ fault model.

- a) transient
- b) permanent
- c) intermittent
- d) simple

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Answer: b  
Explanation: Stuck-at fault model is also called a permanent fault model because the faulty effect is assumed to be permanent.

8. Transient faults does not depend on operating condition.

- a) true
- b) false

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Answer: b

Explanation: Transient faults occur sporadically depending on operating condition and on the data values on surrounding signal lines.

9. The \_\_\_\_\_ between two signal is called as bridging fault.

- a) open circuit
- b) break
- c) connection
- d) short circuit

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Answer: d

Explanation: A short circuit between two signal lines is called as bridging fault and it is similar to stuck-at fault model.  
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10. The sum of all propagation delays along a single path is given as

- a) gate delay fault
- b) transition fault
- c) path delay fault
- d) propagation fault

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Answer: c

Explanation: Path delay fault is given as the sum of all propagation faults along a single path. This fault shows that delay of one or more path exceeds the clock period.

11. Which method is more complex?

- a) stuck at fault
- b) CA
- c) combinational ATPG
- d) sequential ATPG

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Answer: d

Explanation: Sequential automatic test pattern generation method is more complex and remains a complex task for large highly sequential circuits.

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## VLSI Questions and Answers – Fault Models

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Fault Models”.

1. Which are processing faults?

- a) missing contact window
- b) parasitic transistor
- c) oxide breakdown
- d) all of the mentioned

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Answer: d

Explanation: Some of the real defects in chip such as processing faults are missing contact window, parasitic transistor and oxide breakdown.

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2. Surface impurities occurs due to ion migration.

- a) true
- b) false

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Answer: a

Explanation: Some of the material defects are bulk defects and surface impurities. Bulk defects are cracks and crystal imperfection and surface impurities occurs due to ion migration.

3. Electromigration is a

- a) processing fault
- b) material defects
- c) time dependent failure
- d) packaging fault

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Answer: c

Explanation: Different types of real defects in chips are processing fault, material defects, time dependent failure and packaging fault. Time dependent failures are dielectric breakdown and electromigration.

4. Which relation is correct?

- a) failure – error – fault
- b) fault – error – failure
- c) error – fault – failure
- d) error – failure – fault

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Answer: b

Explanation: The relation fault – error – failure is correct. Error is caused by faults and failure which is a deviation of the circuit is caused by error.

5. For a circuit with k lines \_\_\_\_\_ single stuck-at fault is possible.

- a) k
- b) 2k
- c)  $k/2$
- d)  $k^2$

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Answer: b

Explanation: For a circuit with k lines,  $2k$  single stuck-at faults are possible and  $3^k - 1$  multiple stuck-at faults are possible.

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6. Single stuck-at fault is technology independent.

- a) true
- b) false

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Answer: a

Explanation: Single stuck-at fault is technology independent. It can be applied to TTL, CMOS etc. It is also design style independent.

7. For a n signal lines circuit \_\_\_\_\_ bridging faults are possible.

- a) n
- b)  $2n$
- c)  $n^2$
- d)  $n/2$

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Answer: c

Explanation: For circuit with n lines,  $n^2$  bridging faults are possible. Bridging fault occurs when two lines are connected when they should not be connected. It leads to wired AND or wired OR.

8. IDDQ fault occurs when there is

- a) increased voltage
- b) increased quiescent current
- c) increased power supply
- d) increased discharge

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Answer: b

Explanation: When input is low, both P and N transistors are conducting causing increase in quiescent current which leads to IDDQ fault.

9. Which fault causes output floating?

- a) stuck-open
- b) stuck-at
- c) stuck-on
- d) IDDQ

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Answer: a

Explanation: Transistor with stuck-open fault causes output floating. Stuck-open faults requires two vector tests.

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10. Data retention time comes under \_\_\_\_\_ fault.

- a) functional fault
- b) memory fault
- c) parametric fault
- d) structural fault

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Answer: c

Explanation: One of the memory faults is a parametric fault. Some of the parametric faults are noise margin, data retention time, power consumption, output levels, etc.

11. In PLA, missing cross point in OR-array leads to

- a) OR fault
- b) growth fault
- c) missing fault
- d) disappearance fault

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Answer: d

Explanation: In PLA, missing cross point in AND array leads to growth fault and missing cross point in OR-array leads to disappearance fault.

12. In PLA, extra crosspoint in AND-array leads to

- a) OR fault
- b) growth fault
- c) missing fault
- d) disappearance fault

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Answer: d

Explanation: In PLA, extra crosspoint in AND-array leads to shrinkage or disappearance fault whereas extra crosspoint in OR-array leads to appearance fault.

13. The number of paths \_\_\_\_\_ with number of gates.

- a) increases exponentially
- b) decreases exponentially
- c) remains the same
- d) increases rapidly

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Answer: a

Explanation: The number of paths increases exponentially with number of gates. Propagation delay of the path exceeds the clock interval.

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14. The quality of the test set is measured by

- a) fault margin
- b) fault detection
- c) fault correction
- d) fault coverage

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Answer: d

Explanation: The quality of a test set is measured by its fault coverage. It gives the fraction of fault that are detected by the test set.

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# VLSI Questions and Answers – Design for Testability

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Design for Testability”.

1. Design for testability is considered in production for chips because:

- a) Manufactured chips are faulty and are required to be tested
- b) The design of chips are required to be tested
- c) Many chips are required to be tested within short interval of time which yields timely delivery for the customers
- d) All of the mentioned

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Answer: c

Explanation: Design for testability is considered in production for chips because many chips are required to be tested within short interval of time which yields timely delivery for the customers.

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2. The functions performed during chip testing are:

- a) Detect faults in fabrication
- b) Detect faults in design
- c) Failures in functionality

d) All of the mentioned

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Answer: d

Explanation: The functions performed during chip testing are detecting faults in fabrication and design failures in functionality.

3. ATPG stands for:

- a) Attenuated Transverse wave Pattern Generation
- b) Automatic Test Pattern Generator
- c) Aligned Test Parity Generator
- d) None of the mentioned

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Answer: b

Explanation: ATPG is an Automatic Test Pattern Generator.

4. Delay fault is considered as:

- a) Electrical fault
- b) Logical fault
- c) Physical defect
- d) None of the Mentioned

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Answer: b

Explanation: Delay fault is considered a logical fault.

5. A metallic blob present between drain and the ground of the n-MOSFET inverter acts as:

- a) Physical defect
- b) Logical fault as output is stuck on 0
- c) Electrical fault as resistor short
- d) All of the mentioned

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Answer: d

Explanation: A metallic blob present between drain and the ground of the n-MOSFET inverter acts as Physical defect, Logical fault as output is stuck on 0, Electrical fault as resistor short.

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6. High resistance short present between drain and ground of n-MOSFET inverter acts as:

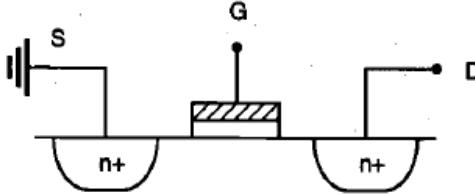
- a) Pull up delay error
- b) Logical fault as output is stuck at 1
- c) Electrical fault as transistor stuck on
- d) All of the mentioned

[View Answer](#)

Answer: a

Explanation: High resistance short present between drain and ground of n-MOSFET inverter acts as Pull up delay error.

7. The defect present in the following MOSFET is:



- a) Logical stuck at 1

- b) Logical stuck at 0

- c) Physical defect

- d) Electrical Transistor stuck open

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Answer: d

Explanation: The dimensions of the gate is less than the distance between source and drain.

8. The fault simulation detects faults by:

- a) Test generation
- b) Construction of fault Dictionaries
- c) Design analysis under faults
- d) All of the mentioned

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Answer: d

Explanation: None.

9. The ease with which the controller establishes specific signal value at each node by setting input values is known as:

- a) Testability
- b) Observability
- c) Controllability
- d) Manufacturability

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Answer: c

Explanation: Controllability is defined as the ease with which the controller establishes specific signal value at each node by setting input values.

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10. The ease with which the controller determines signal value at any node by setting input values is known as:

- a) Testability
- b) Observability
- c) Controllability
- d) Manufacturability

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Answer: b

Explanation: Observability is defined as the ease with which the controller determines signal value at any node by setting input values.

11. The poor controllability circuits are:

- a) Decoders
- b) Clock generators
- c) Circuits with feedback
- d) All of the mentioned

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Answer: d

Explanation: None.

12. The circuits with poor observability are:

- a) ROM
- b) PLA
- c) Sequential circuits with long feedback loops
- d) All of the mentioned

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Answer: c

Explanation: None.

13. Large number of input vectors are used to set a particular node (1) or (0), to propagate an error at the node to output makes the circuit low on:

- a) Testability
- b) Observability
- c) Controllability
- d) All of the mentioned

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Answer: a

Explanation: The circuit is said to be low on Testability if large number of input vectors are used to set a particular node (1) or (0), to propagate an error at the node to output.

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14. Divide and Conquer approach to large and complex circuits for testing is found in:

- a) Partition and Mux Technique
- b) Simplified automatic test pattern generation technique
- c) Scan based technique
- d) All of the mentioned

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Answer: a

Explanation: Divide and Conquer approach to large and complex circuits for testing is found in the partition and Mux technique.

15. LSSD stands for:

- a) Linear system synchronous detection
- b) Level sensitive system detection
- c) Level sensitive scan design
- d) Level sensitive scan detection

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Answer: c

Explanation: None.

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# VLSI Questions and Answers – Submicron CMOS

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Submicron CMOS”.

1. Submicron CMOS technology is

- a) faster
- b) slower
- c) large
- d) slow and large

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Answer: a

Explanation: Submicron CMOS technology is faster small and device dimensions are closely interrelated.

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2. In CMOS devices, which has slower performance?

- a) n-transistor
- b) p-transistor
- c) all of the mentioned
- d) none of the mentioned

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Answer: b

Explanation: In CMOS devices, p-transistors have inherently slower performance than similar n-transistors and this is due to lower mobility of holes compared with that of the electrons.

3. As the channel length is scaled down, influence of mobility

- a) increases
- b) decreases
- c) remains the same
- d) does not affect

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Answer: b

Explanation: As the channel lengths are scaled down, the influence of mobility starts to diminish as the effects of velocity saturation begin to be felt.

4. Current drive is \_\_\_\_\_ to mobility.

- a) directly proportional
- b) inversely proportional
- c) logarithmically proportional
- d) exponentially proportional

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Answer: a

Explanation: Current drive is directly proportional to mobility and inversely proportional to the channel length L.

5. When velocity saturation occurs,  $I_{dsat}$  is \_\_\_\_\_ to  $V_{sat}$ .

- a) inversely proportional
- b) directly proportional
- c) logarithmically proportional
- d) not related

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Answer: b

Explanation: When velocity saturation occurs, drive current saturation  $I_{dsat}$  is directly related to saturation velocity. It is given as  $I_{dsat} = W \cdot C_{ox} \cdot V_{sat} \cdot (V_{gs} - V_t)$ .

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6. Current is dependent on \_\_\_\_\_ when saturation velocity occurs.

- a) mobility
- b) channel length
- c) saturation velocity
- d) transconductance

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Answer: c

Explanation: When saturation velocity occurs, current becomes independent of mobility and the channel length and it is dependent on only saturation velocity.

7. Transconductance is independent of

- a) channel width
- b) channel length
- c) material
- d) channel depth

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Answer: b

Explanation: Transconductance is a constant and it independent of the channel length. Current is independent of mobility and channel length.

8. Velocity saturation occurs at

- a) lower electric field strength in n-devices
- b) higher electric field strength
- c) intermittent electric field strength
- d) lower electric field strength in p-devices

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Answer: a

Explanation: Velocity saturation occurs at lower electric field strengths in n-devices owing to their higher mobility when compared with p-devices.

9. When dimensions are scaled down \_\_\_\_\_ tends to a constant value.

- a) current drive from p-transistors
- b) current drive from n-transistors
- c) voltage drive from p-transistors
- d) voltage drive from n-transistors

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Answer: b

Explanation: When dimensions are scaled down, current drive from n-transistors tends to a constant value independent of channel length.

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10. At \_\_\_\_\_ length, the holes start to run into velocity saturation.

- a) shorter
- b) larger
- c) all of the mentioned
- d) none of the mentioned

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Answer: a

Explanation: At shorter length, the holes start to run into velocity saturation and the current drive from p-transistors does not tend to a constant value.

11. \_\_\_\_\_ technology is used to provide for faster devices.

- a) silicon based FET technology
- b) silicon based MOS technology
- c) gallium arsenide based MOS technology
- d) gallium arsenide based VLSI technology

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Answer: d

Explanation: Gallium arsenide based VLSI technology is used to provide for the faster devices which will be required as the sophistication of our system design capabilities.

12. Silicon logic is faster than gallium arsenide.

- a) true
- b) false

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Answer: b

Explanation: Silicon logic has speed limitations that are becoming apparent in the state-of-the-art fast digital system design.

13. \_\_\_\_\_ is used with silicon to satisfy the need for very high speed integrated technology.

- a) gallium oxide
- b) gallium arsenide
- c) silicon dioxide
- d) aluminium

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Answer: b

Explanation: Gallium arsenide is used in conjunction with silicon to satisfy the need for very high speed integrated technology (VHSI) in many new systems.

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# VLSI Questions and Answers – Gallium Arsenide VLSI

This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Gallium Arsenide VLSI”.

1. Gallium arsenide has \_\_\_\_\_ electron mobility.

- a) high speed
- b) low speed
- c) smaller
- d) larger

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Answer: a

Explanation: The high speed electron mobility of gallium arsenide with respect to silicon is better for innovative systems.

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2. Which technology has semi-insulating substrate?

- a) silicon
- b) silicon nitride
- c) gallium oxide
- d) gallium arsenide

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Answer: d

Explanation: Gallium arsenide has semi-insulating substrate with consequent lower parasitics which improves its opto-electrical properties.

3. Gallium is produced as a byproduct of

- a) aluminium production process
- b) sulphur production process
- c) nitrogen production process
- d) oxygen production process

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Answer: a

Explanation: Gallium which is a toxic material is produced as a byproduct of zinc production process and aluminium production processes.

4. Arsenic is produced from

- a) AsS<sub>3</sub>
- b) As<sub>2</sub>S<sub>3</sub>
- c) As<sub>2</sub>S
- d) As<sub>2</sub>S<sub>3</sub> or As<sub>2</sub>S<sub>4</sub>

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Answer: d

Explanation: Arsenic which is also very toxic material is produced from the ores such as As<sub>2</sub>S<sub>3</sub> or As<sub>2</sub>S<sub>4</sub>.

5. The first process involved in the production of arsenic is

- a) reduction
- b) oxidation
- c) combination
- d) diffusion

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Answer: b

Explanation: Firstly, the ores go through the oxidation process and then reduction with carbon is done to produce arsenic.

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6. Gallium has a

- a) positively charged nucleus +31
- b) positively charged nucleus +33
- c) negatively charged nucleus -31
- d) negatively charged nucleus -33

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Answer: a

Explanation: Gallium has a positively charged nucleus of +31 whereas arsenic has positively charged nucleus of +33.

7. Energy level of electrons are dictated by

- a) electron's charges
- b) electron's momentum
- c) electron's mass
- d) electron's weight

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Answer: b

Explanation: Each electron in its relationship with its parent nucleus exhibits an energy value. This energy is dictated by electron's momentum and its physical proximity to the nucleus.

8. The energy is greater as closer the electron is to the nucleus.

- a) true
- b) false

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Answer: a

Explanation: The closer the electron is to the nucleus the greater is the holding influence of the nucleus and greater is the energy required for the electron to break loose and become free.

9. Which are more stronger?

- a) outer orbit electrons
- b) outer orbit protons
- c) inner orbit electrons
- d) inner orbit protons

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Answer: a

Explanation: Outer orbit electrons are said to be stronger than inner orbit electrons because of their ability to break loose from the parent atom. These are called as valence electrons.

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10. Gallium arsenide is made up of

- a) single element
- b) compound of two elements
- c) compound of three elements
- d) compound of four elements

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Answer: b

Explanation: Gallium arsenide is a compound semiconductor that is defined as a compound of two elements whereas silicon is a single element semiconductor.

11. Gallium has \_\_\_\_\_ valence electrons.

- a) two
- b) three
- c) four
- d) five

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Answer: b

Explanation: Gallium has three valence electrons and arsenic has five valence electrons. These two are combined to form gallium arsenide.

12. Gallium arsenide is a

- a) binary semiconductor
- b) trinary semiconductor
- c) ternary semiconductor
- d) unary semiconductor

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Answer: a

Explanation: Gallium arsenide is a binary semiconductor and high temperatures should be avoided which might result in dissociation of the surface.

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## VLSI Questions and Answers – Doping Process of GA-1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Doping Process of GA-1”.

1. Addition of impurities is essential for creating switching devices.

- a) true
- b) false

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Answer: a

Explanation: It is necessary to introduce impurities into the semi-insulating GaAs to facilitate the creating of switching devices.  
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2. The behaviour of the switching element is decided by

- a) selection of impurity
- b) concentration density
- c) selection of impurity & concentration density
- d) none of the mentioned

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Answer: c

Explanation: Selection of the impurity and its concentration density determines the behaviour of the switching element.

3. \_\_\_\_\_ elements can act as either donors or acceptors.

- a) group II
- b) group III
- c) group IV
- d) group V

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Answer: c

Explanation: Group IV elements such as silicon can act as either donor (on Ga sites) or as acceptors (on As sites).

4. Which element is smaller?

- a) arsenic
- b) gallium
- c) silicon
- d) aluminium

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Answer: a

Explanation: Arsenic is smaller than gallium and silicon. The covalent radius of Ga is 1.26 armstrong unit whereas for As is 1.18 armstrong unit.

5. \_\_\_\_\_ is used as the dopant for the formation of n-type material.

- a) aluminum
- b) arsenic
- c) silicon
- d) gallium

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Answer: c

Explanation: Group IV impurities tend to occupy gallium sites. Silicon is used as the dopant for the formation of n-type material.

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6. Increase in positive charge \_\_\_\_\_ the effective nuclear charge.

- a) increases
- b) decreases
- c) exponentially increases
- d) does not affect

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Answer: a

Explanation: Increase in positive charge of the nucleus results in an increase in the effective nuclear charge thereby increasing the effective atomic radius.

7. \_\_\_\_\_ is used for the formation of p-type material.

- a) beryllium
- b) magnesium
- c) beryllium and magnesium
- d) aluminium

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Answer: c

Explanation: Group II elements such as beryllium and magnesium can be used for the formation of p-type materials.

8. Which is the lightest p-type dopant?

- a) beryllium
- b) magnesium
- c) silicon
- d) arsenic

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Answer: a

Explanation: Beryllium is the lightest p-type dopant for GaAs, deep implantation of the dopant atoms can be accomplished with less lattic damage.

9. \_\_\_\_\_ influences the properties of GaAs field effect transistor.

- a) length dependency
- b) structural dependency
- c) material dependency
- d) orientation dependency

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Answer: d

Explanation: Orientation dependency influences the properties of GaAs field effect transistors. Factors like etching of the crystal, ion implantation and passivation introduces the concept of orientation dependency.

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10. The ion is steered \_\_\_\_\_ of the lattice.

- a) up the open directions
- b) down the open directions
- c) up the closed directions
- d) down the closed directions

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Answer: b

Explanation: When a high energy ion enters a single crystal lattice, the ion is steered down the open directions of the lattice. This steering is called axial channeling.

11. If equivalent direction is not used \_\_\_\_\_ will be increased.

- a) ion concentration
- b) steering angle
- c) area coverage
- d) depth distribution

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Answer: d

Explanation: If a random equivalent direction is not used during ion implantation, the depth distribution will be greater than those predicted by range statistics which are used to establish penetration depth.

12. Electrons become hot in gallium arsenide when the energy of

- a) lower valley electrons decreases
- b) lower valley electrons rises
- c) higher valley electrons decreases
- d) higher valley electrons rises

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Answer: b

Explanation: In gallium arsenide, when the energy of lower valley electrons rises sufficiently at a higher electric field, the electrons become hot.

13. When electrons become hot, drift velocity

- a) increases

- b) decreases
- c) remains the same
- d) does not depend on drift velocity

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Answer: b

Explanation: When electrons becomes hot, there will be a reduction in the number of high mobility electrons and hence decrease in drift velocity.

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## VLSI Questions and Answers – Doping Process of GA-2

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This set of VLSI Question Bank focuses on “Doping Process of GA-2”.

1. \_\_\_\_\_ is a direct gap material with valence bond maximum.  
a) silicon  
b) gallium oxide  
c) gallium arsenide  
d) silicon arsenide

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Answer: c

Explanation: Gallium arsenide is a direct gap material with valence bond maximum and conduction band minimum.

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2. Narrow valleys correspond to  
a) electrons with lower mass state  
b) protons with lower mass state  
c) electrons with higher mass state  
d) protons with higher mass state

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Answer: a

Explanation: Valleys with band structure that are narrow and sharply curved corresponds to electrons with low effective mass state while valleys that are wide are characterized by larger effective masses.

3. The curvature of \_\_\_\_\_ determines the effective mass of electrons.

- a) energy versus concentration
- b) energy versus mass
- c) energy versus momentum
- d) energy versus structural design

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Answer: c

Explanation: The curvature of energy versus electron momentum profile determines the effective mass of electrons travelling through the crystal.

4. Conduction band minimum occurs at

- a) low momentum
- b) high momentum
- c) all of the mentioned
- d) none of the mentioned

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Answer: b

Explanation: The minimum point of gallium arsenide's conduction band is near the zero point of the crystal-lattice momentum. Conduction band minimum occurs at high momentum.

5. Mobility depends on

- a) concentration of impurity
- b) temperature
- c) electron efficient mass
- d) all of the mentioned

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Answer: d

Explanation: Mobility depends on several factors such as concentration of impurity, temperature and is relatively related to electron efficient mass.

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6. The effective mass of GaAs is \_\_\_\_\_ than the mass of a free electron.

- a) 0.67 times greater
- b) 0.67 times lesser
- c) 0.067 times greater
- d) 0.067 times lesser

[View Answer](#)

Answer:c

Explanation: For GaAs, the effective mass of these electrons is 0.067 times the mass of a free electron.

7. Electrons travels faster in

- a) silicon
- b) gallium arsenide
- c) aluminium
- d) silicon oxide

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Answer: b

Explanation: Electrons travel faster in gallium arsenide than in silicon as the result of their superior electron mobility brought out by the shapes of their conduction bands.

8. Electrons in low valley have high mass.

- a) true
- b) false

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Answer: b

Explanation: Electrons in the higher valleys have high mass and strong intervalleys scattering and therefore exhibit very low mobility.

9. The probability of photon emission has energy which is \_\_\_\_\_ the band gap.

- a) greater than
- b) lesser than
- c) equal to
- d) does not depend on

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Answer: c

Explanation: The probability of photon emission with energy nearly equal to the band gap is high, GaAs makes an excellent light-emitting diode.

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10. Silicon can also be used as light-emitting device.

- a) true
- b) false

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Answer: b

Explanation: Silicon cannot be used as light-emitting device. It is indirect-gap semiconductor with the conduction gap minimum separated in momentum from valence band minimum.

11. As the applied field increases

- a) drift velocity increases
- b) energy decreases
- c) drift velocity remains constant
- d) energy remains constant

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Answer: a

Explanation: As long as the resultant balance is positive, the energy and drift velocity of the charge carriers increases with an increase in the applied field.

12. Saturation velocity is attained when

- a) energy gained is greater than energy lost
- b) energy lost is greater than energy gained
- c) energy gained equals energy lost
- d) energy is fully drained

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Answer: c

Explanation: The energy gained from the field equals the energy lost as a result of collisions. At this point, drift velocity attains a limiting value called saturation velocity.

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# VLSI Questions and Answers – Technology Development in VLSI Structures-1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Technology Development in VLSI Structures-1”.

1. The GaAs fabrication has \_\_\_\_\_ gate geometry.

- a) less than one micron
- b) less than two micron
- c) more than one micron
- d) more than two micron

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Answer: a

Explanation: The GaAs fabrication has characteristics such as having less than on-micron gate geometry and less than two-micron metal pitch.  
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2. The GaAs structure has upto \_\_\_\_\_ metal.

- a) two-layer
- b) three-layer
- c) four-layer
- d) one-layer

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Answer: c

Explanation: The GaAs fabrication has the feature of having four-layer metal and four-inch diameter wafer.

3. Electron mobility of gallium arsenide is \_\_\_\_\_ that of silicon.

- a) greater than
- b) lesser than
- c) same as
- d) does not depend on

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Answer: a

Explanation: Electron mobility of gallium arsenide is six to seven times that of silicon resulting in very fast electron transit times.

4. Saturated drift velocity of gallium is \_\_\_\_\_ to that of silicon.

- a) greater
- b) lesser
- c) approximately same
- d) does not depend on

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Answer: c

Explanation: Saturated drift velocity of gallium and silicon are approximately equal. For GaAs saturation velocity occurs at a lower threshold field than for silicon.

5. Larger energy bandgap \_\_\_\_\_ parasitic capacitances.

- a) increases
- b) decreases
- c) maintains constant
- d) does not affect

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Answer: b

Explanation: Large energy bandgap offers bulk semi-insulating substrate and minimizes parasitic capacitances and allows easy electrical isolation.  
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6. In gallium arsenide, radiation resistance is

- a) stronger
- b) weaker
- c) absent
- d) very weak

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Answer: a

Explanation: In gallium arsenide radiation resistance is stronger due to the absence of gate oxide to trap charges.

7. In gallium arsenide, wider operating temperature range is possible.

- a) true
- b) false

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Answer: a

Explanation: In gallium arsenide, wider operating temperature range is possible due to the larger bandgap. GaAs devices are tolerant to wide temperature variations.

8. \_\_\_\_\_ can be used as light emitters.

- a) forward biased pn junction
- b) reverse biased pn junction
- c) forward biased pnp junction
- d) reverse biased pnp junction

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Answer: a

Explanation: Direct bandgap of GaAs allows efficient radiative recombination of electrons and holes and thus forward biased pn junction can be used as light emitters.

9. In GaAs \_\_\_\_\_ has more intrinsic mobility.

- a) electron
- b) holes
- c) proton
- d) neutron

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Answer: a

Explanation: In GaAs, electrons have intrinsic mobility of  $8000 \text{ cm}^2/\text{V.sec}$  whereas in silicon holes has more intrinsic mobility as  $500 \text{ cm}^2/\text{V.sec}$ .

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10. Which has greater intrinsic resistivity?

- a) silicon
- b) gallium arsenide
- c) gallium
- d) silicon and gallium

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Answer: b

Explanation: Gallium arsenide has greater intrinsic resistivity of  $1 \times 10^8 \text{ ohm.cm}$  whereas silicon has intrinsic resistivity of  $2.2 \times 10^5 \text{ ohm.cm}$ .

11. Silicon has a greater density than GaAs.

- a) true
- b) false

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Answer: b

Explanation: GaAs has greater density than silicon. Density of silicon is  $2.33 \text{ gm/cm}^3$  whereas for GaAs it is  $5.32 \text{ gm/cm}^3$ .

12. Which has low breakdown field?

- a) silicon
- b) GaAs
- c) gallium
- d) silicon and gallium

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Answer: a

Explanation: Silicon has low breakdown field in the range of  $3 \times 10^5 \text{ V/cm}$  whereas for GaAs it is  $4 \times 10^5 \text{ V/cm}$ .

13. Which has greater effective electron mass?

- a) silicon
- b) GaAs
- c) free electron
- d) gallium

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Answer: a

Explanation: Silicon has a greater effective electron mass than GaAs. Silicon has electron mass in the range of 0.97 times the mass of free electron.

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## VLSI Questions and Answers – Technology Development in VLSI Structures-2

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This set of VLSI Questions and Answers for Entrance exams focuses on “Technology Development in VLSI Structures-2”.

1. Which has low power dissipation?

- a) CMOS
- b) bipolar
- c) GaAs
- d) NMOS

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Answer: a

Explanation: CMOS has low power dissipation whereas bipolar has high and GaAs has medium power dissipation.

2. Which device has low input impedance?

- a) CMOS
- b) bipolar
- c) GaAs
- d) NMOS

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Answer: b

Explanation: Bipolar transistor has low input impedance and high drive current whereas CMOS and GaAs has high input impedance.

3. Which device has low noise margin?

- a) CMOS
- b) bipolar
- c) GaAs
- d) NMOS

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Answer: c

Explanation: GaAs has low noise margin whereas bipolar has medium noise margin. CMOS has high noise margin than the other two devices.

4. \_\_\_\_\_ has high packing density.

- a) CMOS
- b) bipolar

- c) GaAs
- d) CMOS and GaAs

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Answer: d

Explanation: CMOS and GaAs has high packing density whereas bipolar transistors have low packing density than CMOS and GaAs.

5. Which has low delay sensitivity to load?

- a) CMOS
- b) bipolar
- c) GaAs
- d) CMOS and GaAs

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Answer: b

Explanation: Bipolar transistors have low delay sensitivity to load and fan-out whereas CMOS and GaAs have high delay sensitivity to load, fan-in and fan-out.  
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6. Which is direct band-gap semiconductor?

- a) CMOS
- b) bipolar
- c) GaAs
- d) bipolar and GaAs

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Answer: c

Explanation: GaAs is direct band-gap semiconductor and can be used as good light-emitter whereas CMOS and bipolar are indirect band-gap semiconductors.

7. Factors significant in high speed semiconductors are

- a) carrier mobility
- b) carrier saturation velocity
- c) existence of semi-insulating substrate
- d) all of the mentioned

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Answer: d

Explanation: For very high speed operation in a semiconductor medium, three factors are significant – carrier mobility, carrier saturation velocity and existence of semi-insulating substrate.

8. MESFET is a gallium arsenide device.

- a) true
- b) false

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Answer: a

Explanation: Depletion mode and enhancement mode metal semiconductor field-effect transistor are gallium arsenide devices.

9. Second generation gallium arsenide device are

- a) high electron mobility transistor
- b) heterojunction bipolar transistor
- c) high electron mobility & heterojunction bipolar transistors
- d) none of the mentioned

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Answer: c

Explanation: High electron mobility transistor and heterojunction bipolar transistor are second generation gallium arsenide devices.  
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10. Switching delays of GaAs is in the range of

- a) 40-50
- b) 20-30
- c) 100-120
- d) 70-80

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Answer: d

Explanation: GaAs exhibits switching delays as low as 70 to 80 psec for a low power dissipation.

11. Which device has very high speed?

- a) CMOS
- b) FET
- c) GaAs
- d) MESFET

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Answer: c

Explanation: GaAs device has very high speed and low voltage swing. Bipolar device is faster than CMOS and bit slower when compared to GaAs.

12. Which has high output drive?

- a) Bipolar
- b) CMOS
- c) FET
- d) pnp

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Answer: a

Explanation: Bipolar transistor has high output drive. Whereas CMOS and GaAs has lower output drive comparatively.

13. In bipolar device, the relationship of gm and Vin can be described as

- a) directly related
- b) exponentially related
- c) inversely related
- d) logarithmically related

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Answer: b

Explanation: In bipolar device, gm is exponentially related to Vin. Mathematically it can be expressed as gm is proportional to  $e^{(Vin)}$ .  
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14. Which is unidirectional device?

- a) Bipolar
- b) CMOS
- c) FET
- d) pnp

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Answer: a

Explanation: Bipolar device is a unidirectional device whereas CMOS and GaAs devices are bidirectional devices.

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# VLSI Questions and Answers – MESFET

This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “MESFET”.

1. The gallium arsenide field effect transistor is \_\_\_\_\_ majority carrier device.

- a) bulk current insulation
- b) bulk current conduction
- c) bulk voltage insulation
- d) bulk voltage conduction

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Answer: b

Explanation: The gallium arsenide field effect transistor is a bulk current-conduction majority carrier device and is fabricated from bulk gallium arsenide.  
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2. Method used for fabrication of GaAs FET is

- a) ion implantation
- b) disposition
- c) diffusion
- d) conduction

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Answer: a

Explanation: The methods used for fabrication of gallium arsenide field effect transistors are high-resolution photolithography and ion implantation.

3. How many masking stages does fabrication of GaAs FET require?

- a) five
- b) four
- c) ten
- d) eight

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Answer: d

Explanation: The fabrication of GaAs field effect transistor requires six to eight masking stages and processing is relatively simple.

4. Which region is heavily doped?

- a) drain
- b) gate
- c) n-region
- d) p-region

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Answer: a

Explanation: In GaAs FET, a narrow metal Schottky barrier gate separates the more heavily doped drain and source.

5. Which MOSFET contains Schottky diode?

- a) GaAs
- b) Ga
- c) Si
- d) SiO<sub>2</sub>

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Answer: a

Explanation: GaAs MOSFET differs from silicon MOSFET due to the presence of Schottky diode to separate two thin n-type regions.  
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6. D type and E type MESFETs operates by \_\_\_\_\_ of existing doped channel.

- a) depletion
- b) enhancement
- c) e type MESFET
- d) d type MESFET

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Answer: a

Explanation: D type and E type MESFETs, that is ON and OFF devices operates by the depletion of an existing doped channel.

7. Which is ON device?

- a) e type MESFET
- b) d type MESFET
- c) depletion
- d) enhancement

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Answer: b

Explanation: D-MESFET is normally ‘ON’ and its threshold voltage is negative and E-MESFET is ‘OFF’ and its threshold voltage is positive.

8. The threshold voltage cannot be determined using

- a) concentration density
- b) channel thickness
- c) implanted impurity
- d) channel depth

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Answer: d

Explanation: The threshold voltage can be determined using concentration density, channel thickness and implanted impurity but cannot be determined using channel depth.

9. A highly doped thick channel exhibits \_\_\_\_\_ threshold voltage.

- a) smaller negative
- b) smaller positive
- c) larger negative
- d) larger positive

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Answer: c

Explanation: A highly doped thick channel exhibits a large negative threshold voltage. By reducing channel thickness and concentration density, positive threshold in E-MESFET can be fabricated.

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10. The MESFET has maximum

- a) gate to drain voltage
- b) gate to source voltage
- c) source voltage
- d) drain voltage

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Answer: b

Explanation: The MESFET has a maximum gate to source voltage  $V_{gs}$  of about 0.7-0.8 volt owing to the diode action of schottky diode gate.

11. Schottky barrier is created due to the difference in

- a) voltages
- b) thickness
- c) work function
- d) density

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Answer: c

Explanation: Schottky barrier is an electrostatic potential barrier created at the interface as a result of the difference in work function of the two materials.

12. As the separation between metal-semiconductor surface is reduced, induction charge

- a) increases
- b) decreases
- c) remains constant
- d) is not affected

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Answer: a

Explanation: As the separation between metal-semiconductor surface is reduced, induction charge in the semiconductor increases and also the space charge layer widens.

13. In MESFET for gate \_\_\_\_\_ junction is used.

- a) pnp junction
- b) npn junction
- c) schottky junction
- d) n junction

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Answer: c

Explanation: Metal semiconductor field effect transistor is similar to JFET. In this instead of using pn junction for gate, Schottky gate is used.

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14. MESFET is constructed in

- a) SiC
- b) InP
- c) GaAs
- d) All of the mentioned

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Answer: d

Explanation: MESFET is constructed in compound semiconductor technologies lacking high quality surface such as GaAs, InP and SiC.

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# VLSI Questions and Answers – GaAs Fabrication -1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “GaAs Fabrication -1”.

1. Gallium arsenide crystals are grown from

- a) boron oxide
- b) silicon oxide
- c) silicon nitride
- d) boron nitride

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Answer: d

Explanation: Growth of gallium arsenide crystals from high purity boron nitride cubicles is becoming the primary growth technique.

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2. Wafers in GaAs fabrication are thermally unstable.

- a) true
- b) false

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Answer: b

Explanation: The fabrication of GaAs includes production of round wafers and they are thermally stable and have superior semi-insulating properties.

3. The sequence of the steps followed in fabrication of GaAs is

- i. lapping
- ii. polishing
- iii. grinding
- iv. wafer scrubbing

- a) ii, iii, i, iv
- b) i, ii, iii, iv

- c) iii, i, ii, iv
  - d) iv, i, ii, iii
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Answer: c

Explanation: The steps followed in fabrication of GaAs are grinding the As-grown boules, wafering, edge rounding, lapping, polishing and then wafer scrubbing.

4. Which devices are fabricated using planar process?

- a) enhancement mode MESFET
- b) depletion mode MESFET
- c) enhancement mode MOSFET
- d) depletion mode MOSFET

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Answer: b

Explanation: The depletion mode devices are fabricated using planar process where n-type dopants are directly implanted into semi-insulating GaAs.  
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5. Threshold voltage can be varied by

- a) varying impurity concentration
- b) varying doping level
- c) varying channel length
- d) varying source voltage

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Answer: b

Explanation: Threshold voltage in GaAs can be varied by varying the channel thickness and the doping level of the active region.

6. Stable native oxide was produced by

- a) oxidation of silicon
- b) oxidation of gallium
- c) oxidation of boron
- d) oxidation of aluminium

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Answer: a

Explanation: The driving force with silicon technology were brought about as the result of presence of stable native oxide which was readily produced through oxidation of silicon.

7. In GaAs technology, deposited dielectric films brings about

- a) passivation
- b) combination
- c) decomposition
- d) diffusion

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Answer: a

Explanation: In GaAs technology, due to the absence of a stable native oxide deposited dielectric films brings about passivation or encapsulation.

8. Formation of n-active layer is achieved by

- a) indirect ion implantation
- b) direct ion implantation
- c) liquifying
- d) wafering

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Answer: b

Explanation: Formation of n-active layer is achieved by direct ion implantation into the GaAs semi-insulating substrate through the insulating layer.  
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9. Implantation of \_\_\_\_\_ is done for the formation of source and drain.

- a) n- layer
- b) n+ layer
- c) p- layer
- d) p+ layer

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Answer: b

Explanation: Implantation of a deep low resistivity n+ layer is done for the formation of source and drain and n-layer for the formation of channel layer.

10. The channel resistance is high for

- a) source contact
- b) drain contact
- c) gate contact
- d) source and drain contacts

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Answer: d  
Explanation: The channel resistance is in the order of 1000 to 2500 ohm/square which is too high for source and drain contacts.

11. Stress at the interface cannot arise from

- a) lattice mismatch
- b) intrinsic stress
- c) thermal mismatch
- d) pressure mismatch

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Answer: d

Explanation: Mechanical stability of thin film encapsulation layer depends upon stress at the interface and this can originate from lattice mismatch, intrinsic stress and thermal mismatch.

12. Which has the greatest mismatch?

- a) Si
- b) Ga
- c) GaAs
- d)  $\text{SiO}_2$

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Answer: d

Explanation:  $\text{SiO}_2$  has the greatest mismatch and its coefficient of thermal expansion is  $0.5 \times 10^{-6}/\text{degree celsius}$ .

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13. Which was employed as the first level capping material?

- a)  $\text{SiO}_2$
- b) SiO
- c)  $\text{Si}_3\text{N}_4$
- d)  $\text{Si}_2\text{N}_4$

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Answer: a

Explanation:  $\text{Si}_3\text{N}_4$  has a dielectric constant of 7 compared to 3.9 for silicon dioxide and silicon dioxide was initially employed as the first-level capping material.

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# VLSI Questions and Answers – GaAs Fabrication -2

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This set of VLSI Questions and Answers for Campus interviews focuses on “GaAs Fabrication -2”.

1. The ohmic contacts are deposited by

- a) decomposition
- b) evaporation
- c) deposition
- d) mixing

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Answer: b

Explanation: The ohmic contacts between the metal interconnect and the source and the drain are deposited by evaporation using E-beam technology.

2. Which has high parasitic gate resistance?

- a) platinum
- b) gold
- c) titanium
- d) aluminium

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Answer: c

Explanation: Titanium provides a good, high barrier, Schottky contact and has a high parasitic gate resistance.

3. Which is used as the top layer?

- a) gold
- b) platinum
- c) titanium
- d) tungsten

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Answer: a

Explanation: To reduce the parasitic resistance, gold is used as the top layer with platinum or tungsten as the intermediate layer.

4. First layer metallization is accomplished by plasma etching.

- a) true
- b) false

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Answer: a

Explanation: First layer metallization is accomplished by delineating photoresist patterns, plasma etching, deposition of metal on GaAs wafer and photoresist lift-off.

5. Deposition rate is given as

- a) width per unit time
- b) thickness per unit time
- c) sputtering rate per unit time
- d) depositing rate per unit time

[View Answer](#)

Answer: b

Explanation: Deposition rate is given as thickness per unit time. It depends upon the sticking coefficient of the depositing material and the nature of sputtering equipment.

6. Passivation is used to protect against contamination.

- a) true
- b) false

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Answer: a

Explanation: The last step for fabrication in GaAs is passivation. This process is used to protect the device against contamination and moisture.

7. Plasma-enhanced chemical vapour deposition process is used for fabrication of

- a) conducting films
- b) insulating films
- c) conducting & insulating films

d) none of the mentioned

[View Answer](#)

Answer: c

Explanation: Plasma-enhanced chemical vapour deposition process is a chemical deposition technique used for the fabrication of both insulating and conducting films.

8. Which method uses plasma excitation?

- a) PECVD
- b) low pressure CVD
- c) high pressure CVD
- d) sputtering

[View Answer](#)

Answer: a

Explanation: PECVD (plasma-enhanced chemical vapour deposition) method uses plasma excitation in addition to usual thermal energy.

9. Which causes degradation of transconductance?

- a) low source resistance
- b) high source resistance
- c) low drain resistance
- d) high drain resistance

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Answer: b

Explanation: The very thin undepleted n- layer causes high source resistance and this causes the degradation of the transconductance gm.  
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10. Cuts are not needed for

- a) ohmic contacts
- b) schottky barriers
- c) interconnect metallizations
- d) joining two layers

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Answer: d

Explanation: Cuts are made in dielectric only where ohmic contacts, schottky barriers and interconnect metallizations are required and not for joining any two layers.

11. Which is the less costly material that can be used for first-level metal?

- a) gold
- b) platinum
- c) aluminium
- d) titanium

[View Answer](#)

Answer: c

Explanation: Gold is the more costly material used for first-level and second-level metal layer whereas aluminium is the less costly material that can be used.

12. \_\_\_\_\_ is controlled by varying ion flux and velocity.

- a) doping density
- b) doping thickness
- c) doping rate
- d) doping material

[View Answer](#)

Answer: a

Explanation: Doping density and dopants distribution in the semi-insulating material are controlled by varying the ion flux and velocity.

13. The extent of damage to crystal depends on

- a) target mass
- b) mass of the implanted ion
- c) dose
- d) all of the mentioned

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Answer: d

Explanation: The extent of damage to the crystal depends on several factors such as mass of the implanted ion, target mass, energy associated with the ion, dose, temperature and displacement energies.

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# VLSI Questions and Answers – GaAs Fabrication -3

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This set of VLSI Questions and Answers for Aptitude test focuses on “GaAs Fabrication -3”.

1. Which has a lightly doped channel?

- a) E-MOSFET
- b) D-MOSFET
- c) E-JFET
- d) CE-JFET

[View Answer](#)

Answer: a

Explanation: The E-MOSFET structure is similar to that of D-MOSFET except for a shallower and more lightly doped channel.

2. To begin conduction, E-MOSFET requires

- a) negative gate voltage
- b) positive gate voltage
- c) negative drain voltage
- d) positive drain voltage

[View Answer](#)

Answer: b

Explanation: In E-MOSFET channel is in pinch-off at zero gate voltage. A positive gate voltage is required for the channel to begin conduction.

3. Wafer preparation takes place in

- a) first-level metal phase
- b) second-level metal phase
- c) encapsulation phase
- d) ion implantation phase

[View Answer](#)

Answer: c

Explanation: Encapsulation phase is the first phase and it includes wafer preparation. Encapsulation is a process of deposition of first-level insulator  $\text{Si}_3\text{N}_4$ .

4. Steps involved in ion implantation phase is

- a) metallization
- b) anneal
- c) alignment mark mask
- d) lift-off

[View Answer](#)

Answer: b

Explanation: Anneal is a process involved in ion implantation phase along with other processes like si+ implant mask, channel implant, source drain mask, etc.

5. For the formation of E-MESFET \_\_\_\_\_ is used.

- a) n- implantation
- b) n+ implantation
- c) p- implantation
- d) p+ implantation

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Answer: a

Explanation: A n- implantation is used for formation of E-MESFET and n+ implantation for the formation of D-MESFET.  
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6. To activate a dopant, \_\_\_\_\_ is necessary.

- a) low temperature stable gate
- b) low temperature stable drain
- c) high temperature stable gate
- d) high temperature stable drain

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Answer: c

Explanation: The anneal cycle requires a stable temperature of 850 degree celcius to activate the dopants it is necessary to choose high temperature stable gate.

7. The voltage swing for schottky barrier gate should be

- a) low
- b) high
- c) very high
- d) very low

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Answer: a

Explanation: Schottky barrier gates on GaAs cannot be forward biased above 0.7 to 0.8 volt, the permissible voltage swing should be relatively low.

8. The E-MESFET is defined by intersection of

- a) red and yellow masks
- b) green and red masks
- c) brown and red masks
- d) green and yellow masks

[View Answer](#)

Answer: b

Explanation: E-MESFET is defined by intersection of green and red masks and D-MESFET is defined by intersection of green, red and yellow masks.

9. E-JFET technology has

- a) low voltage swing
- b) high current swing
- c) high power requirements
- d) high voltage swing

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Answer: d

Explanation: E-JFET technology for ultra high speed VLSI has reduced power requirements with larger logic voltage swings.  
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10. In a CE-JFET, the ratio of electron mobility to hole mobility is equal to

- a) 4
- b) 10
- c) 5
- d) 20

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Answer: b

Explanation: In a CE-JFET, the ratio of effective channel electron mobility of the n-channel device to hole mobility of the p-channel device is equal to 10.

11. Equal number of p and n devices in a device will consume

- a) small area
- b) large area
- c) all of the mentioned

d) none of the mentioned

[View Answer](#)

Answer: b

Explanation: The circuits requiring equal numbers of p and n devices will consume large areas. Thus one must use other design methods such as precharge techniques.

12. In high electron mobility transistor, the electrons are

- a) far apart
- b) high mobility
- c) near by and low mobility
- d) far apart and high mobility

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Answer: b

Explanation: The electrons in high electron mobility transistor are spacially separated from ionized donors and they exhibit high mobility.

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# VLSI Questions and Answers – Device Modelling and Performance Estimation -1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Device Modelling and Performance Estimation -1”.

1. MESFETs are \_\_\_\_\_ modulation devices.

- a) channel area
- b) channel voltage
- c) channel current

d) channel variation  
View Answer

Answer: a  
Explanation: MESFETs are channel area modulation devices and they depend upon the capacitance of the schottky barrier.  
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2. Gallium arsenide have \_\_\_\_\_ regions of operation.

- a) two
- b) three
- c) four
- d) five

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Answer: b

Explanation: Gallium arsenide devices have three regions of operation – cutoff, linear and saturation.

3. Drain to source current is due to

- a) flow of majority carriers from drain to source
- b) flow of minority carriers from drain to source
- c) flow of majority carriers from source to drain
- d) flow of majority carriers from drain to source

View Answer

Answer: d

Explanation: The current  $I_{ds}$  results due to the flow of electrons, the majority carrier from source to drain.  $I_{ds}$  can be given as ratio of charge induced in channel to electron transit time.

4. Transit time can be given as the ratio of

- a) channel length to velocity
- b) electron distance to velocity
- c) source length to velocity
- d) drain length to velocity

View Answer

Answer: a

Explanation: The transit time is given as the ratio of channel length to velocity and the carrier velocity can be further given as the product of electric field and electron mobility.

5. The average potential is given as

- a)  $V_{gs} - V_t$
- b)  $0.5(V_{gs} - V_t)$
- c)  $0.25(V_{gs} - V_t)$
- d)  $2(V_{gs} - V_t)$

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Answer: b

Explanation: The average potential difference between the gate and the channel ( $V_{gb}$ ) owing to the shape of the depletion layer can be given as  $0.5(V_{gs}-V_t)$ .  
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6. Average electric field is \_\_\_\_\_ to implant depth.

- a) directly proportional
- b) indirectly proportional
- c) does not depend
- d) exponentially dependent

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Answer: b

Explanation: The average electric field is indirectly proportional to implant depth and this electric field can be given as  $(V_{gs}-V_t)/a$ .

7. The range of  $k_p$  in MESFET is

- a) 0.1 to 1 mA/V<sup>2</sup>
- b) 1 to 5 mA/V<sup>2</sup>
- c) 0.1 to 0.5 mA/V<sup>2</sup>
- d) 0 to 1 mA/V<sup>2</sup>

View Answer

Answer: c

Explanation:  $\beta$  is a common parameter used in MESFET and it is denoted by  $k_p$ .  $K_p$  is in the order of 0.1 to 0.5 mA/V<sup>2</sup>.

8. The hyperbolic tangent function is used to describe the

- a) channel conductance
- b) channel length
- c) channel strength

d) channel depth  
View Answer

Answer: a

Explanation: The hyperbolic tangent function  $\tanh(aVds)$  is used to describe the channel conductance at low drain to source voltage  $Vds$ .

9. The magnitude of the depletion region decreases when

- a)  $Vgs$  decreases
- b)  $Vgs$  increases
- c)  $Vds$  increases
- d)  $Vds$  decreases

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Answer: b

Explanation: When the gate to source voltage  $Vgs$  increases, the magnitude of the depletion region beneath the gate decreases.

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10. Current saturation occurs when

- a)  $Vgs < Vt$
- b)  $Vgs > Vt$
- c)  $Vgs > Vds$
- d)  $Vgs = Vt$

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Answer: a

Explanation: When  $Vgs < Vt$  the increase in drain to source voltage above the saturation voltage leads to current saturation.

11. Velocity saturation occurs in

- a) low electric field
- b) high electric field
- c) low magnetic field
- d) high magnetic field

View Answer

Answer: b

Explanation: The saturation of drain current with an increasing drain to source voltage is caused by velocity saturation which occurs in high electric field in the channel.

12. Knee voltage is the boundary between

- a) active region and saturation region
- b) linear and non linear region
- c) linear and saturation region
- d) linear and cutoff region

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Answer: c

Explanation: The boundary between the linear and saturation regions defined by  $Vds=Vgs-Vt$  is referred to as the 'knee voltage'.

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## VLSI Questions and Answers – Device Modelling and Performance Estimation – 2

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This set of VLSI Assessment Questions and Answers focuses on “Device Modelling and Performance Estimation – 2”.

1. Depletion mode MESFET operates as

- a) reverse biased
- b) forward biased
- c) both reverse and forward biased
- d) none of the mentioned

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Answer: a

Explanation: Depletion mode MESFET operates as reverse biased ( $V_t$  is lesser than  $V_{gs}$ ) and enhancement mode MESFET operates as forward biased.

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2. Pinch-off voltage is equal to

- a) built-in potential
- b) applied voltage
- c) sum of built-in potential and applied voltage
- d) difference of built-in potential and applied voltage

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Answer: c

Explanation: Pinch-off voltage is the total voltage, both built-in potential and applied voltage necessary to completely deplete the channel of mobile charge carriers.

3. Pinch-off voltage is a function of

- a) channel depth
- b) channel thickness
- c) channel length
- d) channel density

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Answer: b

Explanation: Pinch-off voltage is a function of both channel thickness ‘a’ and concentration density  $N_d$  and it is always positive.

4. The threshold voltage is sensitive to

- a) channel length
- b) channel depth
- c) doping density
- d) doping of the channel layer

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Answer: d

Explanation: The threshold voltage  $V_t$  is very sensitive to both the channel thickness ‘a’ and the doping of the channel layer.

5. The dynamic switching energy must exceed the capacitive load.

- a) true
- b) false

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Answer: a

Explanation: In logic structure, the dynamic switching energy must exceed the energy stored in the capacitive load.

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6. To keep dynamic switching energy small

- a) logic voltage swing must be large
- b) logic current swing must be large
- c) logic voltage swing must be small
- d) logic current swing must be small

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Answer: c

Explanation: To keep dynamic switching energy small, the logic voltage swing must be kept small. This requires proper control over threshold voltages.

7. Standard deviation of threshold voltage should be \_\_\_\_\_ of logic voltage swing.

- a) less than 5%
- b) more than 5%
- c) less than 10%
- d) more than 10%

[View Answer](#)

Answer: a

Explanation: To achieve proper control over the threshold voltage, the standard deviation of threshold voltage should be maintained less than 5% of the logic voltage swing.

8. In D-MESFET, voltage swing is less than 1V.

- a) true
- b) false

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Answer: b

Explanation: In D-MESFET, the logic voltage swing can be larger than 1V which means tolerance to higher threshold voltage variation can be accommodated.

9. Threshold voltage is \_\_\_\_\_ on implant depth.

- a) proportionally dependent
- b) inversely proportionally dependent
- c) exponentially dependent
- d) logarithmically dependent

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Answer: c

Explanation: Threshold voltage is exponentially dependent on implant depth and there is the need for proper control of channel thickness.

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10. The drain current is independent of

- a) V<sub>gs</sub>
- b) V<sub>ds</sub>
- c) V<sub>t</sub>
- d) V<sub>s</sub>

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Answer: a

Explanation: The drain current saturates at the same drain to source voltage V<sub>ds</sub> and is independent of gate to source voltage V<sub>gs</sub>.

11. Impurity concentration should be

- a) greater than 20%
- b) lesser than 20%
- c) greater than 10%
- d) lesser than 10%

[View Answer](#)

Answer: b

Explanation: The channel thickness should be controlled within 20 nm and hence impurity concentration should be less than 20%.

12. Threshold voltage is independent of pinch-off voltage.

- a) true
- b) false

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Answer: b

Explanation: Threshold voltage is dependent upon pinch-off voltage V<sub>po</sub> and barrier potential and this is given as the difference between the two.

13. Pinch-off voltage is \_\_\_\_\_ to channel concentration density.

- a) directly related
- b) inversely related
- c) exponentially related
- d) is not related

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Answer: a

Explanation: Pinch-off voltage is directly related to the effective channel concentration density N<sub>d</sub>.

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## VLSI Questions and Answers – Transconductance and Voltage Swing

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This set of Basic VLSI Questions and Answers focuses on “Transconductance and Voltage Swing”.

1. Gain of MESFET is \_\_\_\_\_ to transconductance.

- a) directly proportional
- b) indirectly proportional
- c) exponentially dependent
- d) does not depend on

[View Answer](#)

Answer: a

Explanation: The gain of the MESFET is directly dependent on the transconductance and output conductance of the device.

2. Transconductance gives the relationship of

- a)  $I_{ds}$  and  $V_{ds}$
- b)  $V_{ds}$  and  $V_{gs}$
- c)  $I_{ds}$  and  $V_{gs}$
- d)  $I_{ds}$  and d

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Answer: c

Explanation: Transconductance describes the relationship between the output current  $I_{ds}$  and the input control voltage  $V_{gs}$ .

3. Output conductance gives the slope of linear characteristics.

- a) true

b) false  
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Answer: b  
Explanation: Output conductance is also used to measure the gain of MESFET and it gives the slope of output characteristics.

4. The transconductance value in cut off region is

- a)  $V_{ds}$
- b) 1
- c) cannot be determined
- d) 0

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Answer: d

Explanation: The transconductance value for cut off region is 0 and it is the relationship between  $I_d$ s and  $V_g$ s.

5. GaAs device has

- a) high bandwidth
- b) high transconductance
- c) low gate capacitance
- d) all of the mentioned

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Answer: d

Explanation: GaAs devices have high transconductance, very low gate capacitance, high gain and high bandwidth.  
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6. Transconductance is not influenced by transistor size.

- a) true
- b) false

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Answer: b

Explanation: Transconductance is independent of process and slightly influenced by the transistor size. In GaAs transconductance is both process and size dependent.

7. Switching speed does not depend on

- a) gate length
- b) gate voltage
- c) carrier mobility
- d) doping level

View Answer

Answer: d

Explanation: The switching speed of the device depends on gate length, gate voltage and carrier mobility in the channel but does not depend on the doping level.

8. The output conductance value in cut off region is

- a)  $V_{ds}$
- b) 1
- c) cannot be determined
- d) 0

View Answer

Answer: d

Explanation: The output conductance value for cut off region is 0. This gives the slope of output characteristics.

9. To improve the switching speed

- a) voltage swing should be increased
- b) voltage swing should be decreased
- c) gate length should be increased
- d) gate thickness should be increased

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Answer: a

Explanation: To improve the switching speed, the logic voltage swing should be increased and the gate length should be reduced. The increase in switching speed results in an increase in dissipation.

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10. The device turns off when

- a)  $V_{low} > V_t$
- b)  $V_{low} < V_t$
- c)  $V_{high} < V_t$
- d)  $V_{high} > V_t$

View Answer

Answer: b

Explanation: To establish the logic voltage swing and to turn off the device,  $V_{low}$  the low logic voltage level must be less than the threshold voltage  $V_t$ .

11. For finding transconductance which is kept as constant?

- a) Vss
- b) Vdd
- c) Vds
- d) Vgs

[View Answer](#)

Answer: c

Explanation: For finding transconductance, Vds is kept as constant and the ratio of the variation or change in Ids and Vgs is obtained.

12. Transconductance value is same in linear and saturation region.

- a) true
- b) false

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Answer: a

Explanation: Transconductance value is same in case of linear and saturation region whereas it is 0 in cut-off region.

13. In bipolar transistor, transconductance is \_\_\_\_\_ to collector current.

- a) directly related
- b) inversely related
- c) exponentially related
- d) not related

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Answer: a

Explanation: In bipolar transistor, transconductance is directly proportional to the collector current. It is given as  $gm = Ic(q/kT)$ .  
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14. Figure of merit does not depend on saturation velocity.

- a) true
- b) false

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Answer: b

Explanation: Figure of merit is directly related to saturation velocity Vsat. It can be given as  $ft = Vsat/2(\pi^2 L)$ .

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# VLSI Questions and Answers – FET Logic Inverter

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “FET Logic Inverter”.

1. Inverter uses D-MESFET as

- a) load
- b) switching device
- c) controller
- d) amplifier

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Answer: a

Explanation: Direct-coupled FET logic inverter uses both depletion and enhancement type devices. E-MESFET is used as switching device and D-MESFET is used as load.

2. The allowable output voltage is limited by

- a) load resistance
- b) load capacitance
- c) barrier height
- d) material used for barrier

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Answer: c

Explanation: The design of the inverter is similar to silicon nMOS circuitry and the allowable output voltage is limited by the barrier height of the Schottky gate diode.

3. For depletion mode transistor, gate is connected to

- a) Vdd
- b) source
- c) ground
- d) drain

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Answer: b

Explanation: For the depletion mode transistor, the gate is connected to the source and it is always on and only the characteristic curve  $V_{gs}=0$  is suitable.

4. In DCFL inverter, enhancement mode device is called as

- a) pull down transistor
- b) pull up transistor
- c) buffer
- d) combiner

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Answer: a

Explanation: In direct-coupled FET logic inverter, depletion mode device is called the pull-up and enhancement mode device is called as pull-down transistor.

5. Maximum voltage across enhancement mode device corresponds to minimum voltage across depletion mode device.

- a) true
- b) false

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Answer: a

Explanation: In direct-coupled FET logic inverter, maximum voltage across enhancement mode device corresponds to minimum voltage across the depletion mode transistor.

6. When current begins to flow, output voltage

- a) increases
- b) decreases
- c) remains constant
- d) does not get affected

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Answer: b

Explanation: When  $V_{in}$  exceeds threshold voltage, current begins to flow. Then the output voltage  $V_{out}$  decreases and the transistor becomes resistive.

7. Inverter threshold voltage is the point where

- a)  $V_{in} = V_t$

- b)  $V_{out} = V_t$
  - c)  $V_{in} = V_{out}$
  - d)  $V_{out}$  lesser than  $V_{in}$
- [View Answer](#)

Answer: c

Explanation: The point at which  $V_{out} = V_{in}$ , is denoted as  $V_{inv}$ . The transfer characteristic and  $V_{inv}$  can be shifted by variation of the ratio of pull-up to pull-down resistances.

8. For equal margin,  $V_{inv}$  is set as \_\_\_\_\_ of logic voltage swing.

- a) equal
- b) half of
- c) one third
- d) twice

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Answer: b

Explanation: Since the logic high level is limited by barrier potential then for equal margins  $V_{inv}$  is set to half of the logic voltage swing.

9. For E-MESFET,  $V_{inv}$  is set in midway between

- a)  $V_{dd}$  and  $V_{ss}$
- b)  $V_t$  and  $V_{in}$
- c)  $V_t$  and  $V_{out}$
- d) barrier potential and ground

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Answer: d

Explanation: In pull-down device that is E-MESFET, the inverter threshold voltage  $V_{inv}$  is set midway between barrier potential and ground.  
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10. To improve packing density, gate length should be smaller.

- a) true
- b) false

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Answer: b

Explanation: To improve packing density, gate length should be larger for the pull-up device. This will reduce drain to source saturation current.

11. The ratio of  $Z_{p.u.}/Z_{p.d.}$  for E-MESFET is

- a) 1/10
- b) 10/1
- c) 4/1
- d) 1/4

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Answer: b

Explanation: For E-MESFET, the  $Z_{p.u.}/Z_{p.d.}$  ratio is 10/1. For MESFET with  $L_{p.u.}=L_{p.d.}$ ,  $W_{p.u.}/W_{p.d.}$  is equal to 1/10.

12. In direct coupled logic, the input transistor base is connected to

- a) base output
- b) emitter output
- c) collector output
- d) ground

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Answer: c

Explanation: In direct coupled logic, the input transistor base is directly connected to the collector output without any base resistors.

13. Direct-coupled logic is easy to design.

- a) true
- b) false

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Answer: a

Explanation: Direct-coupled logic devices have fewer components, are economical and simpler to design and fabricate.

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14. For cascade inverters, the relation suitable is

- a)  $V_{in} = V_{out} > V_{inv}$
- b)  $V_{in} = V_{out} = V_{inv}$
- c)  $V_{in} < V_{out} > V_{inv}$
- d)  $V_{in} > V_{out} = V_{inv}$

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Answer: b

Explanation: For cascade inverters without degradation of levels, the relation suitable and required is  $V_{in} = V_{out} = V_{inv}$ .

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# VLSI Questions and Answers – MESFET Design-1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “MESFET Design-1”.

1. MESFET circuits are formed on \_\_\_\_\_ layers.

- a) two
- b) three
- c) four
- d) five

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Answer: a

Explanation: MESFET circuits are formed effectively on two layers – green implant layer and red gate-metal layer.

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2. If gate-metal layer is in contact with the implant layer \_\_\_\_\_ is formed.

- a) diode
- b) transistor
- c) switch
- d) buffer

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Answer: b

Explanation: If the gate-metal layer is in contact with the implant layer a transistor is formed. The implant layer and the gate-metal layer interact to form the Schottky gate where they cross one another.

3. When insulating layer is used in between the implant and gate-metal, it is used as

- a) amplifier
- b) transistor
- c) switch

d) interconnect  
View Answer

Answer: d

Explanation: If an insulating layer is introduced in between the implant and gate-metal, there is no interaction between these layers and it can be used as interconnect.

4. The MESFET properties can be varied by varying the

- a) implant
- b) implant concentration
- c) structure
- d) length

View Answer

Answer: b

Explanation: The basic properties of MESFET can be modified by varying the implant concentration density.

5. Complexity in MESFET design can be reduced by using

- a) layout design
- b) stick diagram
- c) symbolic representation
- d) transistor diagram

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Answer: c

Explanation: Through color encoding and symbolic representation of layers, it is possible to remove much of the complexity associated with the design of MESFET.

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6. \_\_\_\_\_ color is used to represent interconnections.

- a) red
- b) green
- c) yellow
- d) brown

View Answer

Answer: a

Explanation: Red (gate-metal) is used to represent Schottky gate and short interconnections.

7. Which color is used to represent first level metal?

- a) brown
- b) blue
- c) dark blue
- d) green

View Answer

Answer: b

Explanation: Blue (metal 1) is used to represent first level metal and dark blue (metal 2) is used for second level metal.

8. The \_\_\_\_\_ mask identifies all active region.

- a) blue layer
- b) red layer
- c) yellow layer
- d) green layer

View Answer

Answer: d

Explanation: The green layer mask identifies all active regions such as areas that eventually form E and D type devices, active loads and implant resistors.

9. \_\_\_\_\_ forms the more heavily doped channel of D-MESFET.

- a) red inside yellow layer
- b) green inside yellow layer
- c) yellow inside green layer
- d) green outside yellow layer

View Answer

Answer: b

Explanation: The green region inside yellow layer mask form the more heavily doped channel of the D-MESFET.

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10. \_\_\_\_\_ is used to represent the lightly doped channel of E-MESFET.

- a) red inside yellow layer
- b) green inside yellow layer
- c) yellow inside green layer
- d) green outside yellow layer

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Answer: d

Explanation: Green regions outside the yellow layer form the lightly doped channel of the E type MESFET.

11. \_\_\_\_\_ is used to represent implant.

- a) yellow
- b) red
- c) green
- d) brown

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Answer: c

Explanation: Green color is used to represent implant layer. Symbolically it is represented as E-MESFET and it is formed when crossed by gate-metal.

12. \_\_\_\_\_ is used to represent ohmic contact.

- a) yellow
- b) red
- c) green
- d) brown

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Answer: d

Explanation: Brown is used to represent ohmic contact and it is used with source/drain contacts.

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## VLSI Questions and Answers – MESFET Design-2

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This set of VLSI Problems focuses on ” MESFET Design-2?.

1. In the ring diagram, green line is used to represent

- a) E-MESFET
- b) D-MESFET
- c) Interconnection
- d) Transistor

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Answer: a

Explanation: In the ring diagram, green or dotted line represents E-MESFET while yellow or solid line represents D-MESFET.  
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2. E-type and D-type is joined together using

- a) metal 1
- b) metal 2
- c) vias
- d) interconnectors

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Answer: a

Explanation: E-type and D-type features are joined together using blue color which represents metal 1 layer.

3. What is the intermediate stage in converting ring diagram to mask layout?

- a) switch logic
- b) transistor level diagram
- c) symbolic diagram
- d) stick diagram

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Answer: c

Explanation: The ring diagrams can be turned into mask layout directly or through an intermediate symbolic representation stage.

4. In symbolic representation, rings are converted into

- a) color codes
- b) switches
- c) sticks
- d) circuit elements

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Answer: d

Explanation: Symbolic representation is the intermediate stage when turning ring diagram to mask layout and here rings are represented as circuit elements.

5. For inverters color code used is

- a) red followed by green paths
- b) green followed by red paths
- c) green followed by yellow paths
- d) red followed by yellow paths

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Answer: c

Explanation: The green followed by yellow paths are drawn for inverters and inverter based logic such as NOR gates.  
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6. In symbolic representation \_\_\_\_\_ is used to represent E-MESFET.

- a) red transistor
- b) green transistor
- c) yellow transistor
- d) blue transistor

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Answer: b

Explanation: In symbolic representation, green transistor is used to represent E-MESFET and yellow transistor is used to represent D-MESFET.

7. Global control paths are run in

- a) metal 2
- b) metal 1
- c) transistor
- d) interconnects

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Answer: a

Explanation: Long signal and global control paths are run in metal 2 parallel with the power rails.

8. \_\_\_\_\_ gives the instruction for the preparation of photomasks.

- a) design layout
- b) design rules
- c) color codes

d) layout map  
View Answer

Answer: b

Explanation: Design rules are the prescription for the preparation of photomasks that are to be used in the fabrication of integrated circuits.

9. Design rule is not influenced by maturity of property line.

- a) true
- b) false

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Answer: a

Explanation: Design rules can also be influenced by maturity of the process line. If the process is mature, then one can be assured of the process line capability allowing tighter design with fewer constraints.

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10. The separation between implant is determined from

- a) width of transistor
- b) width of E-MESFET
- c) width of D-MESFET
- d) width of photoresist

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Answer: d

Explanation: The separation between implant is determined from width of depletion region and width of photoresist.

11. MESFETs should be positioned

- a) horizontally
- b) vertically
- c) diagonally
- d) randomly

View Answer

Answer: a

Explanation: All MESFETs should be positioned horizontally owing to its anisotropic nature of GaAs which influences the threshold voltage of the device.

12. Saturated resistor is a

- a) FET with schottky gate
- b) FET without schottky gate
- c) MESFET with schottky gate
- d) MESFET without schottky gate

View Answer

Answer: d

Explanation: The saturated resistor is a MESFET with the schottky gate removed. The preferred direction for layout is vertical.

13. MIM capacitor uses

- a) metal 1
- b) metal 2
- c) metal 1 and metal 2
- d) schottky gate

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Answer: c

Explanation: The metal-insulator-metal (MIM) capacitor structure is simple using metal 1 and metal 2 as the plates of a parallel plate capacitor.

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14. The mask is derived from the structural operation of masks.

- a) true
- b) false

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Answer: b

Explanation: The mask is derived from the logical operation of the active layer masks. Some processes require isolation between devices to reduce their interaction.

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## VLSI Questions and Answers – GaAs MESFET Logics

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “GaAs MESFET Logics”.

1. Normally-on logic uses
  - a) depletion mode MESFET
  - b) enhancement mode MESFET
  - c) depletion mode FET
  - d) enhancement mode FET

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Answer: b

Explanation: Normally-on logic uses depletion mode MESFETs which are ON devices and when used as switching elements are required to be turned OFF.

2. Which is the approach used for normally-off logic?
  - a) capacitor diode FET logic
  - b) buffered FET logic
  - c) direct-coupled FET logic
  - d) capacitor coupled FET logic

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Answer: c

Explanation: The approaches used for normally-off logic are direct-coupled FET logic, buffered DCFL and source-follower DCFL.

3. \_\_\_\_\_ is needed to facilitate turn-off.
  - a) positive voltage
  - b) power supply rail
  - c) ground connection
  - d) negative voltage

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Answer: d

Explanation: Since D-MESFETs are ON devices, negative voltage is needed at the gate to facilitate turn-off.

4. \_\_\_\_\_ supply rails are required for proper operation of normally-on logic devices.
  - a) one
  - b) two
  - c) three
  - d) four

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Answer: b

Explanation: Two supply rails together with level shifting networks are necessary for proper circuit operation of normally-on logic gates.

5. In direct coupled FET logic, both depletion and enhancement mode devices are used.

- a) true
- b) false

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Answer: a

Explanation: In direct-coupled FET logic both the depletion mode and enhancement mode transistors are used. Enhancement mode FET is used as switching element and depletion mode FET is used as load.

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6. DCFL circuits have

- a) large voltage swing
- b) small voltage swing
- c) large noise margins
- d) more complexity

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Answer: b

Explanation: In direct-coupled FET logic, only small voltage swings are possible and also relatively small noise margins.

7. Which circuits have weak load drive capability?

- a) DCFL
- b) DCFL with super buffers
- c) FET logic
- d) SDCFL

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Answer: a

Explanation: DCFL circuits have weak load drive capability. This can be improved by the introduction of super buffers with expense of extra area.

8. Which logic is suitable for large loads?

- a) DCFL
- b) DCFL with super buffers
- c) FET logic
- d) SDCFL

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Answer: b

Explanation: DCFL with super buffers are used for larger loads to be driven whereas DCFL circuits are used for light load conditions.

9. Which circuit has large noise margin?

- a) DCFL
- b) DCFL with super buffers
- c) FET logic
- d) SDCFL

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Answer: d

Explanation: Source follower DCFL FET logic has power dissipation and also switching delay. This has a larger noise margin which is due to pull-up transistor being able to be turned off.

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10. Which logic is suitable for And-OR-Invert function?

- a) DCFL
- b) DCFL with super buffers
- c) FET logic
- d) SDCFL

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Answer: d

Explanation: The source-follower DCFL FET logic is most suitable for realization of And-OR-Invert function which usually assists in the optimization of logical functions.

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# VLSI Questions and Answers – FET

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “FET”.

1. Field effect transistor uses \_\_\_\_\_ to control the shape.  
 a) electric field  
 b) magnetic field  
 c) current distribution  
 d) voltage distribution

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Answer: a

Explanation: Field effect transistor uses electric field to control the shape and hence the electrical conductivity of the channel.

2. Field effect transistors are known as  
 a) unipolar device  
 b) bipolar device  
 c) tripolar device  
 d) multipolar device

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Answer: a

Explanation: Field effect transistors are unipolar transistors as they involve single-carrier-type operation.

3. The FET has \_\_\_\_\_ input impedance.  
 a) low  
 b) high  
 c) all of the mentioned  
 d) none of the mentioned

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Answer: b

Explanation: Field effect transistors have high input impedance. The conductivity of non-FET transistors are regulated by the input current thus it has low input impedance.

4. Field effect transistor's conductivity is regulated by  
 a) input current  
 b) output current  
 c) terminal voltage

d) supply voltage

[View Answer](#)

Answer: c

Explanation: Field effect transistor's conductivity is regulated by the voltage applied to a terminal (the gate) which is insulated from the device.

5. In FET, the current enters the channel through

- a) source
- b) drain
- c) gate
- d) nodes

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Answer: a

Explanation: In field effect transistor, the current enters the channel through source and the current leaves the junction through drain.

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6. Which terminal bias the transistor to operation?

- a) source
- b) drain
- c) gate
- d) base

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Answer: d

Explanation: Other than the three terminals, source drain and gate, there is a fourth terminal called as body or base. This is used to bias the transistor to operation.

7. In FET, the width is greater than the length of the gate.

- a) true
- b) false

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Answer: a

Explanation: In FET, the width is greater than the length of the gate. Length gives the distance between source and drain. Width is the extension of the transistor, in the direction perpendicular to cross section.

8. Which terminal controls the electron flow passage?

- a) source
- b) drain
- c) gate
- d) base

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Answer: c

Explanation: Gate permits the electron to flow through or block their passage by creating or eliminating the channel between source and drain.

9. The expansion of depletion region in n-channel device makes the channel

- a) narrow
- b) wide
- c) does not affect the channel
- d) cannot be determined

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Answer: a

Explanation: In n-channel depletion mode device, as the depletion region width expands, it encroaches the channel from the sides and the channel becomes narrow.

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10. Which voltage increases the channel size?

- a) negative  $V_{gs}$
- b) positive  $V_{gs}$
- c) negative  $V_{ds}$
- d) positive  $V_{ds}$

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Answer: b

Explanation: A positive gate to source voltage increases the channel size and allows the electrons to flow easily.

11. Which relation is correct?

- a)  $V_{gs}$  greater than  $V_{ds}$
- b)  $V_{ds}$  greater than  $V_{gs}$
- c)  $V_{ds}$  equal to  $V_{gs}$
- d)  $V_{gs}$  lesser than  $V_{ds}$

[View Answer](#)

Answer: a

Explanation: In FET, for either depletion or enhancement mode device the drain to source voltage is much less than the gate to source voltage.

12. Which mode of operation of FET is used, when amplification is needed?

- a) active
- b) saturation
- c) non saturation
- d) linear

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Answer: b

Explanation: Saturation mode, which is in between the ohmic and saturation region is used when amplification is needed.

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# VLSI Questions and Answers – Metal Oxide Semiconductor (MOS) Transistor – 1

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Metal Oxide Semiconductor (MOS) Transistor – 1”.

1. The conductivity of the pure silicon is raised by:

- a) Introducing Dopants (impurities)
- b) Increasing Pressure
- c) Decreasing Temperature
- d) Deformation of Lattice

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Answer: a

Explanation: By introducing Dopants free charge carriers increase further increasing the conductivity of silicon.

2. The n-type semiconductor have \_\_\_\_\_ as majority carriers.

- a) Holes
- b) Negative ions
- c) Electrons
- d) Positive ions

[View Answer](#)

Answer: c

Explanation: In n-type semiconductor the majority charge carriers present are electrons.

3. The majority carriers of p-type semiconductor are:

- a) Holes
- b) Negative ions
- c) Electrons
- d) Positive ions

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Answer: a

Explanation: The majority charge carriers of n-type semiconductors are holes.

4. The n-MOS transistor is made up of:

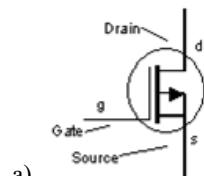
- a) N-type source, n-type drain and p-type bulk
- b) N-type source, p-type drain and p-type bulk
- c) P-type source, n-type drain and n-type bulk
- d) P-type source, p-type drain and n-type bulk

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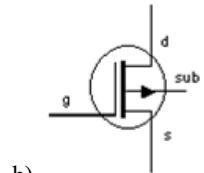
Answer: a

Explanation: n-MOS Transistor consists of n-type source, n-type drain and p-type bulk.

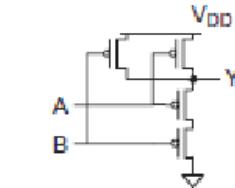
5. The correct representation of n-MOSFET is:



a)



b)

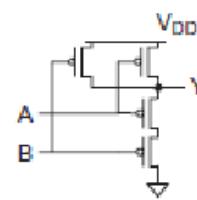


c)

- d) None of the mentioned

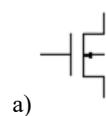
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Answer: c



Explanation: This is the correct representation of n-MOSFET :

6. The correct representation of p-MOSFET is:



a)

- b) 
- c) 
- d) 

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Answer: b



Explanation: This is the correct representation of p-MOSFET:

7. The oxide layer formed in the MOSFET is:

- a) Metal oxide
- b) Silicon dioxide
- c) Poly Silicon oxide
- d) Oxides of Non metals

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Answer: b

Explanation: Silicon Dioxide (Commonly called as glass) is the insulating oxide layer formed in MOSFET.

8. The drain current is varied by:

- a) Gate to source voltage
- b) Gate current
- c) Source Voltage
- d) None of the mentioned

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Answer: a

Explanation: The Gate to Source voltage acts as input which varies the drain current.

9. The low voltage on the gate of p-MOSFET forms:

- a) Channel of negative carriers
- b) Channel is not formed
- c) Channel is clipped
- d) Channel of positive carriers

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Answer: d

Explanation: For a p-MOS low gate voltage forms a conducting channel of positive carriers.

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10. The n-MOSFET is working as accumulation mode when:

- a) Gate is applied with positive voltage
- b) Gate is grounded
- c) Gate is applied with negative voltage
- d) Gate is connected to source

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Answer: c

Explanation: When the negative voltage is applied to the gate, there develops a presence of negative charge on the gate. The mobile positively charged holes are attracted to the region beneath the gate. This explains the formation of accumulation mode.

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# VLSI Questions and Answers – Metal Oxide Semiconductor (MOS) Transistor – 2

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Metal Oxide Semiconductor (MOS) Transistor – 2”.

1. The current through the n-MOS transistor will flow when:

- a)  $V_{gs} > V_{threshold}$ ,  $V_{ds}=0$
- b)  $V_{gd} < V_{threshold}$ ,  $V_{ds}=0$
- c)  $V_{gs} > V_{threshold}$ ,  $V_{ds}>0$
- d)  $V_{gd} > V_{threshold}$ ,  $V_{ds}<0$

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Answer: c

Explanation: The current flows through the n-MOS transistor when  $V_{gs} > V_{threshold}$ ,  $V_{ds}>0$ .

2. The p-MOS Transistor is said to be in Saturation mode when:

- a)  $V_{ds} > V_{gp} - V_{tp}$
- b)  $V_{gp} < V_{ds} - V_{tp}$
- c)  $V_{gp} > V_{tp}$
- d)  $V_{ds} < V_{gp} - V_{tp}$

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Answer: d

Explanation: The pMOS transistor is in Saturation mode when  $V_{ds} < V_{gp} - V_{tp}$  and  $V_{gp} < V_{tp}$ .

3. The Fermi potential of the p-type MOSFET is:

- a)  $f_{fp} = (kT/q)\ln(ND/NA)$
- b)  $f_{fp} = (kT/q)\ln(NA/ND)$
- c)  $f_{fp} = (kT/q)\ln(NA/ni)$
- d)  $f_{fp} = (kT/q)\ln(ni/NA)$

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Answer: d

Explanation: The Fermi potential of the p-type semiconductor is  $f_{fp} = (kT/q)\ln(ni/NA)$  where ni denotes the intrinsic carrier concentration of silicon, NA is acceptor concentration, ND is Donor Concentration.

4. The Fermi potential( $f_{fp}$ ) for the n-type MOSFET is:

- a)  $f_{fp} = (kT/q)\ln(ND/NA)$
- b)  $f_{fp} = (kT/q)\ln(NA/ND)$
- c)  $f_{fp} = (kT/q)\ln(ND/ni)$

d)  $ffp = (kT/q)\ln(n_i/ND)$

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Answer: c

Explanation: The Fermi potential of the p-type semiconductor is  $ffp = (kT/q)\ln(ND/n_i)$  where  $n_i$  denotes the intrinsic carrier concentration of silicon, NA is acceptor concentration, ND is Donor Concentration.

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5. The principle of the MOSFET operation is:

- a) Control the conduction of current between the source and the drain, using the potential difference applied at the gate voltage as a control variable
- b) Control the current conduction between the source and the gate, using the electric field applied at the drain voltage as a control variable
- c) Control the current conduction between the PN junction, using the electric field generated by the bias voltage as a control variable
- d) Control the current conduction between the PN junctions, using the electric potential generated by the gate voltage as a control variable

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Answer:a

Explanation: By varying the gate voltage the current between the source and drain are varied.

6. The conduction of current  $IDS$  depends on:

- i) Gate to source voltage
- ii) Drain to source voltage
- iii) Bulk to source voltage
- iv) Threshold voltage
- v) Dimensions of MOSFET

- a) Only i
- b) Only i, ii and iii
- c) Only v
- d) All of the mentioned

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Answer: d

Explanation: The current depends on  $V_{GS}$ ,  $V_{DS}$ ,  $V_{BS}$ ,  $V_t$  and dimensions of MOSFET.

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7. The impedance at the input of n-MOS transistor circuit is:

- a) Lesser than p-MOS transistor
- b) Greater than BJT transistor
- c) Lesser than JFET transistor
- d) Zero

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Answer: b

Explanation: The impedance at the input of n-MOS transistor is more than BJT transistor.

8. The depletion mode n-MOS differs from enhancement mode n-MOS in:

- a) Threshold voltage
- b) Channel Length
- c) Switching time
- d) None of the mentioned

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Answer: a

Explanation: If n-MOS operates with negative threshold voltage then it is in depletion mode. If n-MOS operates with positive threshold voltage then it is in enhancement mode.

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## VLSI Questions and Answers – nMOS and Complementary MOS (CMOS)

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “nMOS and Complementary MOS (CMOS)”.

1. The n-MOS invertor is better than BJT in terms of:

- a) Fast switching time
- b) Low power loss
- c) Smaller overall layout area
- d) All the mentioned

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Answer: d

Explanation: The n-MOS invertor is better than BJT invertor due to fast switching time, low power loss, smaller overall layout area.  
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2. The n-MOS invertor consists of n-MOS transistor as driven and

- a) Resistor as a load
- b) Depletion mode n-MOS as a load
- c) Enhancement mode n-MOS as a load
- d) Any of the mentioned

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Answer: d

Explanation: The n-MOS inverter consists of n-MOS and resistor or depletion mode n-MOS or enhancement mode n-MOS at the pull up load.

3. If the n-MOS and p-MOS of the CMOS inverters are interchanged the output is measured at:

- a) Source of both transistor
- b) Drains of both transistor
- c) Drain of n-MOS and source of p-MOS
- d) Source of n-MOS and drain of p-MOS

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Answer: a

Explanation: When the transistors are interchanged, The drain of n-MOS is connected to supply voltage, drain of p-MOS is connected to the ground. The output is measured at source of both the transistors.

4. What will be the effect on output voltage if the positions of n-MOS and p-MOS in CMOS inverter circuit are exchanged?

- a) Output is same
- b) Output is reversed
- c) Output is always high
- d) Output is always low

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Answer: b

Explanation: When the input is low, p-MOS is ON and the output is pulled down to the ground. When the input is high, n-MOS is ON and the output is pulled up to the supply voltage.

5. The average power dissipated in resistive load n-MOS inverter is:

- a) 0
- b)  $V_{DD} (V_{DD}-V_{OL})/R$

- c) VDD (VDD-VOL)/2R
- d) VDD (VDD-VIH)/2R

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Answer: c

Explanation: When the input voltage is equal to VOH on the other hand, both the driver MOSFET and the load resistor conduct a nonzero current. Since the output voltage in this case is equal to VOL, DC power consumption of the inverter can be estimated as  $VDD (VDD-VOL)/2R$ .

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6. The depletion mode n-MOS as an active load is better than enhancement load n-MOS in:

- a) Sharp VTC transition and better noise margins
- b) Single power supply
- c) Smaller overall layout area
- d) All of the mentioned

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Answer: d

Explanation: The depletion mode n-MOS transistor as load requires single power supply, smaller overall layout area, and sharp VTC transition.

7. The enhancement mode n-MOS load inverter requires 2 different supply voltages to:

- a) Keep load transistor in cutoff region
- b) Keep load transistor in linear region
- c) Keep load transistor in saturation region
- d) None of the mentioned

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Answer: b

Explanation: The enhancement mode n-MOS load inverter requires 2 different supply voltages to keep load transistor in linear region.

8. The CMOS inverter consists of:

- a) Enhancement mode n-MOS transistor and depletion mode p-MOS transistor
- b) Enhancement mode p-MOS transistor and depletion mode n-MOS transistor
- c) Enhancement mode p-MOS transistor and enhancement mode p-MOS transistor
- d) Enhancement mode p-MOS transistor and enhancement mode n-MOS transistor

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Answer: d

Explanation: The CMOS inverter consist of enhancement mode p-MOS and enhancement mode n-MOS.

9. In the CMOS inverter the output voltage is measured across:

- a) Drain of n-MOS transistor and ground
- b) Source of p-MOS transistor and ground
- c) Source of n-MOS transistor and source of p-MOS transistor
- d) Gate of p-MOS transistor and Gate of n-MOS transistor

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Answer: a

Explanation: In the CMOS inverter the output voltage is measured across Drain of n-MOS transistor and ground.

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10. When the input of the CMOS inverter is equal to Inverter Threshold Voltage  $V_{th}$ , the transistors are operating in:

- a) N-MOS is cutoff, p-MOS is in Saturation
- b) P-MOS is cutoff, n-MOS is in Saturation
- c) Both the transistors are in linear region
- d) Both the transistors are in saturation region

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Answer: d

Explanation: When the input of the CMOS inverter is equal to Inverter Threshold Voltage  $V_{th}$ , both the transistors are operating in saturation region

11. The switching threshold voltage  $V_{TH}$  for an ideal inverter is equal to:

- a)  $(VDD-VOL)/2$
- b)  $VDD$
- c)  $(VDD)/2$
- d) 0

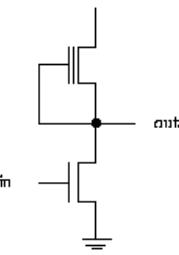
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Answer: c

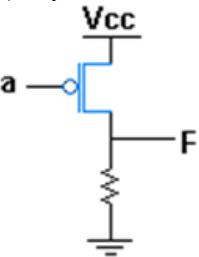
Explanation: The switching threshold voltage  $V_{TH}$  for an ideal inverter is equal to  $(VDD)/2$ .

12. Which of these inverters is more efficient?

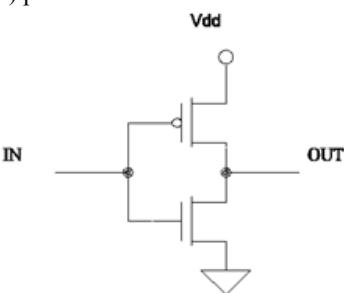
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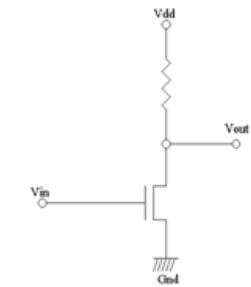
a) Depletion mode n-MOS inverter



b) pMOS inverter



c) CMOS inverter



d) Resistive load nMOS inverter

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Answer: c

Explanation: The power loss in CMOS inverter is very small and the I-V characteristics is approximately equal to ideal inverter. Therefore the CMOS inverter is most efficient.

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# VLSI Questions and Answers – MOS Transistor Threshold Voltage

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “MOS Transistor Threshold Voltage”.

1. The electrical equivalent component for MOS structure is:

- a) Resistor
- b) Capacitor
- c) Inductor
- d) Switch

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Answer: b

Explanation: The MOS structure acts as a capacitor with a metal gate and semiconductor acting as parallel plate conductors and oxide as dielectric between them.

2. The Fermi potential is the function of:

- a) Temperature
- b) Doping concentration
- c) Difference between Fermi level and intrinsic Fermi level
- d) All of the mentioned

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Answer: d

Explanation: The Fermi potential, which is a function of temperature and doping, denotes the difference between the intrinsic Fermi level and the Fermi level.

3. The direction of electric field when the gate voltage is zero:

- a) Metal to semiconductor
- b) Semiconductor to metal
- c) No electric field exists
- d) None of the mentioned

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Answer: a

Explanation: Metal being more positive compared to semiconductor. The electric field exists from metal to semiconductor.

4. Consider a MOS structure with equilibrium Fermi potential of the doped silicon substrate is given as 0.3eV. Electron affinity of Si is 4.15eV and metal is 4.1eV. Find the built in potential of the MOS system.

- a) -0.8eV
- b) 0.8eV
- c) 0.9eV
- d) -0.9eV

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Answer: d

Explanation: Surface potential:  $qFs = 4.15\text{eV} + 0.55\text{eV} + 0.3\text{eV} = 5.0\text{eV}$   
 $qFm - qFs = 4.1\text{eV} - 5.0\text{eV} = -0.9\text{eV}$ .

5. When gate voltage is negative for enhancement mode n-MOS, the direction of electric field will be:

- a) Metal to semiconductor
- b) Semiconductor to metal
- c) No field exists
- d) None of the mentioned

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Answer: b

Explanation: When gate voltage is negative, holes in substrate are attracted towards surface creating electric field from semiconductor to metal.  
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6. At threshold Voltage, the surface potential is:

- a) – Fermi potential
- b) Fermi potential
- c) 2 Fermi potential
- d) -2 Fermi potential

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Answer: a

Explanation: When surface potential reaches –fermi potential, the surface inversion occurs. The gate voltage which brings these changes is known as threshold voltage.

7. Surface inversion occurs when gate voltage is:

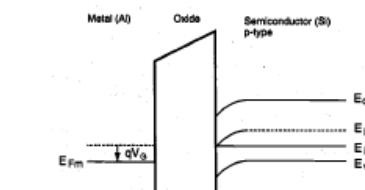
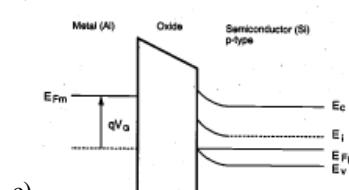
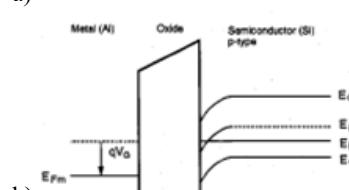
- a) Less than zero
- b) Less than threshold voltage
- c) Equal to threshold voltage
- d) Greater than threshold voltage

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Answer: c

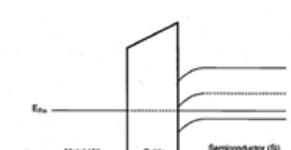
Explanation: Surface inversion occurs when gate voltage is equal to threshold voltage.

8. The energy band diagram of the MOS system when gate voltage is zero is:



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Answer: a



Explanation: The energy band diagram of enhancement mode nMOSFET when gate voltage is zero is :

9. For enhancement mode n-MOSFET, the threshold voltage is:

- a) Equal to 0
- b) Greater than zero or Positive quantity
- c) Negative voltage or lesser than zero
- d) All of the mentioned

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Answer: b

Explanation: For enhancement mode n-MOSFET, the threshold voltage is positive quantity.

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10. The threshold voltage depends on:

- a) The workfunction difference between gate and channel
- b) The gate voltage component to change surface potential
- c) The gate voltage component to offset the depletion charge and fixed charges in gate oxide
- d) All of the mentioned

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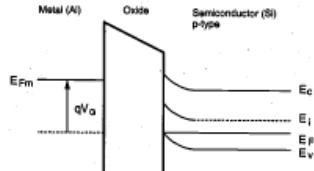
Answer: d

Explanation: The threshold voltage depends on: The workfunction difference between gate and channel, The gate voltage component to change surface potential, The gate voltage component to offset the depletion charge and fixed charges in gate oxide

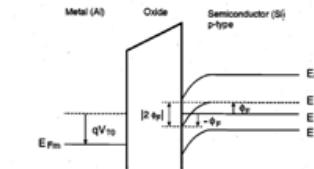
11. The Energy band diagram of MOS system when gate voltage is equal to threshold voltage is:



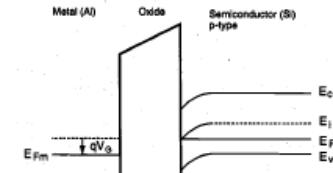
a)



b)



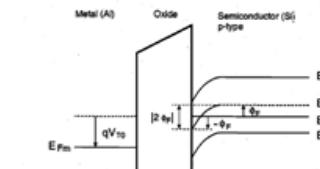
c)



d)

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Answer: c



Explanation: The Energy band diagram of MOS system when gate voltage is equal to threshold voltage is

12. The expression for threshold voltage for the enhancement mode nMOSFET is:

- a)  $F_{gc} - 2fQ_{bo}/C_{ox}Q_{ox}/C_{ox}$
- b)  $F_{gc} + fQ_{bo}/C_{ox}$
- c)  $F_{gc} - fQ_{bo}/C_{ox}Q_{ox}/C_{ox}$
- d)  $F_{gc} + 2fQ_{bo}/C_{ox}Q_{ox}/C_{ox}$

[View Answer](#)

Answer: a

Explanation: The expression for threshold voltage for the enhancement mode nMOSFET is  $F_{gc} - 2fQ_{bo}/C_{ox}Q_{ox}/C_{ox}$ .

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# VLSI Questions and Answers – Noise Margin

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Noise Margin”.

1. Noise Margin is:
  - a) Amount of noise the logic circuit can withstand
  - b) Difference between VOH and VIH
  - c) Difference between VIL and VOL
  - d) All of the Mentioned

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Answer: d

Explanation: Noise Margin is defined as the amount of noise the logic circuit can withstand, it is given by the difference between VOH and VIH or VIL and VOL.

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2. The VIL is found from transfer characteristic of inverter by:

- a) The point where the straight line at VOH ends
- b) The slope of the transition at a point at which the slope is equal to -1
- c) The midpoint of the transition line
- d) All of the mentioned

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Answer: b

Explanation: The VIL is the input voltage at which the slope of the transition will be equal to -1.

3. The VIH is found from transfer characteristic of inverter by:

- a) The point where straight line at VOH ends
- b) The slope of the transition at a point at which the slope is equal to -1
- c) The midpoint of the transition line
- d) All of the mentioned

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Answer: b

Explanation: The VIH is the input voltage at which the slope of the transition will be equal to -1. In Transfer characteristics at 2 points we will find the slope to be -1.

4. The relation between threshold voltage and Noise Margin is:

- a)  $V_{th} = \text{sqrt}(\text{Noise Margin})$
- b)  $V_{th} = NMH - NML$
- c)  $V_{th} = (NMH + NML)/2$
- d) None of the mentioned

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Answer: d

Explanation: None.

5. The Lower Noise Margin is given by:

- a)  $V_{OL} - V_{IL}$
- b)  $V_{IL} - V_{OL}$
- c)  $V_{IL} \sim V_{OL}$  (Difference between VIL and VOL, depends on which one is greater)
- d) All of the Mentioned

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Answer: b

Explanation: Noise margin =  $V_{IL} - V_{OL}$ .

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6. The Higher Noise Margin is given by:

- a)  $V_{OH} - V_{IH}$
- b)  $V_{IH} - V_{OH}$
- c)  $V_{IH} \sim V_{OH}$  (Difference between VIH and VOH, depends on which one is greater)
- d) All of the mentioned

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Answer: a

Explanation: Noise margin =  $V_{OH} - V_{IH}$ .

7. The Uncertain or transition region is between:

- a) VIH and VOH
- b) VIL and VOL
- c) VIH and VIL
- d) VOH and VOL

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Answer: c

Explanation: In Input the uncertain region is VIH and VIL.

8. The noise immunity \_\_\_\_\_ with noise margin.

- a) Decreases
- b) Increases
- c) Constant
- d) None of the Mentioned

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Answer: b

Explanation: The noise immunity is directly proportional to noise margin.

9. If VIL of the 2nd gate is higher than VOL of the 1st gate, then logic output 0 from the 1st gate is considered as:

- a) Logic input 1
- b) Uncertain
- c) Logic input 0
- d) None of the mentioned

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Answer: c

Explanation: Logic output 0 from first gate is considered as logic input 0 at second gate as it lies within the range.

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10. If VIL of the 2nd gate is lower than VOL of the 1st gate, then logic output 0 from the 1st gate is considered as:

- a) Logic input 1
- b) Uncertain
- c) Logic input 0
- d) None of the mentioned

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Answer: b

Explanation: The level of output signal from 1st gate is higher than the range for low input at 2nd gate. So it is uncertain.

11. Input Voltage between VIL and VOL is considered as:

- a) Logic Input 1
- b) Logic Input 0
- c) Uncertain
- d) None of the mentioned

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Answer: b

Explanation: None.

12. If VIH of the 2nd gate is higher than VOH of the 1st gate, then logic output 0 from the 1st gate is considered as:

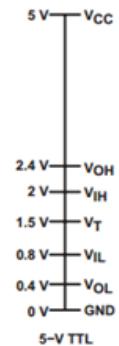
- a) Logic input 1
- b) Uncertain
- c) Logic input 0
- d) None of the mentioned

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Answer: b

Explanation: The level of output signal from 1st gate is higher than the range for low input at 2nd gate. So it is uncertain.

13. Determine the Noise Margin for 5V TTL inverter gate:



- a) NMH = 0.4V and NML = 0.4V
- b) NMH = 2.4V and NML = 0.4V
- c) NMH = 2V and NML = 0.8V
- d) NMH = 1.5V and NML = 0.4V

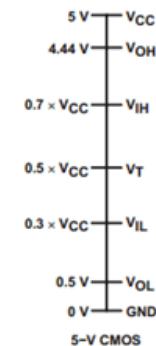
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Answer: a

Explanation: None.

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14. Determine the Noise Margin for 5V CMOS inverter gate:



- a) NMH = 1V and NML = 1V
- b) NMH = 3.7V and NML = 0.2V
- c) NMH = 0.9V and NML = 1V
- d) NMH = 0.2V and NML = 0.5V

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Answer: c

Explanation: None.

15. Noise margin of CMOS is:

- a) Better than TTL and ECL
- b) Less than TTL and ECL
- c) Equal to TTL and ECL
- d) None of the Mentioned

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Answer: a  
Explanation: None.

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# VLSI Questions and Answers – Noise in MOS Device

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This set of VLSI Multiple Choice Questions & Answers (MCQs) focuses on “Noise in MOS Devices”.

1. Noise in VLSI circuits mean:
  - a) Unwanted signals that arise due to vibration in the passive circuits
  - b) Unknown signal that limits the minimum signal level that a circuit can process with acceptable quality
  - c) Signal which undergoes distortion
  - d) All of the mentioned

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Answer: b

Explanation: In VLSI circuits noise limits the minimum signal level that a circuit process with acceptable quality.

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2. In probability Noise is described as:

- a) Random function
- b) Random process
- c) Deterministic function
- d) Deterministic process

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Answer: b

Explanation: Noise is a Random Process.

3. Noise generated by independent devices are:

- a) Correlated

- b) Uncorrelated
  - c) Equal
  - d) None of the mentioned
- [View Answer](#)

Answer: b

Explanation: Noise generated by independent devices are uncorrelated, eg: noise generated from resistor is not similar to noise generated from transistor.

4. The 2 types of noise that the analog systems face during signal processing are:

- a) Device electronic noise and environmental noise
- b) Noise due to Vibration and electronic noise
- c) Passive and active noise
- d) None of the mentioned

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Answer: a

Explanation: Device electronic noise and environmental noise affects signal processing of analog signals.

5. Thermal noise is generated from:

- a) Resistor
- b) Capacitor
- c) Inductor
- d) All of the mentioned

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Answer: a

Explanation: Thermal noise is due to random motion of electrons in a conductor.

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6. Thermal noise is generated from MOSFET by:

- a) Conduction of charge carriers in the channel
- b) Electric field across the gate and channel
- c) Capacitance of the gate oxide
- d) Substrate bias effect

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Answer: a

Explanation: Thermal noise is generated due to conduction of charge carriers in the channel.

7. Thermal noise current in the MOSFET is proportional to:

- a) Transconductance
- b) Resistance
- c) Gate voltage
- d) None of the mentioned

[View Answer](#)

Answer: a

Explanation: Noise current  $I^2 = 4kTgm$ .

8. Flicker noise is found in MOSFET at:

- a) Gate and oxide interface
- b) Gate oxide and silicon interface
- c) Source and substrate interface
- d) Drain and substrate interface

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Answer: b

Explanation: The interface between Gate oxide and silicon substrate generates flicker noise.

9. Flicker noise originates due to:

- a) Conduction in channel
- b) Drain to Source voltage
- c) Reduction in channel length
- d) Dangling bonds

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Answer: d

Explanation: Dangling bonds generate flicker noise.

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10. The average power of flicker noise depends on:

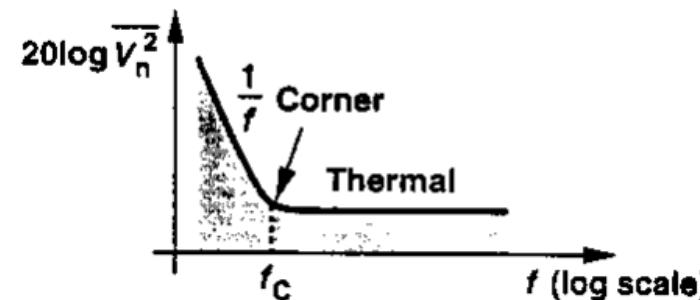
- a) Thickness of oxide
- b) Cleanliness of the oxide silicon interface
- c) Voltage on oxide
- d) Length of channel

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Answer: b

Explanation: Depending on the Cleanliness of oxide silicon interface flicker noise varies.

11. In the following graph the fc is called as:



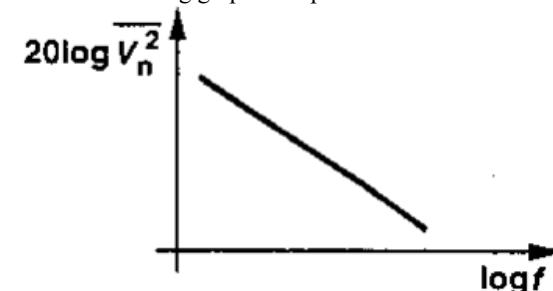
- a) Cutoff frequency
- b) Threshold frequency
- c) Corner frequency
- d) None of the mentioned

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Answer: c

Explanation: None.

12. The following graph is a spectrum of which noise:



- a) Thermal noise
- b) Gaussian Noise
- c) Flicker noise
- d) None of the mentioned

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Answer: d

Explanation: None.

13. If VIH of the 2nd gate is lower than VOH of the 1st gate, then logic output 0 from the 1st gate is considered as:

- a) Logic input 1
- b) Uncertain
- c) Logic input 0
- d) None of the mentioned

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Answer: a

Explanation: Logic output 1 from first gate is considered as logic input 1 at second gate as it lies within the range.  
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14. Input Voltage between VIH and VOH is considered as:

- a) Logic Input 1
- b) Logic Input 0
- c) Uncertain
- d) None of the mentioned

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Answer: a

Explanation: None.

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## **Analytical Instrumentation Questions and Answers – Spectral Method of Analysis**

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Spectral Method of Analysis”.

1. Spectroscopy deals with interaction of electromagnetic radiation with matter. What is the speed of this radiation in vacuum in m/s?

- a)  $6 \times 10^8$
- b)  $5 \times 10^8$
- c)  $7 \times 10^8$
- d)  $3 \times 10^8$

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Answer: d

Explanation: Speed of light is also the speed of all electromagnetic radiations. Speed of light is  $3 \times 10^8$ m/s.

2. Which type of Quantum Transition takes place in Ultra Violet and Visible spectroscopy?

- a) Rotation of molecules
- b) Nuclear
- c) Bonding electrons
- d) Spin of nuclei in a magnetic field

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Answer: c

Explanation: In UV and Visible Spectroscopy, type of Quantum Transmission is Bonding electrons. The rest of the options are Quantum Transmission type of other spectroscopic methods.

3. Which of the following is not a property or parameter of electromagnetic radiation?

- a) Wavelength
- b) Voltage
- c) Wave number
- d) Amplitude

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Answer: b

Explanation: Wavelength, Amplitude and Wavenumber are parameters of electromagnetic radiation. Other parameters are Velocity and Frequency.

4. Which of the following is not a type of Spectroscopy?

- a) Gamma ray

- b) X ray
- c) Nuclear magnetic resonance
- d) Sound

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Answer: d

Explanation: Sound is not a type of electromagnetic radiation. Hence, it is not a type of Spectroscopy.

5. Electromagnetic radiation can travel through a vacuum.

- a) True
- b) False

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Answer: a

Explanation: Electromagnetic radiation can travel through a vacuum. It does not need a medium for propagation.  
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6. Which of the following is false about the wavelengths of electromagnetic radiation?

- a) Radiation with short wavelengths have high energies
- b) Energy does not depend on wavelength
- c) Radiation with long wavelengths have low energies
- d) Energy depends on wavelength

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Answer: b

Explanation: The radiations with short wavelength have high energies and vice versa. Thus, energy depends on wavelength.

7. Which of the following is the wavelength of microwave radiation?

- a) 10 – 780nm
- b) 0.78 – 30 $\mu$ m
- c) 0.6 – 10 m
- d) 0.75 – 3.75 mm

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Answer: d

Explanation: The wavelength of Microwave radiation is 0.75 – 3.75 mm. The rest of the options are the wavelength of other Electro Magnetic radiations.

8. How is the wave number of electromagnetic radiation related to wavelength?

- a) It is the reciprocal of wavelength
- b) It is directly proportional to wavelength
- c) It is not related to wavelength
- d) It is equal to wavelength

[View Answer](#)

Answer: a

Explanation: Wave number is the number of waves spread in a length of one centimeter. It is the reciprocal of wavelength.

9. Which of the following is the wavenumber of UV and Visible radiation?

- a)  $1 \times 10^6$  to  $1.3 \times 10^4 \text{ m}^{-1}$
- b)  $1 \times 10^6$  to  $1.3 \times 10^4 \text{ m}$
- c)  $13 - 27 \text{ m}^{-1}$
- d)  $1 \times 10^6$  to  $1.3 \times 10^4 \text{ m}^2$

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Answer: a

Explanation: Wave number of UV, Visible radiation is  $1 \times 10^6$  to  $1.3 \times 10^4 \text{ m}^{-1}$ . Wave number is the reciprocal of wavelength. So, the unit is  $\text{m}^{-1}$ .  
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10. Velocity of electromagnetic radiation is more in a vacuum than in any medium.

- a) True
- b) False

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Answer: a

Explanation: Velocity of electromagnetic radiation tends to decrease when a medium is present. Hence, it attains maximum speed in a vacuum.

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# Analytical Instrumentation Questions and Answers – Introduction to UV Visible Spectrometers

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This set of Analytical Instrumentation Interview Questions and Answers focuses on “Introduction to UV Visible Spectrometers”.

1. Beer Lambert’s law gives the relation between which of the following?

- a) Reflected radiation and concentration
- b) Scattered radiation and concentration
- c) Energy absorption and concentration
- d) Energy absorption and reflected radiation

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Answer: c

Explanation: Beer Lambert’s law gives the relation between Energy absorption and Concentration. It was proposed by Beer and Lambert.

2. In which of the following ways, absorption is related to transmittance?

- a) Absorption is the logarithm of transmittance
- b) Absorption is the reciprocal of transmittance
- c) Absorption is the negative logarithm of transmittance
- d) Absorption is a multiple of transmittance

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Answer: c

Explanation: Transmittance is the ratio of the radiant power transmitted by a sample to the radiant power incident on the sample. Absorption is the negative logarithm of transmittance.

3. Which of the following is not a limitation of Beer Lambert’s law, which gives the relation between absorption, thickness and concentration?

- a) Concentration must be lower
- b) Radiation must have higher bandwidth
- c) Radiation source must be monochromatic
- d) Does not consider factors other than thickness and concentration that affect absorbance

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Answer: b

Explanation: The law is derived assuming that the radiation is monochromatic. So, if bandwidth increases it will create deviation.

4. Beer’s law states that the intensity of light decreases with respect to \_\_\_\_\_

- a) Concentration

- b) Distance
  - c) Composition
  - d) Volume
- [View Answer](#)

Answer: a  
Explanation: Beer's law states that the intensity of light decreases with the concentration of the medium. It was stated by Beer.

5. Lambert's law states that the intensity of light decreases with respect to \_\_\_\_\_

- a) Concentration
- b) Distance
- c) Composition
- d) Volume

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Answer: b

Explanation: Lambert's law states that the intensity of light decreases with respect to the concentration of the medium. It was stated by Lambert.  
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6. The representation of Beer Lambert's law is given as  $A = abc$ . If 'b' represents distance, 'c' represents concentration and 'A' represents absorption, what does 'a' represent?

- a) Intensity
- b) Transmittance
- c) Absorptivity
- d) Admittance

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Answer: c

Explanation: 'a' represents the absorption constant. It is also known as absorptivity.

7. Which of the following is not true about Absorption spectroscopy?

- a) It involves transmission
- b) Scattering is kept minimum
- c) Reflection is kept maximum
- d) Intensity of radiation leaving the substance is an indication of a concentration

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Answer: c

Explanation: In Absorption spectroscopy, reflection must also be kept minimum along with scattering. Amount of absorption depends on the number of molecules in the material.

8. Transmittance is given as  $T = P/P_0$ . If  $P_0$  is the power incident on the sample, what does  $P$  represent?

- a) Radiant power transmitted by the sample
- b) Radiant power absorbed by the sample
- c) Sum of powers absorbed and scattered
- d) Sum of powers transmitted and reflected

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Answer: a

Explanation:  $P$  represents radiant power transmitted by the sample. Transmittance is the ratio of radiant power transmitted by the sample to the radiant power that is incident on it.

9. What is the unit of absorbance which can be derived from Beer Lambert's law?

- a)  $L \text{ mol}^{-1} \text{ cm}^{-1}$
- b)  $L \text{ gm}^{-1} \text{ cm}^{-1}$
- c) Cm
- d) No unit

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Answer: d

Explanation: Absorbance has no unit. The units of absorptivity, distance and concentration cancel each other. Hence, absorption has no unit.  
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10. What is the unit of molar absorptivity or absorptivity which is used to determine absorbance  $A$  in Beer Lambert's formula?

- a)  $L \text{ mol}^{-1} \text{ cm}^{-1}$
- b)  $L \text{ gm}^{-1} \text{ cm}^{-1}$
- c) Cm
- d) No unit

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Answer: a

Explanation: The unit of absorptivity is  $L \text{ mol}^{-1} \text{ cm}^{-1}$ . If concentration is represented as gm per litre it becomes  $L \text{ gm}^{-1} \text{ cm}^{-1}$ .

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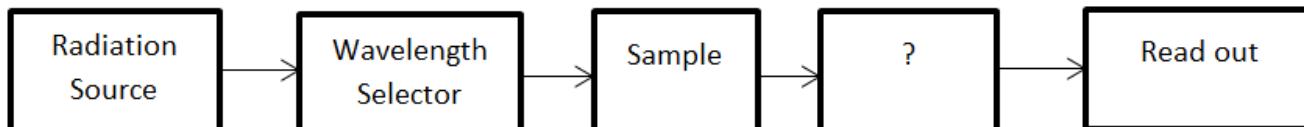
# Analytical Instrumentation Questions and Answers – Absorption Instrumentation and Block Diagram Representation

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Absorption Instrumentation and Block Diagram Representation”.

1. Which is the missing block in the block diagram for Absorption of Radiation Instrument given below?



- a) Filter
  - b) Reflector
  - c) Converging lens
  - d) Detector
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Answer: d

Explanation: To measure the amount of radiation absorbed and transmitted detector is very important. It detects the amount of radiation which is then inferred using read out device.

2. Which of the following detectors does not require a battery and is also known as barrier layer cell?

- a) Photomultiplier tube
- b) Photovoltaic cell
- c) Photoemissive tubes

d) Photo reflector  
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Answer: b

Explanation: Photovoltaic cell does not require a battery for operation. Its working is entirely different from Photomultiplier tube or Photoemissive tubes.

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3. Which of the following detectors is used to detect light intensities which are very weak?

- a) Photomultiplier tube
- b) Photovoltaic cell
- c) Photoemissive tubes
- d) Photo reflector

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Answer: a

Explanation: PMT is used for detection of light intensities which are weak. As the name suggests, Photomultiplier tube multiplies the incident electrons using dynodes causing an avalanche of electrons.

4. How is Tungsten Halogen lamp differs from normal Tungsten filament lamp used in absorption spectroscopy?

- a) It has a tungsten filament and is filled with inert gas
- b) Iodine is added to normal filling gas
- c) Iodine is coated on tungsten filament
- d) Iodine is added to inert gas

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Answer: b

Explanation: In Tungsten filament lamp tungsten filament is enclosed in a bulb of glass filled with inert gas or vacuum. In Tungsten Halogen lamp iodine is added to the normal filling glass.

5. Instead of glass filters, why gelatin filters could not be used for a long period while both are Absorption filters?

- a) Gelatin tends to evaporate and hence they deteriorate
- b) Gelatin is affected by humidity in the environment
- c) They deteriorate due to absorption of heat leading to changes in gelatin
- d) Gelation is affected by temperature in the environment

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Answer: c

Explanation: With the absorption of heat they deteriorate due to changes in gelatin. Bleaching of dye occurs.

6. How does continuous wedge filter differ from normal interference filter used in absorption spectroscopy?

- a) It permits continuous selection of different wavelength
- b) It allows a narrow band of wavelengths to pass
- c) It has two semi-transparent layers of silver
- d) Space layer is made of a substance having low refractive index

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Answer: a

Explanation: It allows continuous selection of wavelength by using a spacer film of graded thickness. Rest of the options are properties of normal interference filters.

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7. Which of the following could be used as the layer of dielectric in interference filters used in Absorption Spectroscopy?

- a) Graphite
- b) MgF<sub>2</sub>
- c) Fe
- d) AgNO<sub>3</sub>

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Answer: b

Explanation: MgF<sub>2</sub> is used as layer of dielectric in interference filters. Other material that can be used is ZnS.

8. How can stability of radiation be achieved in incandescent or discharge source used in Absorption Spectroscopy?

- a) Using filters
- b) Using monochromators
- c) Using slits
- d) By controlling the source voltage

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Answer: d

Explanation: The intensity of radiation in the incandescent source is proportional to the lamp source voltage. Therefore, by controlling the source voltage stability can be achieved.

9. To tolerate high operating temperatures, which of the following has to be done in incandescent or tungsten filament lamps?

- a) Alloys must be used

- b) Nitrogen be used instead of inert gas
- c) Envelope is fabricated with quartz
- d) Envelope is fabricated with copper

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Answer: c

Explanation: The envelope is fabricated with quartz to allow high operating temperatures. Tungsten filament and inert gas are generally used and are not modified.

10. Which of the following is not a reason for laser not being generally used as a source of radiation for UV, Visible Spectroscopy?

- a) High cost
- b) Limited range of wavelength
- c) Less intensity
- d) Complex to work with

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Answer: c

Explanation: Laser has high intensity. It is used in special applications where cost is not a matter and a limited range of wavelength is required.

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# Analytical Instrumentation Questions and Answers – Single Beam and Double Beam Instruments

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Single Beam and Double Beam Instruments”.

1. Which of the following statements is false about single beam absorption instruments?

- a) Tungsten bulb is used as a source
- b) Beam splitter is used to get parallel beam
- c) Test tube is used as sample holder

d) Photovoltaic cell as detector

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Answer: b

Explanation: Single beam instruments make use of one beam. Therefore, beam splitters are not required in single beam instruments.

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2. Which of the following statement is false about double beam absorption instruments?

- a) It is similar to single beam instruments except two beams are present
- b) Tungsten bulb is used as a source
- c) Reference beam must have a higher intensity than sample beam
- d) Both the beams after they pass through respective samples are compared

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Answer: c

Explanation: Reference beam cannot have a higher intensity than sample beam. The beam is split into two beams of equal intensity.

3. Which of the following is not an application of colorimeter?

- a) Paints
- b) Inks
- c) Cosmetics
- d) Composition detection

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Answer: d

Explanation: Colorimeter is not used to determine composition. Its application is paints, dyes, inks, cosmetics and plastics.

4. In photometers, the readings of the specimen are initially obtained in the form of which of the following parameters?

- a) Transmittance
- b) Absorption
- c) Wavelengths
- d) Volume

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Answer: a

Explanation: In photometers, the reading is initially obtained in the form of transmittance as some radiation is absorbed by the sample and the rest of the beam is transmitted. This transmitted beam is measured by the detector.

5. Colorimeters are used in applications where great accuracy is required.

- a) True
- b) False

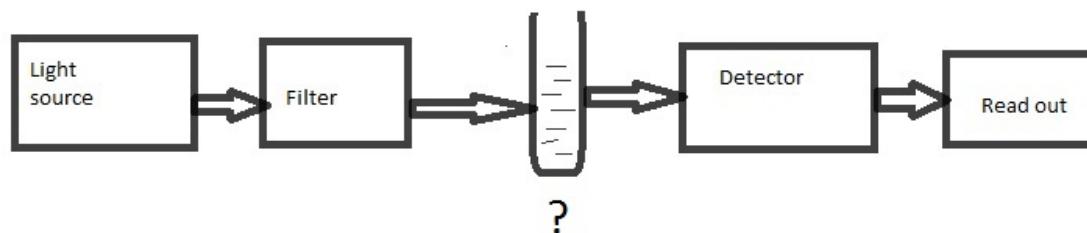
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Answer: b

Explanation: Colorimeters are used in applications where great accuracy is not required. They are also known as photometers.

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6. In the diagram of single beam photometer given below, identify the component that is not marked.



- a) Monochromator
- b) Absorption filter
- c) Sample holder
- d) Interference filter

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Answer: c

Explanation: In single beam spectrophotometer, the beam passed through the sample which is held in the sample holder. The transmitted beam is measured by the detector.

7. Colorimeters are used to determine the concentration of solutions.

- a) True
- b) False

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Answer: a

Explanation: Colorimetry is the science of colour measurement. It is used to determine the concentrations of solutions.

8. Which of the following is the purpose of balance indicator in double beam photometer or colorimeter?

- a) Selects a particular wavelength
- b) Splits the wavelength selected into two equal beams
- c) Detects and indicates the amount of light falling on it
- d) Indicates the difference between the output of two photometers

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Answer: d

Explanation: It compares the output of the two photometers obtained using two beams. It indicates the output.

9. Which of the following is the purpose of the beam splitter in double beam photometer or colorimeter?

- a) Splits beam into two equal intensity beams
- b) Splits beam in such a way that sample beam has higher intensity
- c) Splits beam in such a way that a reference beam has higher intensity
- d) Merge two equal intensity beams into single beam

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Answer: a

Explanation: Beam splitter splits beam into two equal intensity beams. One beam passes through the sample and other through the reference.  
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10. Which of the following is a source used in spectroscopy?

- a) LASER
- b) Tube light
- c) Sodium vapour lamp
- d) Tungsten lamp

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Answer: d

Explanation: Tungsten lamp is the source used in spectroscopy. It is the source used in UV, Visible spectroscopy.

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# Analytical Instrumentation Questions and Answers – Instrumentation of IR

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Instrumentation of IR”.

1. Which of the following is not a source used in Mid Infrared Spectrophotometer?

- a) Nernst glower
- b) High pressure mercury arc lamp
- c) Globar
- d) Nichrome wire

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Answer: b

Explanation: High pressure mercury arc lamp is used as the source for Far IR Spectrophotometer. Rest of the options are used as a source in Mid Infrared Spectrophotometer.

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2. Which of the following is the wave number of near infrared spectrometer?

- a) 4000 – 200 cm<sup>-1</sup>
- b) 200 – 10 cm<sup>-1</sup>
- c) 12500 – 4000 cm<sup>-1</sup>
- d) 50 – 1000 cm<sup>-1</sup>

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Answer: c

Explanation: The wave number of near infrared spectrometer ranges between 12500 – 4000. Wavenumber is the reciprocal of wavelength.

3. Which of the following options are correct in terms of wavelength for the different types of IR spectrometer?

- a) Near IR: 0.8 – 2.5 mm
- b) Mid IR: 0.8 – 2.5 mm
- c) Far IR: 2.5 – 50 mm
- d) Mid IR: 50 – 100 mm

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Answer: a

Explanation: Wavelength of near IR is 0.8 – 2.5 mm and for mid IR it is 2.5 – 50 mm. The wavelength of far IR is 50 – 1000 mm.

4. Which of the following is not a composition of Nernst glower or Nernst filament?

- a) Oxides of Zirconium
- b) Oxides of Barium
- c) Oxides of Yttrium
- d) Oxides of Thorium

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Answer: b

Explanation: Oxides of Barium is not present in Nernst glower. They are constructed by fusing oxides of Zirconium, yttrium and thorium.

5. What is the composition of Globar rod which is used as a source in Mid IR spectroscopy?

- a) Silicon carbide
- b) Silver chloride
- c) Silicon dioxide
- d) Silver carbide

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Answer: a

Explanation: Globar is a silicon carbide rod. It is 5mm in diameter and 50mm long.

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6. Bolometer, a type of detector, is also known as \_\_\_\_\_

- a) Resistance temperature detector (RTD)
- b) Thermistor
- c) Thermocouple
- d) Golay cell

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Answer: b

Explanation: Bolometers are also known as thermistors. It is a type of resistance thermometer constructed of metals such as platinum or nickel.

7. Which of the following is not a technique for preparing solid samples in IR spectroscopy?

- a) Solids run in solution
- b) Mull technique

- c) Solid films
- d) Thin films

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Answer: d

Explanation: Four techniques are generally used to prepare solid samples. They are: Solids run in solution, Mull technique, Solid films and pressed pellet techniques.

8. Which of the following is not used as pyroelectric material used in pyroelectric transducers in Infrared spectroscopy?

- a) Triglycine Sulphate
- b) Deuterated Triglycine Sulphate
- c) Some Polymers
- d) Tetraglycine sulphate

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Answer: d

Explanation: Pyroelectric materials are deuterated triglycine sulphate, triglycine sulphate and some polymers. They give rise to potential when subjected to a heating or cooling effect.

9. Which of the following is the principle of Golay cell which is used as a detector in IR spectroscopy?

- a) Expansion of gas upon heating
- b) Increase in resistance due to an increase in temperature and vice versa
- c) Temperature difference gives rise to a potential difference in the material
- d) Decrease in resistance due to an increase in temperature

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Answer: a

Explanation: It is also known as pneumatic detector. The gases expand on heating and this in turn leads to the movement of a diaphragm just like in pneumatic sensors.

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10. In a solid sample treatment technique, the finely ground solid sample is mixed with mineral oil to make a thick paste which is then spread between IR transmitting windows. What is the name of this solid sample treatment technique?

- a) Pressed pellet
- b) Mull technique
- c) Solid films
- d) Solids run in solution

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Answer: b

Explanation: The mentioned technique is Mull technique. This method is used for qualitative analysis but not quantitative analysis.

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## Analytical Instrumentation Questions and Answers – Fourier Transform Infra-red Spectrometers

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Fourier Transform Infra-red Spectrometers”.

1. Which of the following is not true about Fourier Transform Infrared (FTIR) spectrometer?

- a) It is of non-dispersive type
- b) It is useful where repetitive analysis is required
- c) Size has been reduced over the years
- d) Size has increased over the years

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Answer: d

Explanation: FTIR is of non-dispersive type of instruments and is used for repetitive analysis. Initially, it was bulky and the cost was high and hence, it was limited to a special application. Now, the size has been reduced.

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2. In the most widely used beam splitter, a thin film of \_\_\_\_\_ is sandwiched between two plates of low refractive index solid. Fill the blank with a suitable option.

- a) Mylar
- b) Silicon carbide
- c) Ferrous oxide
- d) Silver chloride

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Answer: a

Explanation: Generally, mylar is the thin film used in beam splitters. Beam splitter has to pass 50% of the radiation and reflect 50% of the radiation.

3. Which of the following is not the function of the drive mechanism in Fourier Transform Infrared Spectrophotometer?

- a) Movement of mirror to obtain a satisfactory interferogram
- b) Acquire a good interferogram pattern
- c) Allow 50% of the beam to pass
- d) Keep the speed of the moving mirror constant

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Answer: c

Explanation: Drive mechanism does the functions specified in the other options. It is the function of the beam splitter to allow 50% of the beam to pass through.

4. Only pyroelectric transducer or pyroelectric crystals are used as detectors in Fourier Transform Infrared Spectrophotometer (FTIR). What is the main reason for other types of thermal detectors are not being used in FTIR spectrophotometer?

- a) Less accuracy
- b) Slower response
- c) Less precision
- d) Less sensitivity

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Answer: b

Explanation: Other thermal detectors are not employed due to slower response of the detectors. Pyroelectric transducers or pyroelectric crystals are chosen for their high speed, accuracy, precision, sensitivity and resolution.

5. Which of the following is not the advantage of Fourier Transform Spectrometers?

- a) Signal to noise ratio is high
- b) Information could be obtained on all frequencies
- c) Retrieval of data is possible
- d) Easy to maintain

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Answer: d

Explanation: The instrument is not easy to maintain and it is a disadvantage. The other disadvantage is that the cost is high.

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6. Which of the following has to be computed to determine transmittance and absorbance at various frequencies?

- a) Ratio of signal and noise

b) Ratio of sample and reference spectra

c) Sample spectra

d) Reference spectra

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Answer: b

Explanation: The ratio of sample and reference spectra needs to be computed to determine transmittance and absorbance. First, reference interferogram is obtained and then the sample is obtained.

7. Computer accepts analog signals directly.

a) True

b) False

[View Answer](#)

Answer: b

Explanation: Computer does not accept analog signals directly. An A/D converter is required to feed the signals to the computer.

8. Which of the following is the reference that is generally used in FTIR interferometer?

a) Air

b) NaCl solution

c) Alcohol

d) Base solution

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Answer: a

Explanation: Air is generally used as the reference. It is scanned for about 20 to 30 times and the results are stored in a computer.

9. In Michelson Interferometer, if the reflected and transmitted beams are in phase at the beam splitter, then maximum intensity will reach the detector.

a) True

b) False

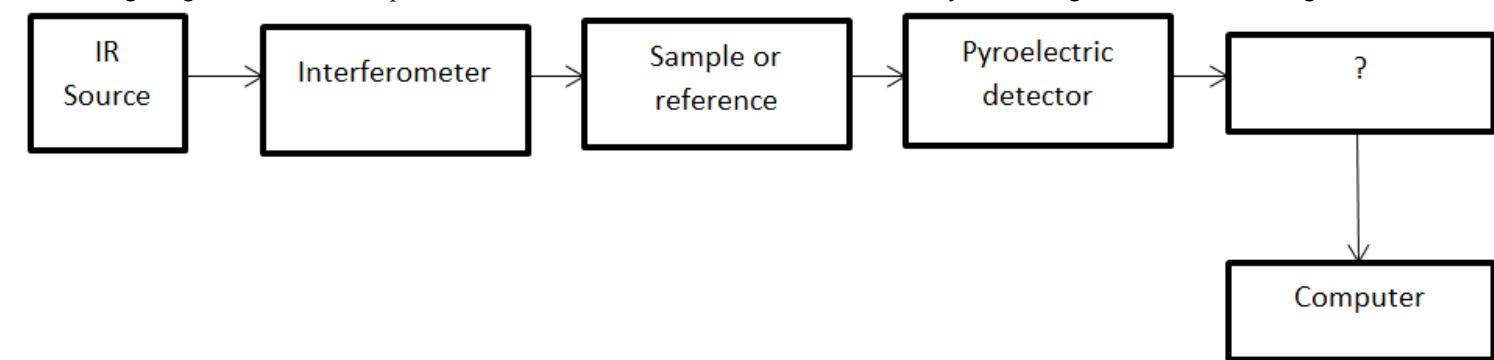
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Answer: a

Explanation: If the reflected and transmitted beams are in phase at the beam splitter then maximum intensity will reach the detector. If they are out of phase, then minimum intensity will reach the detector.

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10. The diagram given below is the representation of Fourier transform interferometer. Identify the missing block in the block diagram.



a) Pyroelectric crystal

b) Display

c) High speed plotter

d) A/D converter

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Answer: d

Explanation: Computer does not accept analog signals directly. An A/D converter is required to feed the signals to the computer.

11. In Michelson's interferometer, the frequency of the detector output can be determined by translating the \_\_\_\_\_ of movable mirror and the \_\_\_\_\_ of monochromatic radiation.

a) Velocity, wavelength

b) Thickness, intensity

c) Length, velocity

d) Angle, intensity

[View Answer](#)

Answer: a

Explanation: The frequency can be determined by translating the velocity of the movable mirror and the wavelength of monochromatic radiation. The reflected beam passes towards the movable mirror.

12. In Michelson's interferometer, the \_\_\_\_\_ of the detector output will depend upon the intensity of incoming radiation.

a) Velocity

b) Frequency

- c) Amplitude
- d) Phase

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Answer: c

Explanation: In Michelson's interferometer, the amplitude of the detector output will depend upon the intensity of incoming radiation. If a movable mirror is moved uniformly, the output will be a sine wave.

13. Why is the computer necessary in Fourier Transform Spectrometer?

- a) To display the detector output
- b) To process the detector output
- c) To determine the amplitude
- d) To determine the frequency

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Answer: b

Explanation: The computer is necessary to process the output of the detector. The Fourier Transform of output is determined using software using computers.  
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# Analytical Instrumentation Questions and Answers – Atomic Absorption Spectroscopy

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Atomic Absorption Spectroscopy”.

1. Which of the following is the principle of Atomic Absorption Spectroscopy?
  - a) Radiation is absorbed by non-excited atoms in vapour state and are excited to higher states
  - b) Medium absorbs radiation and transmitted radiation is measured
  - c) Colour is measured

d) Colour is simply observed

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Answer: a

Explanation: Atoms in gaseous state absorb the radiation and are excited to a higher state. Since the higher state is unstable the atom returns the ground state with the emission of radiation which is measured.

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2. In Atomic Absorption Spectroscopy, which of the following is the generally used radiation source?

- a) Tungsten lamp
- b) Xenon mercury arc lamp
- c) Hydrogen or deuterium discharge lamp
- d) Hollow cathode lamp

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Answer: d

Explanation: Hollow cathode lamp is the source used in Atomic Absorption Spectroscopy. It emits stable and intense radiation.

3. In Atomic Absorption Spectroscopy, with what material is the cathode in Hollow cathode lamp constructed?

- a) Tungsten
- b) Quartz
- c) Element to be investigated
- d) Aluminium

[View Answer](#)

Answer: c

Explanation: The cathode in Hollow cathode lamp is constructed of the element to be investigated. The anode is made of tungsten.

4. How can the intensity of radiation be increased in Hollow cathode lamp?

- a) Addition of non-conductive protective shield of mica
- b) Addition of nitrogen to neon or argon in the lamp
- c) Increasing the pressure of the filling gas
- d) Changing the metal of the anode

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Answer: a

Explanation: The intensity of radiation is increased in Hollow cathode lamp by the addition of a non-conductive protective shield of mica. The protective shield can be made of glass too.

5. Which of the following is the function of the chopper in Atomic Absorption Spectroscopy?

- a) To split the beam into two
- b) To break the steady light into a pulsating light
- c) To filter unwanted components
- d) To reduce the sample into atomic state

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Answer: b

Explanation: The function of the chopper in Atomic Absorption Spectroscopy is to break the steady light into pulsating light. It is a rotating wheel placed between the flame and the source.

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6. Which of the following is the function of the Flame or Emission system in Atomic Absorption Spectroscopy?

- a) To split the beam into two
- b) To break the steady light into pulsating light
- c) To filter unwanted components
- d) To reduce the sample into atomic state

[View Answer](#)

Answer: d

Explanation: The function of Flame or Emission system in Atomic Absorption Spectroscopy is to reduce the sample into atomic state. In Atomic Absorption Spectroscopy, the production of atomic vapour by flame is the most important phase.

7. Atomic absorption spectroscopy is also called as Absorption Flame Photometry.

- a) True
- b) False

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Answer: a

Explanation: In Atomic Absorption Spectroscopy, sample is sprayed into the flame. Hence, it is called Absorption Flame Photometry.

8. Which of the following is not a component of the emission system in Flame photometer?

- a) Burner
- b) Atomiser
- c) Fuel gases and their regulation
- d) Chopper

[View Answer](#)

Answer: d

Explanation: Chopper is not a component of the emission system in Flame photometer. The parts of flame photometer are burner, atomiser, fuel gases and their regulation and flame.

9. Which of the following is the function of the atomiser in the emission system of Atomic Absorption Spectroscopy?

- a) To split the beam into two
- b) To break the steady light into pulsating light
- c) To break large mass of liquid into small drops
- d) To reduce the sample into atomic state

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Answer: c

Explanation: The function of atomiser in the emission system of Atomic Absorption Spectroscopy is to break large mass of liquid into small drops. It also introduces liquid sample into the flame at a stable rate.

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10. Which of the following is not a fuel used in flame photometry?

- a) Acetylene
- b) Propane
- c) Hydrogen
- d) Camphor oil

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Answer: d

Explanation: The commonly used fuel gases in flame photometry are acetylene, propane and hydrogen. Oxygen supply is given to the fuel gases.

11. Which of the following is not the requirement of a good flame in flame photometer?

- a) Liquid sample must be evaporated to form solid residue
- b) Solid residue must decompose to form atoms
- c) Atoms must be produced such that they have the ability to get excited to higher states
- d) Atoms must be produced such that they are in stable state

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Answer: d

Explanation: Atoms must be produced such that they have the ability to get excited to higher states. These atoms in higher states return to ground state with the emission of photons.

12. Atomic Absorption Spectroscopy is used for the analysis of metals.

- a) True
- b) False

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Answer: a

Explanation: Atomic Absorption Spectroscopy is used for the analysis of metals.

13. Which of the following options explains the process of ‘sputtering’ that occurs in Hollow Cathode Lamp?

- a) Positive ions collide with cathode surface and metal atoms from cathode are ejected
- b) Negative ions collide with cathode surface and metal atoms from anode are ejected
- c) Positive ions collide with negative ions and metal atoms from anode are ejected
- d) Positive ions collide with negative ions and photons are ejected

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Answer: a

Explanation: When potential is applied across the electrode, the gas filled in tube ionises and flow of current occurs. Positive ions collide with negatively charged cathode surface and metal atoms from a cathode are ejected.

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14. At what pressure should the gases in the sealed tube be maintained in the Hollow cathode lamp?

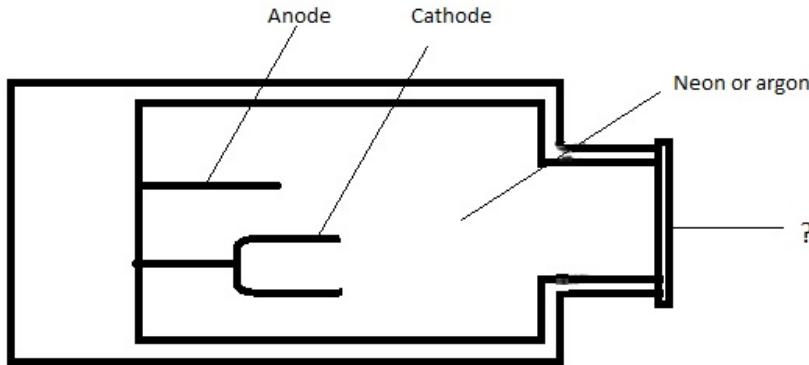
- a) 1 to 5 torr
- b) 20 to 30 torr
- c) 40 to 50 torr
- d) 50 to 55 torr

[View Answer](#)

Answer: a

Explanation: It consists of a cylindrical cathode and an anode made of tungsten. The tube is sealed and neon and argon are filled at a pressure of 1 to 5 torr.

15. The diagram below is the picture of Hollow cathode lamp. Identify the unmarked component.



- a) Glass tube
- b) Quartz window
- c) Non-conducting glass
- d) Mica shield

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Answer: b

Explanation: The unmarked portion is Quartz window. The window can be made of quartz or borosilicate glass.

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## Analytical Instrumentation Questions and Answers – Flame Emission Photometers

1. The function of pressure regulators in the emission system of flame photometer is to have a steady flame which is free from flickers.

- a) True
- b) False

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Answer: a

Explanation: The function of pressure regulators is to have a steady flame which is free from flickers. Pressure gauges indicate pressure.  
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2. In Total consumption burner, only samples of particular droplet size will enter the burner.

- a) True
- b) False

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Answer: b

Explanation: Samples will enter the burner irrespective of their droplet size. Hence, it has the name Total consumption burner.

3. Which of the following is the principle of Flame emission photometers?

- a) Radiation is absorbed by non-excited atoms in vapour state and are excited to higher states
- b) Medium absorbs radiation and transmitted radiation is measured
- c) Colour and wavelength of the flame is measured
- d) Only wavelength of the flame is measured

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Answer: c

Explanation: In Flame emission photometers, colour and intensity of the flame are measured. The intensity of light emitted when sample is introduced into the flame is also measured.

4. In Flame emission photometers, the measurement of \_\_\_\_\_ is used for qualitative analysis.

- a) Colour
- b) Intensity
- c) Velocity
- d) Frequency

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Answer: a

Explanation: The colour and the wavelength of the flame are used for qualitative analysis. It is used to determine the element which is present in the sample.

5. In Flame emission photometers, the measurement of \_\_\_\_\_ is used for quantitative analysis.

- a) Colour
- b) Intensity
- c) Velocity
- d) Frequency

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Answer: b

Explanation: The intensity of the flame is used for quantitative analysis. It is used to determine the amount of elements present in the sample.  
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6. Which of the following is not an advantage of Laminar flow burner used in Flame photometry?

- a) Noiseless
- b) Stable flame for analysis
- c) Efficient atomization of sample
- d) Sample containing two or more solvents can be burned efficiently

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Answer: d

Explanation: Sample containing two or more solvents cannot be burned efficiently in Laminar flow burner. One more advantage of laminar flow burner is that it allows steady movement of gas flow.

7. Laminar flow burner used in Flame photometers is also known as \_\_\_\_\_

- a) Turbulent burner
- b) Premix burner
- c) Total consumption burner
- d) Nozzle mix burner

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Answer: b

Explanation: Laminar flow burner used in Flame photometers is also known as Premix burner. Sample, fuel and oxidant are mixed thoroughly before reaching the burner.

8. Which of the following is the advantage of prism monochromators?

- a) Dispersion is non-overlapping
- b) Dispersion occurs in non-linear manner
- c) Dispersion is overlapping

d) Dispersion occurs in a linear manner

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Answer: a

Explanation: The advantage of a prism is that dispersion that occurs is non-overlapping. The disadvantage is that it occurs in a non-linear manner.

9. Which of the following is the advantage of grating monochromators?

- a) Dispersion is non-overlapping
- b) Dispersion occurs in non-linear manner
- c) Dispersion is overlapping
- d) Dispersion occurs in a linear manner

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Answer: d

Explanation: The advantage of the grating is that dispersion that occurs is linear. The disadvantage is that the dispersion is overlapping.  
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10. Which of the following is not a detector used in Flame emission photometers?

- a) Photronic cell
- b) Photovoltaic cell
- c) Photoemissive tube
- d) Chromatogram

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Answer: d

Explanation: Detectors used in Flame emission photometers are Photovoltaic cell and photo emissive tubes. Photovoltaic cell is also known as photronic cell.

11. Phototubes are more sensitive than photovoltaic cells.

- a) True
- b) False

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Answer: a

Explanation: Phototubes are more sensitive than photovoltaic cells. Therefore, it can be used to measure low intensities.

12. Which of the following is not an application of Flame emission photometers?

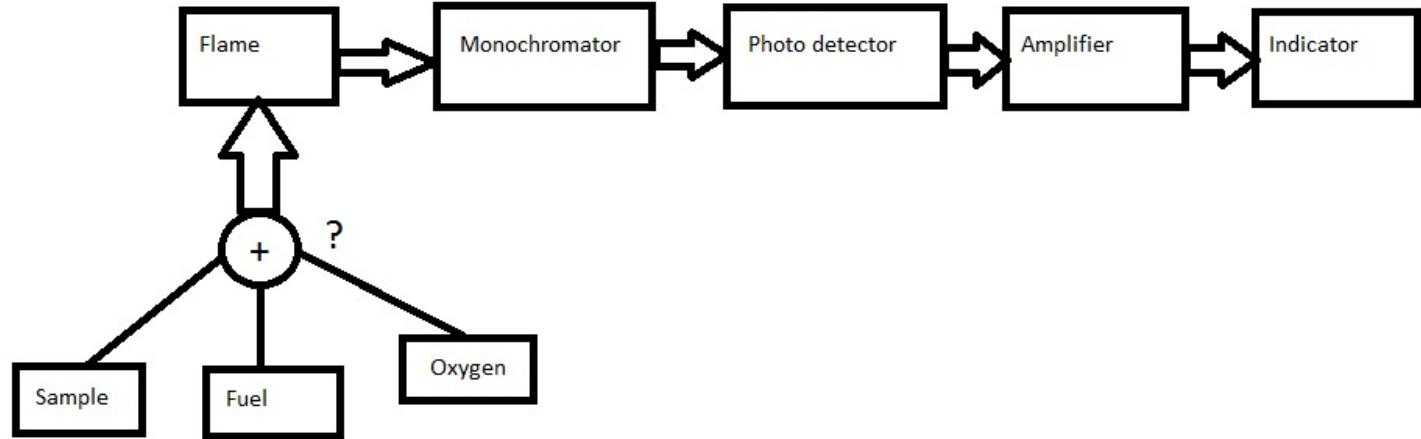
- a) Analysis of biological fluids
- b) Determination of sodium, potassium in soil
- c) Determination of metals such as Mn, Cu
- d) Analysis of complex mixtures

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Answer: d

Explanation: The applications of Flame emission photometers are the analysis of biological fluids, determination of sodium and potassium in soil and determination of metals such as Mn and Cu. It is also used for the analysis of plant materials and industrial cement.

13. Given below is the diagram of Flame emission photometers. Identify the unmarked component.



- a) Filter
- b) Atomiser
- c) Pressure regulator

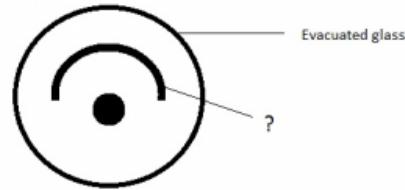
d) Burner  
View Answer

Answer: d

Explanation: The unmarked portion is Burner. Burner is where flame is obtained by mixing sample, fuel and oxygen.

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14. Given below is the diagram of evacuated glass tube of photo emissive tube. Identify the part which is indicated with a question mark.



Evacuated glass

?

- a) Anode
- b) Cathode
- c) Grid
- d) Dynode

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Answer: b

Explanation: The cathode is formed of half cylinder. The anode is a metal ring near the centre of the glass.

15. Which of the following is not an advantage of a photovoltaic cell which is used as a detector in Flame emission photometers?

- a) Portable
- b) No external supply
- c) Robust in construction
- d) Does not show fatigue

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Answer: d

Explanation: It does show fatigue. It shows a decrease in response with continued illumination.

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# Analytical Instrumentation Questions and Answers – Introduction to Chromatography

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Introduction to Chromatography”.

1. Chromatography is a physical method that is used to separate and analyse \_\_\_\_\_

- a) Simple mixtures
- b) Complex mixtures
- c) Viscous mixtures
- d) Metals

[View Answer](#)

Answer: b

Explanation: Chromatography is a physical method that is used to separate complex mixtures. The mixture of different components is flushed through the system at different rates.

2. In which type of chromatography, the stationary phase held in a narrow tube and the mobile phase is forced through it under pressure?

- a) Column chromatography
- b) Planar chromatography
- c) Liquid chromatography
- d) Gas chromatography

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Answer: a

Explanation: In Column chromatography, the stationary phase held in a narrow tube and the mobile phase is forced through it under pressure. It is carried out in a long glass column having a stop-cock near the bottom.

3. In chromatography, the stationary phase can be \_\_\_\_\_ supported on a solid.

- a) Solid or liquid
- b) Liquid or gas
- c) Solid only
- d) Liquid only

[View Answer](#)

Answer: a

Explanation: In chromatography, there are two phases namely, stationary phase and mobile phase. The stationary phase can be solid or a liquid supported on a solid.

4. In chromatography, which of the following can the mobile phase be made of?

- a) Solid or liquid
- b) Liquid or gas
- c) Gas only
- d) Liquid only

[View Answer](#)

Answer: b

Explanation: In chromatography, the mobile phase can be composed of liquid or gas. It cannot be a solid material.

5. Which of the following cannot be used as an adsorbent in Column adsorption chromatography?

- a) Magnesium oxide
- b) Silica gel
- c) Activated alumina
- d) Potassium permanganate

[View Answer](#)

Answer: d

Explanation: The given options are all examples of adsorbents in Column adsorption except potassium permanganate. Some other adsorbents are starch and chromatographic purified siliceous earth.

6. Which of the following types of chromatography involves the separation of substances in a mixture over a 0.2mm thick layer of an adsorbent?

- a) Gas liquid
- b) Column
- c) Thin layer
- d) Paper

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Answer: c

Explanation: Thin layer chromatography involves the separation of substances of a mixture over a 0.2mm thick layer (thin layer) of an adsorbent. The adsorbent

can be silica gel or alumina.

7. Chromatography cannot be used to purify volatile substances.

- a) True
- b) False

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Answer: b

Explanation: Chromatography can be used to purify volatile substances if the carrier fluid, operating conditions and right adsorbent material are employed.

8. In Column chromatography, the stationary phase is made of \_\_\_\_\_ and the mobile phase is made of \_\_\_\_\_

- a) Solid, liquid
- b) Liquid, liquid
- c) Liquid, gas
- d) Solid, gas

[View Answer](#)

Answer: a

Explanation: In Column chromatography, the stationary phase is made of solid and the mobile phase is made of liquid. It is carried out in a long glass column which has a stop-cock near the bottom.

9. Chromatography cannot be used to separate delicate products.

- a) True
- b) False

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Answer: b

Explanation: Chromatography can be used to separate delicate products. This is because chromatography is not performed under severe conditions.  
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10. In Thin layer chromatography, the stationary phase is made of \_\_\_\_\_ and the mobile phase is made of \_\_\_\_\_

- a) Solid, liquid
- b) Liquid, liquid
- c) Liquid, gas
- d) Solid, gas

[View Answer](#)

Answer: a

Explanation: In Thin layer chromatography, the stationary phase is made of solid and the mobile phase is made of liquid.

11. In which of the following type of paper, chromatography does the mobile phase move horizontally over a circular sheet of paper?

- a) Ascending paper chromatography
- b) Descending paper chromatography
- c) Radial paper chromatography
- d) Ascending – descending chromatography

[View Answer](#)

Answer: c

Explanation: In Radial paper chromatography, the mobile phase moves horizontally over a circular sheet of paper. Separation takes place based on partition.

12. Liquid chromatography can be performed in which of the following ways?

- a) Only in columns
- b) Only on plane surfaces
- c) Either in columns or on plane surfaces
- d) Neither in columns nor on plane surfaces

[View Answer](#)

Answer: c

Explanation: Liquid chromatography can be performed either in columns or on plane surfaces. It could be liquid-solid chromatography or liquid-liquid chromatography.

13. Gas chromatography can be performed in which of the following ways?

- a) Only in columns
- b) Only on plane surfaces
- c) Either in columns or on plane surfaces
- d) Neither in columns nor on plane surfaces

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Answer: a

Explanation: Gas chromatography can be performed only in columns. It could be gas-solid chromatography or gas-liquid chromatography.  
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14. In Gas-liquid phase chromatography, the stationary phase is composed of \_\_\_\_\_ and the mobile phase is made of \_\_\_\_\_

- a) Solid, liquid
- b) Liquid, liquid
- c) Liquid, gas

d) Solid, gas  
View Answer

Answer: c

Explanation: In Gas-liquid phase chromatography, the stationary phase is made of liquid and the mobile phase is made of gas. Separation is based on partition.

15. Which of the following types of chromatography involves the process, where the mobile phase moves through the stationary phase by the influence of gravity or capillary action?

- a) Column Chromatography
- b) High Pressure Liquid Chromatography
- c) Gas Chromatography
- d) Planar Chromatography

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Answer: d

Explanation: In Planar Chromatography, the stationary phase is supported on a flat plate of paper. The mobile phase moves by the influence of gravity or capillary action.

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## Analytical Instrumentation Questions and Answers – Operation of Chromatography

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Operation of Chromatography”.

1. Which of the following steps takes place after injection of feed in Column chromatography?

- a) Detection of components
- b) Separation in the column
- c) Elution from the column

d) Collection of eluted component

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Answer: b

Explanation: The operation that occurs after the injection of feed is a separation in the column. After that, elution from the column and detection of components takes place.

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2. Components with a strong attraction to the support move more slowly than components with weak attraction.

- a) True
- b) False

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Answer: a

Explanation: Different components will adsorb to the stationary phase in varying degrees. Components with a strong attraction to the support move more slowly than components with weak attraction.

3. What happens during the ‘elution from the column’ phase in chromatography?

- a) Components with greatest affinity elute first
- b) Components with least affinity elute first
- c) Components elute in a random manner
- d) Components elute according to their concentration in the mixture

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Answer: b

Explanation: During the elution phase, different components elute at different times. Components with least affinity elute first.

4. In chromatogram, the position of peaks on the time axis can be used to determine which of the following?

- a) Components of the sample
- b) Amount of component in the sample
- c) Column efficiency
- d) Column resolution

[View Answer](#)

Answer: a

Explanation: Chromatogram is a detector that responds to concentration solute and is placed at the end of the column. The position of peaks on the time axis can be used to determine components of the sample.

5. In chromatogram, the area under the peak can be used to determine which of the following?

- a) Components of the sample
- b) Amount of component in the sample
- c) Column efficiency
- d) Column resolution

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Answer: b

Explanation: Chromatogram is a detector that responds to concentration solute and is placed at the end of the column. The area under the peak can be used to determine the amount of component in the sample.

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6. The stationary phase could be a viscous liquid coated over a surface of solid particles.

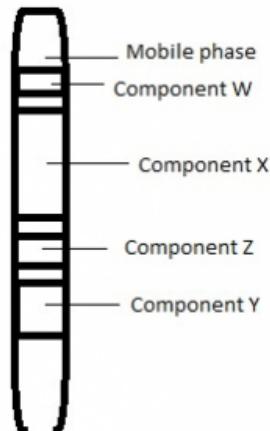
- a) True
- b) False

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Answer: a

Explanation: The stationary phase could be a viscous liquid coated over a surface of solid particles. The solid particles can also be the stationary phase.

7. Given below is a diagram of separation of two components of a mixture in a chromatographic column. From the diagram, infer which component has lesser affinity to the stationary phase.



- a) W
- b) X
- c) Y
- d) Z

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Answer: c

Explanation: Y will elute from the column first. Components with least affinity to the stationary phase will elute first.

8. Using Chromatogram as detector in Chromatography, a graph is obtained between \_\_\_\_\_ and time.

- a) Quantity
- b) Density
- c) Concentration
- d) Specific gravity

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Answer: c

Explanation: Using Chromatogram as a detector in Chromatography, a graph is obtained between concentration and time. The detector is placed at the bottom of the column.

9. In older analytical methods, which of the following methods were used to allow movement of the mobile phase?

- a) Pumps
- b) Pressure
- c) Gravity
- d) Blowing air into the column

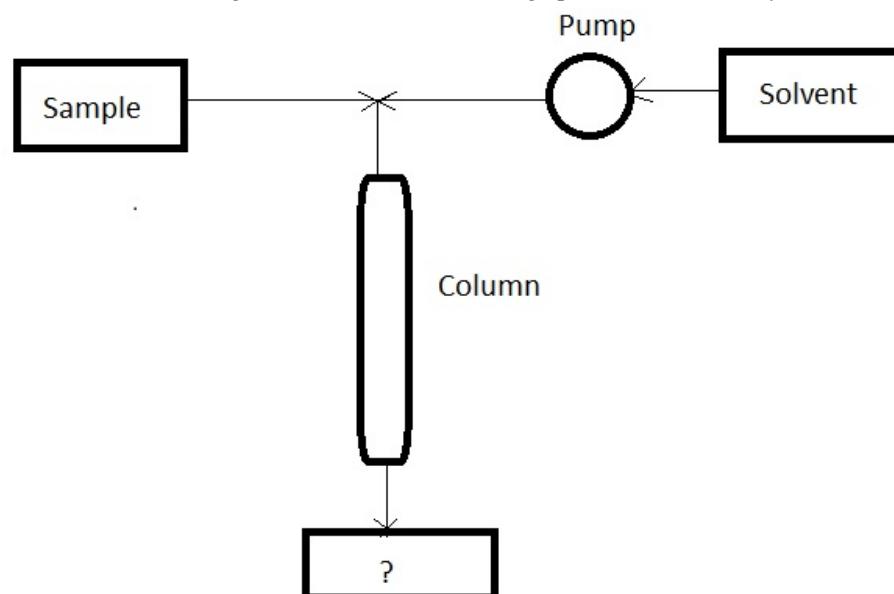
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Answer: c

Explanation: In older analytical methods, gravity facilitated the movement of the mobile phase. The effect of capillary action was also employed to allow movement.

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10. Given below is the diagram of 'Process of chromatographic column'. Identify the unmarked component in the process.



- a) Reservoir
- b) Collection tank
- c) Microprocessor
- d) Detector

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Answer: d

Explanation: The unmarked component is detector. It is placed at the bottom of the column. It responds to solute concentration.

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# Analytical Instrumentation Questions and Answers – Chromatographic Behaviour of Solutes

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Chromatographic Behaviour of Solutes”.

1. How is the molar concentration of solute in stationary phase related to molar concentration of solute in the mobile phase?

- a) Directly proportional
- b) Inversely proportional
- c) Equal
- d) Not related

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Answer: a

Explanation: In chromatography, molar concentration of solute in stationary phase is directly proportional to molar concentration of solute in mobile phase.

$$C_s \propto C_m$$

$$C_s = k C_m$$

‘k’ is the distribution constant.

2. If the value of the distribution constant ‘k’ is one, then what could be inferred about the distribution of solute?

- a) Its distribution in stationary phase is greater
- b) Its distribution in mobile phase is greater
- c) It is equally distributed in stationary and mobile phase
- d) It is distributed in a random manner

[View Answer](#)

Answer: c

Explanation:

$$C_s \propto C_m$$

$$C_s = k C_m$$

If  $k=1$ , it denotes that the solute is equally distributed in the mobile and stationary phase.

3. The time taken by the analyte after sample injection to reach the detector is called \_\_\_\_\_

- a) Dead time
- b) Solute migration rate
- c) Adjusted retention time
- d) Retention time

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Answer: d

Explanation: The time taken by the analyte after sample injection to reach the detector is called retention time. The retention of a solute in the system can be used to identify the solute.

4. The time required for a molecule of the mobile phase to pass through the column is called \_\_\_\_\_

- a) Dead time
- b) Solute migration rate
- c) Adjusted retention time
- d) Retention time

[View Answer](#)

Answer: a

Explanation: The time required for a molecule of the mobile phase to pass through the column is called dead time. The effectiveness of the system depends on dead time.

5. Adjusted retention time is the remaining retention time after subtracting \_\_\_\_\_ from \_\_\_\_\_

- a) Solute migration rate and retention time
- b) Retention time and solute migration rate
- c) Dead time and retention time
- d) Retention time and dead time

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Answer: c

Explanation: Adjusted retention time is the remaining retention time after subtracting dead time from retention time. It affects the effectiveness of the system.

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6. Which of the following is the volume of mobile phase required to make a solute band move from the point of injection through the column to the detector?

- a) Dead volume
- b) Retention volume
- c) Void volume
- d) Adjusted retention volume

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Answer: b

Explanation: Retention volume is the volume of mobile phase required to make a solute band move from the point of injection through the column to the detector.

7. Adjusted retention volume is the remaining retention volume after subtracting \_\_\_\_\_ from \_\_\_\_\_

- a) Solute migration rate and retention volume
- b) Retention volume and solute migration rate
- c) Dead volume and retention volume
- d) Retention volume and dead volume

[View Answer](#)

Answer: c

Explanation: Adjusted retention volume is the remaining retention volume after subtracting dead volume from retention volume.

$$V_{\text{adjusted retention}} = V_{\text{retention}} - V_{\text{dead}}$$

8. Which of the following is defined as the ratio of moles of solute in stationary phase to the moles of solute in the mobile phase?

- a) Distribution constant
- b) Volumetric phase ratio
- c) Retention factor
- d) Total porosity

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Answer: c

Explanation: Retention factor is defined as the ratio of moles of solute in stationary phase to the moles of solute in the mobile phase. It is used for determining the migration rates of solutes in the column.

9. Which of the following is the ratio of the interstitial volume of packing to the volume of its total mass?

- a) Distribution constant
- b) Volumetric phase ratio
- c) Retention factor
- d) Total porosity

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Answer: d

Explanation: Total porosity is the ratio of the interstitial volume of packing to the volume of its total mass. In a capillary column, total porosity is 1.

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10. Which of the following is the ratio of the length of column packing to dead time?

- a) Average linear rate of solute migration
- b) Average linear rate of mobile migration
- c) Relative migration rate
- d) Selectivity factor

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Answer: b

Explanation: Average linear rate of mobile migration is the ratio of the length of column packing to dead time. It influences the effectiveness of the column in separating solutes.

11. Which of the following is the ratio of a length of column packing to retention time?

- a) Average linear rate of solute migration
- b) Average linear rate of mobile migration
- c) Relative migration rate
- d) Selectivity factor

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Answer: a

Explanation: Average linear rate of solute migration is the ratio of a length of column packing to retention time. It influences the effectiveness of the column in separating solutes.

12. Retention distance is the distance between point of injection and minimum peak in the recorder or computer generated chart.

- a) True
- b) False

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Answer: b

Explanation: Retention distance is the distance between point of injection and maximum peak in the recorder. The chart is drawn between time and concentration of the solute.

13. Retention volume can be obtained by finding the product of which of the following parameters?

- a) Dead time and total porosity
- b) Retention time and volumetric flow rate
- c) Adjusted retention time and volumetric flow rate
- d) Retention time and total porosity.

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Answer: b

Explanation: Retention volume can be obtained by finding the product of retention time and volumetric flow rate.

Flow rate = Cross section of empty column × Average linear velocity × Total porosity  
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14. Retention factor is also known as the capacitance factor.

- a) True
- b) False

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Answer: a

Explanation: Retention factor is also known as the capacitance factor. It can be denoted as  $k'$ .

15. What must be the value of the selectivity factor?

- a) Equal to 1
- b) Less than 1
- c) Greater than 1
- d) Greater than 0

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Answer: c

Explanation: Selectivity factor/ Relative retention must always be greater than 1. It is also known as Relative migration rate.

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## Analytical Instrumentation Questions and Answers – Column Efficiency and Column Resolution

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This set of Analytical Instrumentation Questions and Answers for Freshers focuses on “Column Efficiency and Column Resolution”.

1. Which of the following is the distance that the solute moves while undergoing one partition?

- a) Retention distance
- b) Distribution constant
- c) Plate height
- d) Column packing length

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Answer: c

Explanation: Plate height is the distance that the solute moves while undergoing one partition. It is expressed in length.

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2. Which of the following conditions will cause the efficiency of the column to increase?

- a) Plate number becomes greater, plate height becomes smaller
- b) Plate number becomes smaller, plate height becomes smaller
- c) Plate number becomes greater, plate height becomes larger
- d) Plate number becomes greater, plate height becomes larger

[View Answer](#)

Answer: a

Explanation: The efficiency of the column increases when the plate number becomes greater and the plate height becomes smaller. Column efficiency greatly depends on plate height and plate number.

3. Which of the following is the expression for Eddy diffusion in the column, if ‘?’ represents obstruction factor, ‘ $d_p$ ’ represents particle diameter, ‘ $D_M$ ’ represents Solute diffusion co-efficient and ‘?’ represents function for packing uniformity?

- a)  $? d_M$
- b)  $2 ? D_M$
- c)  $D_M ?$
- d)  $?/d_M$

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Answer: a

Explanation: Eddy diffusion is given as,  $A = ? d_p$ . It is also called multipath term.

4. Which of the following is the expression for longitudinal diffusion in the column, if ‘?’ represents obstruction factor, ‘ $d_M$ ’ represents particle diameter, ‘ $D_M$ ’ represents Solute diffusion co-efficient and ‘?’ represents function for packing uniformity?

- a)  $? d_M$
- b)  $2 ? D_M$
- c)  $D_M ?$
- d)  $?/d_M$

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Answer: b

Explanation: Longitudinal diffusion is given as,  $B = 2 ? D_M$ . It is also called axial diffusion.

5. In gas-liquid chromatography, when films are used in the interior of the capillary column, then what is the value of Eddy diffusion?

- a) Greater than 1
- b) Less than 1
- c) Zero
- d) Less than zero

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Answer: c

Explanation: In gas-liquid chromatography, when films are used in the interior of the capillary column the value of Eddy diffusion (A) is zero. To minimize A, diameter of packing should be small and uniform.

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6. For an unpacked coated capillary column, the obstruction factor takes which of the following values?

- a) 0
- b) 0.6
- c) 1
- d) 1.6

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Answer: c

Explanation: For an unpacked coated capillary column, the value of the obstruction factor is 1. For a packed column, the value is 0.6.

7. Base line resolution is achieved when degree of resolution/separation is \_\_\_\_\_

- a) 1
- b) 0
- c) 0.5
- d) 1.5

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Answer: d

Explanation: Base line resolution is achieved when degree of resolution/separation is 1.5. The baseline bandwidths of adjacent bands are almost constant.

8. Which of the following equations give the expression for plate number, N when ' $t_R$ ' is the adjusted retention time and ' $W_b$ ' is the width at the base of the peak which is equal to 4 standard deviations.

- a)  $16 t_R^2/W_b$
- b)  $4 t_R^2/W_b$
- c)  $(4t_R/W_b)^2$
- d)  $4 (t_R/W_b)^2$

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Answer: c

Explanation: The expression for plate number, N is given as  $N = (4t_R/W_b)^2$ . It is a dimensionless quantity.

9. It is more difficult to measure the width at half peak height than the base width in the detector output.

- a) True
- b) False

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Answer: b

Explanation: The width at half peak height is easier to measure than the base width. Hence, the plate number is calculated at peak height.

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10. The solute, while moving in the column is always in equilibrium with both the stationary phase and the mobile phase.

- a) True
- b) False

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Answer: a

Explanation: The solute, while moving in the column is always in equilibrium with both the stationary phase and the mobile phase. But, the two phases will never be in equilibrium with each other.

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## Analytical Instrumentation Questions and Answers – Gas Chromatography

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Gas Chromatography”.

1. For the separation of which of the following substances, Gas-solid chromatography is being used?
  - a) Thermally stable organic components
  - b) Volatile organic components
  - c) Thermally stable inorganic components
  - d) Low molecular weight gaseous species

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Answer: d

Explanation: Gas-solid chromatography is used for the separation of low molecular weight gaseous species. Its application is limited because of semi-permanent retention of the analyte.

2. Which of the following is not a feature of carrier gas used in gas chromatography?
  - a) It must be chemically inert
  - b) It should be suitable for the detector employed
  - c) It should not be completely pure
  - d) It should be cheap

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Answer: c

Explanation: It should be highly pure. Further, it should be readily available and non-inflammable.

3. Which of the following is the disadvantage of hydrogen, which can be used as carrier gas in gas chromatography?
  - a) Dangerous to use
  - b) Expensive
  - c) Reduced sensitivity
  - d) High density

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Answer: a

Explanation: Hydrogen is dangerous to use. It has better thermal conductivity and lower density.

4. Which of the following is the disadvantage of helium, which can be used as carrier gas in gas chromatography?
  - a) Dangerous to use
  - b) Expensive
  - c) Reduced sensitivity

d) High density  
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Answer: b  
Explanation: Helium is expensive. Its advantages are that it has low density and it allows greater flow rates.

5. Which of the following is the disadvantage of nitrogen, which can be used as carrier gas in gas chromatography?

- a) Dangerous to use
- b) Expensive
- c) Reduced sensitivity
- d) High density

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Answer: c  
Explanation: Nitrogen has reduced sensitivity. It is still one of the commonly used carrier gas in gas chromatography.  
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6. Slow injection of large samples leads to band broadening and loss of resolution.

- a) True
- b) False

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Answer: a

Explanation: Slow injection of large samples leads to band broadening and loss of resolution. Hence, for desired column efficiency, samples should not be too large.

7. In which of the following methods are liquid samples injected into the column in gas chromatography?

- a) Gas tight syringe
- b) Micro-syringe
- c) Rotary sample valve
- d) Solid injection syringes

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Answer: b

Explanation: Liquid samples injected into the column in gas chromatography using micro-syringe. Syringes of various capacities are available.

8. What must be done to the solid samples for it to be introduced into the column without using solid injection syringes in gas chromatography?

- a) Introduced in hot-zone of the column
- b) Dissolved in volatile liquids
- c) Introduced using rotary sample valve
- d) Introduced using sampling loops

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Answer: b

Explanation: Solid samples must be dissolved in volatile liquids for introducing it into the column. They can be introduced directly using solid injection syringes.

9. Which of the following is the commonly used support material for the packed column in gas chromatography?

- a) Glass
- b) Metal
- c) Diatomaceous earth
- d) Stainless steel

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Answer: c

Explanation: Diatomaceous earth is the commonly used support material for the packed column in gas chromatography. The columns could be made of glass or metal.  
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10. Which of the following is the advantage of a straight packed column?

- a) It can be packed uniformly
- b) It can be repacked easily
- c) It is compact
- d) It is easier to heat it evenly

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Answer: c

Explanation: The advantage of the straight column is that it can be repacked easily. It is not compact in size.

11. Which of the following is the disadvantage of coiled or helical shaped packed chromatographic column?

- a) It cannot be packed uniformly
- b) It cannot be repacked easily
- c) It is not compact
- d) It is not easy to heat it evenly

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Answer: b

Explanation: The disadvantage of coiled or helical shaped packed chromatographic column is that it cannot be repacked easily. It is compact in size and can easily be heated in an even manner.

12. Capillary columns are open tubular columns constructed from which of the following materials?

- a) Glass
- b) Metal
- c) Stainless steel
- d) Fused silica

[View Answer](#)

Answer: d

Explanation: Capillary columns are constructed using fused silica. It is a very high purity glass.

13. Sample injection port must be maintained at a temperature at which rapid vapourisation occurs but thermal degradation does not occur.

- a) True
- b) False

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Answer: a

Explanation: Sample injection port must be maintained at a temperature at which rapid vapourisation occurs but thermal degradation does not occur. The column is maintained at a different temperature.

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14. Which of the following is not a desirable feature of the ovens used in gas chromatography?

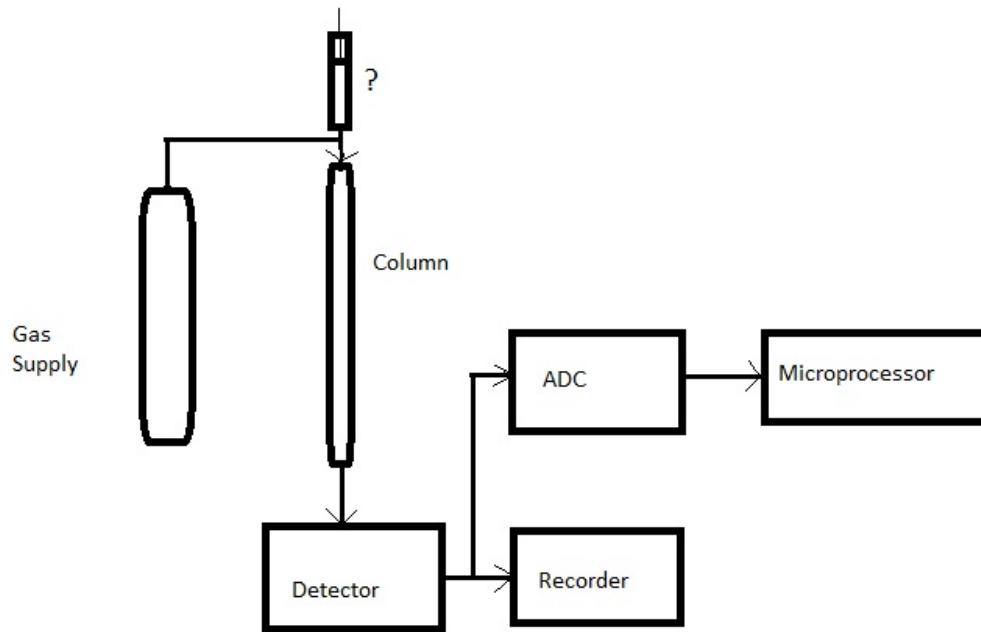
- a) It must have a fast rate of heating
- b) Power consumption should be kept low
- c) It must have maximum thermal gradients
- d) It should have proper insulation

[View Answer](#)

Answer: c

Explanation: The ovens used in gas chromatography must have maximum thermal gradients. The temperature must be uniform over the whole column.

15. Given below is the block diagram of gas chromatography. Identify the unmarked component.



- a) Pumping system
- b) Pressure regulator
- c) Flow regulator
- d) Sample injection system

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Answer: d

Explanation: The unmarked component is syringe. Hence, the answer is sample injection system. It is for the introduction of sample into the flowing gas stream.

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# Analytical Instrumentation Questions and Answers – Detection System of Gas Chromatography

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This set of Analytical Instrumentation Interview Questions and Answers for freshers focuses on “Detection System of Gas Chromatography”.

1. Which of the following is not an ideal characteristic of a detector used in gas chromatography?

- a) Linear response to the solutes
- b) Short response time
- c) High reliability
- d) Sensitive to the changes in the flow rate of a carrier gas

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Answer: d

Explanation: The detector used in gas chromatography must be insensitive to the changes in flow rate of carrier gas. There are many detectors used in gas chromatography.

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2. Which of the following is not a type of detector used in gas chromatography?

- a) Argon ionisation detector
- b) Thermal conductivity detector
- c) UV visible spectrometric detector
- d) Electron capture detector

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Answer: c

Explanation: UV visible spectrometric detector is not used in gas chromatography. It is used in liquid chromatography.

3. Which of the following detectors have high sensitivity to all organic compounds?

- a) Sulphur chemiluminescence detector
- b) Thermionic emission detector
- c) Flame ionization detector
- d) Argon ionisation detector

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Answer: c

Explanation: Flame ionization detector has high sensitivity to all organic compounds. It is the commonly used detector for gas chromatography.

4. Which of the following is not the advantage of thermal conductivity detector used in gas chromatography?

- a) Simple in construction
- b) High sensitivity
- c) Large linear dynamic range
- d) Non-destructive character

[View Answer](#)

Answer: b

Explanation: Thermal conductivity detector has relatively low density when compared to other detectors used in gas chromatography. It is based on the principle that all gases conduct heat in varying degrees.

5. Which of the following detectors is widely used to detect environmental samples like chlorinated pesticides and polychlorinated biphenyls?

- a) Flame ionization detector
- b) Thermal conductivity detector
- c) Argon ionisation detector
- d) Electron capture detector

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Answer: d

Explanation: Electron capture detector is used to detect environmental samples like polychlorinated biphenyls and chlorinated pesticides. It is highly sensitive to molecules containing functional groups such as halogen and phosphorous.

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6. In which of the following detector is the eluent mixed with hydrogen and burned and then mixed with ozone and its intensity is measured?

- a) Sulphur chemiluminescence detector
- b) Thermal conductivity detector
- c) Flame ionization detector
- d) Electron capture detector

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Answer: a

Explanation: In Sulphur chemiluminescence detector, the eluent is mixed with hydrogen and burned and then mixed with ozone and its intensity is measured. The resultant is a measure of sulphur compounds present.

7. Filter photometer detector is primarily responsive to which of the following compounds/elements?

- a) Volatile sulphur or phosphorous compounds
- b) Nitrogen
- c) Halogen
- d) Potassium

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Answer: a

Explanation: Flame photometric detector is primarily responsive to volatile sulphur or phosphorous compounds. It is also responsive to tin and nitrogen.

8. Which of the following detector uses ultraviolet radiation from lamps to produce ionisation of solute molecules?

- a) Sulphur chemiluminescence detector
- b) Thermal conductivity detector
- c) Photo ionization detector
- d) Electron capture detector

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Answer: c

Explanation: Photo ionization detector uses ultraviolet radiation from lamps to produce ionisation of solute molecules. The current produced is measured and recorded.

9. Flame ionisation detector is also known as Katharometer.

- a) True
- b) False

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Answer: b

Explanation: Thermal conductivity detector is known as Katharometer. It uses heated filament as a sensing element and it is placed in the emerging gas stream.

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10. Thermionic emission detector used in gas chromatography is most sensitive to which of the following elements?

- a) Nitrogen
- b) Phosphorous
- c) Halogen
- d) Carbon

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Answer: b

Explanation: Thermionic emission detector used in gas chromatography is most sensitive to phosphorous. It is 500 times more sensitive to phosphorous than Flame ionization detector.

11. Which of the following detectors has a non-volatile bead of rubidium silicate placed above the flame tip?

- a) Argon ionisation detector

- b) Thermionic emission detector
- c) Flame ionization detector
- d) Electron capture detector

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Answer: b

Explanation: Thermionic emission detector has a non-volatile bead of rubidium silicate placed above the flame tip. It is maintained at about 180V with respect to the collector.

12. In which of the following detectors, the carrier gas is excited by a radioactive source and the atoms of carrier gas are excited to a metastable state?

- a) Argon ionisation detector
- b) Thermionic emission detector
- c) Flame ionization detector
- d) Electron capture detector

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Answer: a

Explanation: In Argon ionisation detector, the carrier gas is excited by a radioactive source and the atoms of carrier gas are excited to a metastable state. It uses argon as carrier gas.

13. Which of the following is not used as a heating element in a Thermal conductivity detector?

- a) Platinum
- b) Gold
- c) Graphite
- d) Tungsten wire

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Answer: c

Explanation: Graphite is not used as a heating element in Thermal conductivity detector. Platinum, gold and tungsten wire are used as heating elements.  
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14. Electron capture detector is much less susceptible to contamination when nickel is used instead of tritium.

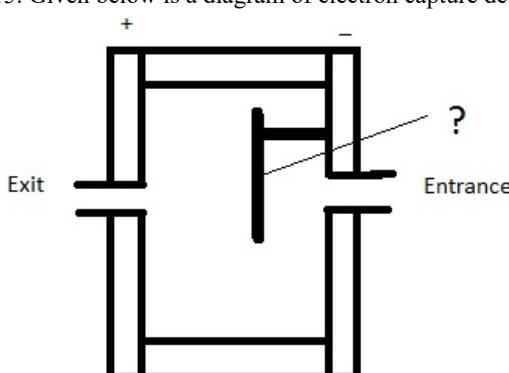
- a) True
- b) False

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Answer: a

Explanation: Electron capture detector is much less susceptible to contamination when nickel is used instead of tritium. The sensitivity of nickel is less than that of tritium.

15. Given below is a diagram of electron capture detector. Identify the unmarked component in the diagram.



- a) Glass shield
- b) Electrode
- c) Quartz shield
- d) Radioactive  $\beta$ - emitter

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Answer: d

Explanation: The unmarked component is Radioactive  $\beta$ - emitter. Nitrogen and hydrogen are the best carrier gases for these detectors.

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## **Analytical Instrumentation Questions and Answers – Gas Solid Chromatography**

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Gas Solid Chromatography”.

1. Gas-solid chromatography is based on which of the following processes?
  - a) Partition of the analyte between a gaseous mobile phase and a stationary liquid phase
  - b) Adsorption of gaseous substances on solid surface
  - c) Ion exchange
  - d) Large molecules cannot penetrate through the gel

[View Answer](#)

Answer: b

Explanation: Gas-solid chromatography is based on the adsorption of gaseous substances on a solid surface. It is useful for the separation of rare gases.

2. Which of the following components cannot be retained by gas-liquid columns but can be separated by using gas-solid chromatography?
  - a) Formaldehyde
  - b) Hydrogen sulphide
  - c) Benzene
  - d) Carbon dioxide

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Answer: b

Explanation: Hydrogen sulphide cannot be retained by gas-liquid columns. It can be separated using gas-solid chromatography.

3. Which of the following is not an advantage of gas-solid chromatography?
  - a) Increased column life
  - b) Can be used for separation of rare gases
  - c) Leads to semi-permanent retention of the analyte
  - d) Ability to retain some components that cannot be easily retained by other gas chromatography method

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Answer: c

Explanation: Gas-solid chromatography leads to semi-permanent retention of the analyte. Hence, it is used for limited applications.

4. The distribution coefficients of Gas-solid chromatography are greater than that of Gas-liquid chromatography.
  - a) True
  - b) False

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Answer: a

Explanation: The distribution coefficients of Gas-solid chromatography are greater than that of Gas-liquid chromatography. The stationary phase is a solid particle.

5. Which of the following columns can be used in Gas-solid chromatography?

- a) Open tubular column
- b) Analytical column
- c) Separation column
- d) Guard column

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Answer: a

Explanation: Open tubular column can be used in Gas-solid chromatography. Analytical/separation column and guard column is used in liquid chromatography.  
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6. Which of the following is not an advantage for the conversion of packed columns into wide bore capillaries?

- a) Longer retention times
- b) Longer life
- c) Higher efficiency
- d) Greater inertness

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Answer: a

Explanation: Wide bore capillary has a shorter retention time. It is an advantage. It is undesirable to have a longer retention time.

7. Which of the following is not a disadvantage of gas-solid chromatography?

- a) Strong retention of polar solutes
- b) Lifetime is short
- c) Occurrence of catalytic changes
- d) Cannot be used for very wide range of components

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Answer: b

Explanation: The lifetime of gas-solid chromatography is long. It can be used for geometrical isomers.

8. Gas-solid chromatography can be used only for separation of certain low molecular weight gaseous species.

- a) True
- b) False

[View Answer](#)

Answer: a

Explanation: Gas-solid chromatography can be used only for separation of certain low molecular weight gaseous species. This is because of gas-solid chromatography, semi-permanent retention of analyte only takes place.

9. Which of the following is a special adsorbent used in gas-solid chromatography?

- a) Molecular sieves
- b) Silica gel
- c) Alumina
- d) Starch

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Answer: a

Explanation: Molecular sieves are a special adsorbent used in gas-solid chromatography. It is used in open tubular columns.  
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10. Which of the following properties of molecular sieves make it ideal for exclusion mechanism of separation?

- a) High thermal stability
- b) Large inner surface area
- c) Variable framework charge
- d) Ability to distinguish materials on the basis of their size

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Answer: d

Explanation: Molecular sieves have the ability to distinguish materials on the basis of their size. This property can be used in separating molecules of linear structure from bulky ones.

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# Analytical Instrumentation Questions and Answers – Liquid Chromatography

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Liquid Chromatography”.

1. Which of the following is the disadvantage of reciprocating pump used in liquid chromatography?

- a) Produces pulsed flow
- b) Corrosive components
- c) Does not have small hold-up value
- d) Does not have moderate flow rate

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Answer: a

Explanation: The disadvantage of reciprocating pump used in liquid chromatography is that it produces pulsed flow. Therefore, the flow must be damped before it affects the column.

2. Which of the following is not a disadvantage of Pneumatic pumps used in liquid chromatography?

- a) Pulsed output
- b) Dependent on solvent viscosity
- c) Dependent on back pressure
- d) Inconvenient for solvent gradient elution

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Answer: a

Explanation: Pneumatic pumps provide pulse free output. They are inexpensive.

3. Which of the following is not a desired characteristic of pulse dampers or flow smootheners used in liquid chromatography?

- a) Easy mobile phase change over
- b) Constant flow must be maintained
- c) Should be effective at low system pressure
- d) Maximal dead volume

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Answer: d

Explanation: Pulse dampers are used to avoid variations in flow. They must have minimal dead volume.

4. Which of the following will improve the efficiency of the separation process in liquid chromatography?

- a) Increase in sample size, increase in column diameter

- b) Reduction in sample size, increase in column diameter
- c) Increase in sample size, reduction in column diameter
- d) Reduction in sample size, reduction in column diameter

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Answer: d

Explanation: Reduction in sample size and reduction in column diameter will improve the efficiency of the separation process in liquid chromatography. The effect of uneven flow will also be reduced.

5. Which of the following are the practical problems that arise due to the decrease in column diameter?

- a) Requirement of large particle size and high pressure drop
- b) Requirement of large particle size and low pressure drop
- c) Requirement of small particle size and high pressure drop
- d) Requirement of small particle size and low pressure drop

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Answer: c

Explanation: The practical problems that arise due to a decrease in column diameter are the requirement of small particle size and high pressure drop. But, it increases column efficiency.

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6. Which of the following is not true about the guard column used in liquid chromatography?

- a) It filters particles that clog the separation column
- b) It extends the lifetime of separation column
- c) It allows particles that cause precipitation upon contact with stationary or mobile phase
- d) The size of packing varies with the type of protection needed

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Answer: c

Explanation: Guard column removes particles that cause precipitation upon contact with stationary or mobile phase. It is placed before the separation column.

7. Which of the following columns are not used in liquid or high performance liquid chromatography?

- a) Analytical column
- b) Separation column
- c) Guard column
- d) Capillary column

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Answer: d

Explanation: Capillary column is used in gas chromatography. Analytical column is also known as a separation column.

8. Which of the following is not a Column-type Liquid chromatography?

- a) Gel permeation
- b) Ion exchange
- c) Liquid-solid
- d) Paper

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Answer: d

Explanation: Paper chromatography is not a column-type chromatography. It makes use of strips of hollow cylinders of filter paper.

9. Which of the following is not true about the radial compression column when compared to standard separation column?

- a) Internal diameter decreases
- b) Overall operating pressure decreases
- c) Analysis time decreases
- d) Solvent flow increases

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Answer: a

Explanation: Radial compression columns have a wider diameter than the standard separation column. The cartridges used are of low cost.

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10. Which of the following is not true about narrow bore column when compared to standard columns?

- a) Internal diameter decreases
- b) Volumetric flow decreases
- c) Solvent cost is saved
- d) Detector response time increases

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Answer: d

Explanation: Detector response time increases in narrow bore columns. High purity solvents must be used in these columns.

11. Which of the following types of liquid chromatography uses immobilized biochemical as a stationary phase?

- a) Ion exchange chromatography
- b) Exclusion chromatography
- c) Affinity chromatography

d) Gel permeation chromatography

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Answer: c

Explanation: In Affinity chromatography, immobilized biochemical is used as stationary phase. It is used to separate one or few solutes from hundreds of unretained solutes.

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## Analytical Instrumentation Questions and Answers – High Pressure Liquid Chromatography

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “High Pressure Liquid Chromatography”.

1. Which of the following is not true about High pressure liquid chromatography (HPLC)?

- a) It requires high pressure for the separation of the specious
- b) There is no need to vaporise the samples
- c) It is performed in columns
- d) It has high sensitivity

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Answer: b

Explanation: In High pressure liquid chromatography (HPLC), samples need to be vaporised. It has high sensitivity.

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2. High pressure liquid chromatography can be performed only in columns.

- a) True
- b) False

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Answer: a

Explanation: High pressure liquid chromatography can be performed only in columns. This is because the application of high pressure in the open bed will not be effective.

3. Which of the following is not an advantage of Syringe type pumps used in High pressure liquid chromatography?

- a) Independent of viscosity
- b) Pulse-less flow
- c) High pressure capability
- d) Unlimited solvent capacity

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Answer: d

Explanation: The limitation of Syringe type pump is that it has a limited solvent capacity and is inconvenient when solvents are to be changed.

4. Which of the following is not true about solvent programming which is done in high performance liquid chromatography?

- a) It provides unequal bandwidths
- b) It provides fast overall separation
- c) It provides maximum resolution
- d) It provides maximum sensitivity

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Answer: a

Explanation: Solvent programming is done to provide equal bandwidths. It provides maximum sensitivity for every solute in the sample.

5. Which of the following pulse damper takes up some amount of the pulsation energy which is released to provide smooth pressure without pulsations?

- a) Flexible bellows or compressible gas passed through tee columns
- b) Flexible inert diaphragm
- c) Electronic pulse damper
- d) Electrical pulse damper

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Answer: a

Explanation: Flexible bellows or compressible gas passed through tee columns take up some of the pulsation energy which is released to provide smooth pressure without pulsations. Its main purpose is to avoid pulses.

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6. Which of the following is not a characteristic of the syringe pump used in high pressure liquid chromatography?

- a) Pressure capability is high
- b) Maintenance is frequent
- c) Limited reservoir capability
- d) Slight change of flow rate when extremely high pressure compresses the solvent

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Answer: b

Explanation: In syringe pumps, maintenance is infrequent. However, it has high pressure capability.

7. Syringe pumps used in High pressure liquid chromatography are most suitable for which of the following columns?

- a) Capillary columns
- b) Guard columns
- c) Short-fast columns
- d) Small bore columns

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Answer: d

Explanation: Syringe pumps used in High pressure liquid chromatography are most suitable for small bore columns. It is the most commonly used piston type pump.

8. Gravity feed method for solvent delivery is not used with narrow bore columns packed with fine mesh particles.

- a) True
- b) False

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Answer: a

Explanation: Gravity feed method for solvent delivery is not used with narrow bore columns packed with fine mesh particles. This is because they cannot deliver solvent at high pressure.

9. Which of the following cannot be done to reduce ripple in High pressure liquid chromatography?

- a) Using bellows
- b) Using restrictors
- c) Using long nylon tube between pump and column
- d) Avoiding the use of the solvent pump

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Answer: d

Explanation: Solvent pumps have to be used to reduce pulses in a solvent flow. When there is a pulsed flow, the efficiency of column decreases.

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10. Which of the following is not true about Hydraulic capacitance flow control system used in HPLC?

- a) It can be used only for liquids with low viscosity
- b) It is irrespective of solvent compressibility
- c) It maintains a constant flow
- d) It smoothens high pressure pump pulsations

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Answer: a

Explanation: Hydraulic capacitance flow control system used in HPLC is irrespective of the solvent viscosity. It is also irrespective of the solvent compressibility.

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## Analytical Instrumentation Questions and Answers – Detection System of Liquid Chromatography

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This set of Analytical Instrumentation Problems focuses on “Detection System of Liquid Chromatography”.

1. Bulk property detectors used in liquid chromatography does not respond to which of the following properties?

- a) Refractive index
- b) Density
- c) Properties of solutes
- d) Dielectric constant

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Answer: c

Explanation: Bulk property detectors respond only to bulk properties of the mobile phase. It does not respond to properties of solutes.

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2. Which of the following is not a property of a good detector used in liquid chromatography?

- a) Good sensitivity

- b) Ability to function in the presence of a large background signal
- c) Short response time
- d) Volume of detector must be large

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Answer: d  
Explanation: The volume of the detector must be small. If the volume of the detector is large it may lead to band broadening.

3. Detector selectivity is more important in Liquid chromatography than in Gas chromatography.

- a) True
- b) False

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Answer: a

Explanation: Detector selectivity is more important in Liquid chromatography than in Gas chromatography. This is because of liquid chromatography, chances of overlapping are higher.

4. Which of the following UV absorbance detectors provide a real time spectrum of the component of interest?

- a) Continuous wavelength detector
- b) Variable wavelength detector
- c) Scanning wavelength detector
- d) Fixed wavelength detector

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Answer: c

Explanation: Scanning wavelength detector provides a real time spectrum of the component of interest. UV visible detector is the most widely used detection system.

5. Fluorescence detection is less selective than absorption detection.

- a) True
- b) False

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Answer: b

Explanation: Fluorescence detection is more selective than absorption detection. This is because of its high sensitivity.  
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6. Which of the following detectors depend on Snell's law at the interface between the cell wall and the flowing liquid to deflect the light beam?

- a) Electrochemical detectors
- b) Fluorescence detectors
- c) Refractive index detectors
- d) Thermal conductivity detectors

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Answer: c

Explanation: Refractive index detectors depend on Snell's law at the interface between the cell wall and the flowing liquid to deflect the light beam. Changes in refractive index are monitored by a position sensor.

7. Refractive index detectors used in liquid chromatography are not based on which of the following processes?

- a) Interference
- b) Refraction
- c) Reflection
- d) Absorption

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Answer: d

Explanation: Refractive index detectors used in liquid chromatography are not dependent on absorption. It depends on reflection, refraction and interference.

8. Which of the following detectors can be used for detection of amino acids in protein hydrolyzates by introducing the reagent dansylchloride in the sample?

- a) Electrochemical detectors
- b) Fluorescence detectors
- c) Refractive index detectors
- d) Thermal conductivity detectors

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Answer: b

Explanation: Fluorescence detectors can be used for detection of amino acids in protein hydrolyzates by introducing the reagent dansylchloride in the sample. Other compounds that can be detected are petroleum products and natural products.

9. The reference cell is packed with which of the following in the Adsorption detector used in liquid chromatography?

- a) Inactive glass beads
- b) Porous glass beads
- c) Alumina
- d) Silica

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Answer: a

Explanation: In Adsorption detector used in liquid chromatography, the reference cell is packed with inactive glass beads. The other detector cavity is packed with silica, alumina or porous glass beads.

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10. Which of the following is true about Laser detectors used in liquid chromatography?

- a) Causes thermal distortion has decreased sensitivity
- b) Causes thermal distortion has increased sensitivity
- c) Does not cause thermal distortion, has decreased sensitivity
- d) Does not cause thermal distortion, has increased sensitivity

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Answer: a

Explanation: Laser detectors used in liquid chromatography cause thermal distortion and have decreased sensitivity. This is because of the high energies of a laser.

11. Which of the following detectors used in liquid chromatography is also called micro-adsorption detector?

- a) Electrochemical detectors
- b) Fluorescence detectors
- c) Refractive index detectors
- d) Thermal detectors

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Answer: d

Explanation: Another name for the thermal detector is micro-adsorption detector. The operation depends upon temperature changes taking place due to the heat of adsorption.

12. In UV-Visible detectors, the cells are not made of which of the following materials?

- a) Quartz
- b) Teflon
- c) Silica
- d) KELF

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Answer: c

Explanation: The cells in UV-Visible detectors are made of quartz, KELF and Teflon. They are not made of silica.

13. Which of the following is not a feature of refractive index type detectors?

- a) Higher potential sensitivity
- b) Low cost
- c) High volume flow rates
- d) Easy cell accessibility

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Answer: c

Explanation: Refractive index type detectors have low volume flow rates. It is one of the major advantages of the refractive index type of detectors.

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14. Which of the following detectors can detect almost any component?

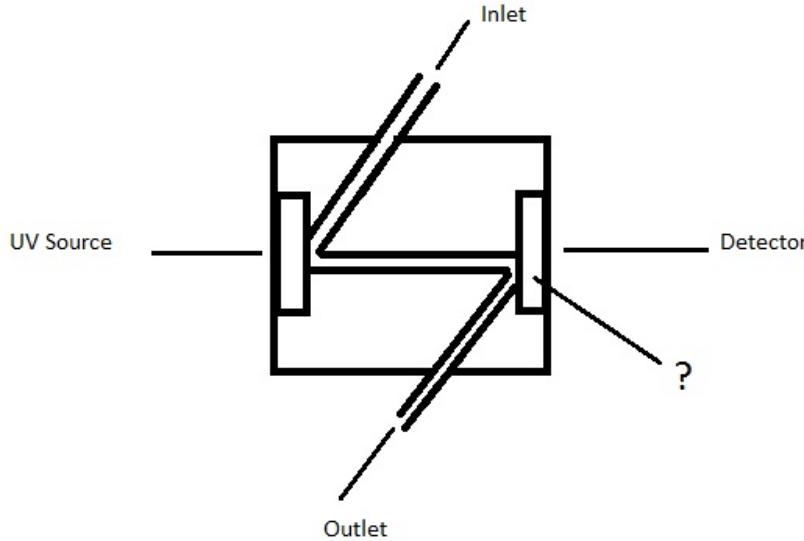
- a) Combining two UV detectors
- b) Combining RI and UV detectors
- c) Mass detector
- d) Laser-based detectors

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Answer: b

Explanation: Combining RI and UV detectors almost any component can be detected. In some cases, single detection system may give incorrect results.

15. Given below is the diagram of Ultraviolet detector used in liquid chromatography. Identify the unmarked component.



- a) Collimator
  - b) Lens
  - c) Monochromator
  - d) Quartz window
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Answer: d

Explanation: The part that is not marked is quartz window. This detector is used to detect components that absorb any wavelength in the UV-Visible region.

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# Analytical Instrumentation Questions and Answers – Amino-Acid Analysers

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Amino-Acid Analysers”.

1. What is the drawback that occurs in using ion exchange chromatography on sulphonated polystyrene resin and colourimetry for amino-acid analysis?

- a) Less accuracy
- b) Low resolution
- c) Inconvenient to handle many individual samples
- d) Slow in operation

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Answer: c

Explanation: When ion exchange chromatography is used for amino-acid analysis, high accuracy is obtained. It is inconvenient to handle many individual samples and cleaning of glassware is laborious.

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2. Which one of the following methods is the most suitable for amino-acid analysis?

- a) Gas chromatography
- b) Ion exchange chromatography
- c) Paper electrophoresis
- d) Resin column chromatography

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Answer: d

Explanation: Resin column chromatography is the most suitable for amino-acid analysis. Here, ion exchange resin chromatography is followed.

3. Which of the following colour reagents are used in Resin column chromatography?

- a) Marquis reagent
- b) Benedict reagent
- c) Ninhydrin
- d) Nessler's reagent

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Answer: d

Explanation: Ninhydrin is the colour reagent used in resin column chromatography. The colour reaction occurs during a known period and controlled temperature.

4. Which of the following amino-acids is measured at a wavelength of 440nm using photometric systems?

- a) Proline
- b) Alanine
- c) Glutamine
- d) Valine

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Answer: a

Explanation: Proline and hydroxyproline are measured at 440nm. All the other amino acids are measured at 570nm.

5. In Automatic amino-acid analyzer, the sample containing \_\_\_\_\_ of each amino compound is introduced at the top of the ion exchange column.

- a) 1 to 10  $\mu$ moles
- b) 1 to 10 moles
- c) 0.05 to 2 moles
- d) 0.05 to 2  $\mu$ moles

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Answer: d

Explanation: In Automatic amino-acid analyzer, the sample having 0.05 to 2  $\mu$ moles of each amino compound is introduced at the top of the ion exchange column. Buffer is then supplied to the column.

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6. Which of the following cannot be analysed using resin column chromatography?

- a) Peptides
- b) Amines
- c) Amino compounds
- d) Components which are ninhydrin negative

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Answer: d

Explanation: Components which are ninhydrin negative cannot be analysed using resin column chromatography. Only the components that are nindhydrin positive are analysed using this method.

7. Trapped air in pumps of Automatic amino-acid analyzer is eliminated using which of the following ways?

- a) Suction pump
- b) De-aerator
- c) Overcome naturally by pump pressure
- d) Using pulse damper

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Answer: b

Explanation: De-aerator is used to eliminate trapper air in pumps of an automatic amino-acid analyzer. Here, bubble-trap type de-aerator is used.

8. Amino-acids are distinguishable from each other only by one or two atoms in their structure.

- a) True
- b) False

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Answer: a

Explanation: Amino-acids are distinguishable from each other only by one or two atoms in their structure. They are components of all proteins and are essential for growth of organisms.

9. What is the drawback that occurs in using gas chromatography for amino-acid analysis?

- a) Costly
- b) Cannot be used for proteins or polypeptides
- c) Slow process
- d) Complex in operation

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Answer: b

Explanation: Gas chromatography cannot be used for proteins or polypeptides. Further, accuracy is lost while converting amino-acids into the gaseous phase.  
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10. Resin column chromatography does not involve breaking of bonds in amino-acids.

- a) True
- b) False

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Answer: b

Explanation: Resin column chromatography involves breaking of bonds in amino-acids. This causes a delay as acid is eluted through the column by a buffer.

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# Analytical Instrumentation Questions and Answers – Paramagnetic Oxygen Analyser

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Paramagnetic Oxygen Analyser”.

1. Which among the following gases have diamagnetic property (ability to be repelled by magnetic fields)?

- a) Oxygen
- b) Nitrogen
- c) Nitrogen dioxide
- d) Nitric oxide

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Answer: b

Explanation: Nitrogen has diamagnetic property. Other components that have diamagnetic property are carbon, boron, etc.

2. Which of the following gases have paramagnetic property (ability to get attracted to a magnetic field)?

- a) Nitric oxide
- b) Hydrogen
- c) Helium
- d) Nitrogen

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Answer: a

Explanation: Nitric oxide has paramagnetic property. Nitrogen dioxide and oxygen are other gases that have paramagnetic property.

3. The force produced during the operation of Paramagnetic oxygen analyzer is proportional to which of the following?

- a) Magnetic susceptibility of sphere
- b) Magnetic susceptibility of surrounding gas
- c) Difference between magnetic susceptibility of sphere and magnetic field strength
- d) Difference between magnetic susceptibility of sphere and that of surrounding gas

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Answer: d

Explanation: The paramagnetic property of oxygen is used in this method for the analysis of oxygen. The force produced during operation of Paramagnetic oxygen analyzer is proportional to the difference between magnetic susceptibility of sphere and that of surrounding gas.

4. In Paramagnetic oxygen analyzer, the expression for magnitude of force produced can be expressed as,  $F = C (K - K_O)$ , where  $K$ = magnetic susceptibility of surrounding gas and  $K_O$ = magnetic susceptibility of sphere. C denotes which of the following?

- a) Magnetic field strength
- b) Magnetic gradient
- c) Function of magnetic field strength and gradient
- d) Magnetic flux

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Answer: c

Explanation: In the expression for magnitude of force, C denotes the function of magnetic field strength and gradient. The forces are thus a measure of magnetic susceptibility and hence of oxygen.

5. In Paramagnetic oxygen analyzer, the electrostatic force that is exerted should have which of the following features?

- a) It should be greater than the magnetic field and must be in the same direction
- b) It should be equal to the magnetic field and must be in the same direction
- c) It should be greater than the magnetic field and must be in the opposite direction
- d) It should be equal to the magnetic field and must be in the opposite direction

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Answer: d

Explanation: The electrostatic force that is exerted should be equal to the magnetic field and must be in the opposite direction. It is exerted by two charged vanes.

6. Which of the following is true about the two charged vanes that produce electric field in Paramagnetic oxygen analyzer?

- a) Both the vanes should be at higher potential than the test body
- b) Both the vanes should have the same potential as the test body
- c) One vane should be at higher potential than the test body and the other vane should be at lower potential

d) Both the vanes should be at lower potential than the test body

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Answer: c

Explanation: In Paramagnetic oxygen analyzer, the two charged vanes should be such that one vane should be at higher potential than the test body and the other vane should be at lower potential. This electric field produces a force.

7. In Paramagnetic oxygen analyzer, when no oxygen is present the magnetic force balances torque of the fibre.

- a) True
- b) False

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Answer: a

Explanation: In Paramagnetic oxygen analyzer, when no oxygen is present the magnetic force balances torque of the fibre. If oxygen is present, it would displace the dumb-bell sphere.

8. To improve paramagnetic oxygen analyzer, the quartz suspension must be replaced with which of the following?

- a) Platinum-iridium
- b) Phosphor-bronze
- c) Gold-palladium
- d) Antimony

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Answer: a

Explanation: To improve paramagnetic oxygen analyzer, the quartz suspension must be replaced with Platinum-iridium. It is more robust.

9. In the Beckman instrument, the flow rate recommended when the sample enters through a porous diffusion disc is which of the following?

- a) 100-200 cc/min
- b) 50-250 cc/min
- c) 40-60 cc/min
- d) 200-300 cc/min

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Answer: b

Explanation: In the Beckman instrument, the flow rate recommended when the sample enters through a porous diffusion disc is 50-250 cc/min. paramagnetic oxygen analyzer was first described by Pauling.

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10. In the Beckman instrument, the flow rate recommended when the sample enters directly for rapid response is which of the following?

- a) 100-200 cc/min
- b) 50-250 cc/min
- c) 40-60 cc/min
- d) 200-300 cc/min

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Answer: c

Explanation: In the Beckman instrument, the flow rate recommended when the sample enters directly for rapid response is 40-60 cc/min. paramagnetic oxygen analyzer was first described by Pauling.

11. Which of the following happens to the magnetic susceptibility of gases when the temperature changes?

- a) It increases with increase in temperature
- b) It decreases with increase in temperature
- c) It remains constant with increase in temperature
- d) It remains constant with decrease in temperature

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Answer: b

Explanation: Magnetic susceptibility of gases decreases with increase in temperature. Magnetic susceptibility of oxygen decreases with increase in temperature.

12. If the oxygen content is not greater than 21%, which of the following gases must be used to set the span point?

- a) Oxygen
- b) Dry air
- c) Nitrogen
- d) Hydrogen

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Answer: b

Explanation: If the oxygen content is not greater than 21%, dry air is used to set the span point. This is done for calibration purposes.

13. If the oxygen content is greater than 21%, which of the following gases must be used to set the span point?

- a) Oxygen
- b) Dry air
- c) Nitrogen
- d) Hydrogen

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Answer: a  
Explanation: If the oxygen content is greater than 21%, oxygen is used to set the span point. This is done for calibration purposes.  
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## Analytical Instrumentation Questions and Answers – Magnetic Wind Instruments

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Magnetic Wind Instruments”.

1. Which of the following does not occur in Hartman and Braun oxygen analyzer based on the magnetic wind?

- a) Oxygen is attracted to the magnetic field
- b) Oxygen becomes less paramagnetic due to rise in temperature
- c) Resistance change in a resistance connected to the Wheatstone bridge occurs
- d) Wheatstone Bridge becomes balanced due to temperature change

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Answer: d

Explanation: In Hartman and Braun oxygen analyzer, the magnetic wind cools the heated winding. As a result, the bridge becomes unbalanced.  
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2. Which of the following is not a cause of the error that could occur in Hartman and Braun oxygen analyzer based on the magnetic wind?

- a) The filament temperature could be affected by changes in thermal conductivity of the carrier gas
- b) Hydrocarbons in sample stream may react on the heated filaments
- c) Gravitation chimney flow effect lead to errors when cross tube is horizontal
- d) Combustible gases may react on the heated filaments

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Answer: c

Explanation: Error occurs when a cross tube is vertical. When the cross tube is horizontal, errors due to gravitation chimney flow effect is avoided.

3. Hydrocarbons need to be removed from the sample gas to avoid errors in Hartman and Braun oxygen analyzer.

- a) True
- b) False

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Answer: a

Explanation: Hydrocarbons need to be removed from the sample gas to avoid errors. This is because they may react on the heated filaments and lead to a change in temperature and resistance.

4. Magnetic wind analyzers are also known as which of the following?

- a) Thermo-magnetic analyzers
- b) Electro-magnetic analyzers
- c) Thermo-analytical analyzers
- d) Hot wire analyzers

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Answer: a

Explanation: Magnetic wind analyzers are also known as Thermo-magnetic analyzers. In Europe, it is known as Magnetic wind analyzers. In the United States, it is known as Thermo-magnetic analyzers.

5. In OXYMAT-M oxygen analyser which of the following is usually used as reference gas?

- a) Hydrogen
- b) Nitrogen
- c) Helium
- d) Ambient air

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Answer: d

Explanation: In OXYMAT-M oxygen analyser, ambient air is usually used as a reference gas. Its measuring procedure is based on pressure difference which develops between two gases having different oxygen concentration in the magnetic field.

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6. Which of the following is used in magnetic wind instruments to determine the amount of oxygen?

- a) Change in resistance
- b) Change in capacitance
- c) Change in inductance
- d) Change in concentration

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Answer: a

Explanation: In magnetic wind instruments to determine the amount of oxygen, change in temperature leads to a change in resistance. This change in resistance is measured to determine the amount of oxygen.

7. Which of the following concepts are not used in magnetic wind instruments?

- a) Change in resistance due to cooling by magnetic wind
- b) Displacement of membrane by magnetised oxygen
- c) Difference in pressure difference between two gases having varying concentration of oxygen
- d) By measuring temperature using thermometer

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Answer: d

Explanation: Temperature is not measured in magnetic wind instruments. The cooling effect of magnetic wind causes a change in resistance which is measured.

8. How are the hydrocarbons in the samples removed in magnetic wind instruments?

- a) By using a cold trap
- b) By using a filter
- c) By using a semipermeable membrane
- d) By using magnetic effect

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Answer: a

Explanation: The hydrocarbons in the samples are removed in magnetic wind instruments by using a cold trap. It is removed to avoid combustion.

9. Which of the following bridges are used in magnetic wind instruments?

- a) Wheatstone bridge
- b) Kelvin's bridge
- c) Anderson's bridge
- d) Schering's bridge

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Answer: a

Explanation: Wheatstone bridge is generally used in magnetic wind instruments. The change in resistance due to cooling effect is measured using a Wheatstone bridge.

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10. The extremely high inertia of the thin membrane in the oxygen sensor allows it to rapidly attain equilibrium.

- a) True

b) False  
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Answer: b

Explanation: The extremely low inertia of the thin membrane in the oxygen sensor allows it to attain equilibrium. It reaches an equilibrium state in 0.25 to 0.5 seconds.

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## Analytical Instrumentation Questions and Answers – Electrochemical Methods for Oxygen Analysis

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This set of Basic Analytical Instrumentation Questions and Answers focuses on “Electrochemical Methods for Oxygen Analysis”.

1. Which of the following is not true about the galvanic method of oxygen analysis?
  - a) Electrodes are composed of noble and base metals
  - b) It can measure dissolved content of oxygen
  - c) Its principle is based on electrolysis
  - d) It utilizes an electronic cell

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Answer: c

Explanation: Galvanic method of oxygen analysis is based on the reverse of electrolysis. In this method, the electrical current developed is related to the rate of oxygen uptake by the cell.

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2. Which of the following is true about Hersch cell which is one of the arrangements of a galvanic cell?

- a) Cell is spherical in shape
- b) Cathode is made of porous material
- c) Cathode is placed centrally

d) Cathode is formed by gauze which surrounds the anode

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Answer: d

Explanation: In Hersch cell, cell is cylindrical in shape. Anode is placed centrally and is made of porous material. Cathode is formed by gauze which surrounds the anode.

3. Polarographic cells type of electrochemical method uses which of the following concepts?

- a) Cyclic reactions
- b) Exothermic reactions
- c) Reversible reactions
- d) Redox reactions

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Answer: d

Explanation: Polarographic cells type of electrochemical method uses redox reactions. It is used to measure the partial pressure of the percentage of oxygen.

4. Which of the following methods, is the widely used method for trace gas analysis?

- a) Galvanic methods
- b) Conductometric method
- c) Polarographic cells
- d) Thermal conductivity method

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Answer: b

Explanation: Conductometric method is the widely used method for trace gas analysis. This method is very convenient.

5. In the conductometric method, the difference in gas conductivity before and after passing sample gas denotes which of the following?

- a) Efficiency of the cell
- b) Quantity of reagent
- c) Concentration of gas
- d) Density of the reagent

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Answer: c

Explanation: In the conductometric method, the difference in gas conductivity before and after passing sample gas denotes the concentration of gas. The sample gas is passed through the liquid reagent.

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6. Conductometric method is not very suitable for measuring traces of which of the following gases in ppb range?

- a) H<sub>2</sub>S
- b) SO<sub>2</sub>
- c) NH<sub>3</sub>
- d) CO

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Answer: d

Explanation: Conductometric method is not very suitable for measuring traces of CO. It is suitable for measuring traces of H<sub>2</sub>O.

7. Polarographic cells are not sensitive to which of the following gases?

- a) Carbon monoxide
- b) Carbon dioxide
- c) Nitrous oxide
- d) Oxygen

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Answer: a

Explanation: Polarographic cells are not sensitive to carbon monoxide. They show 0.1% error while measuring oxygen.

8. In polarographic cell when potential is applied, oxygen is reduced at \_\_\_\_\_ when KCl is present.

- a) Anode
- b) Cathode
- c) Electrolyte
- d) Both the electrode

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Answer: b

Explanation: In polarographic cell when potential is applied, oxygen is reduced at the cathode. Reduction reactions take place at the cathode. KCl is the electrolyte.

9. Polarographic cells are used to measure the partial pressure of gases only in static gas monitoring systems and not in continuous streams.

- a) True
- b) False

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Answer: b

Explanation: Polarographic cells are not used to measure the partial pressure of gases in static gas monitoring systems alone. They can also be used for measuring the partial pressure of gases in continuous samples and injected samples.

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10. Polarographic cells used for measuring the partial pressure of oxygen are temperature-sensitive.

- a) True
- b) False

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Answer: a

Explanation: Polarographic cells used for measuring the partial pressure of oxygen are temperature-sensitive. This is because diffusion co-efficient changes with temperature.

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# Analytical Instrumentation Questions and Answers – NO<sub>2</sub> Analyser

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “NO<sub>2</sub> Analyser”.

1. Nitrogen dioxide can be detected with a paramagnetic analyser.

- a) True
- b) False

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Answer: a

Explanation: Nitrogen dioxide can be detected with a paramagnetic analyser. This is because nitrogen has paramagnetic property ie. it is attracted by magnetic fields.

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2. Nitrogen oxide cannot be directly analysed using UV and Visible analyzers due to which of the following reasons?

- a) Less accuracy

- b) Very low range
- c) It leads to contamination of the sample
- d) It is transparent in UV visible regions

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Answer: d

Explanation: Nitrogen oxide cannot be directly analysed using UV and Visible analyzers because it is transparent in UV visible regions. Hence, it is converted into nitrogen dioxide and then analysed.

3. How is NO converted to NO<sub>2</sub> for analysis in UV and Visible analyzers?

- a) Treating sample gas with pressurized oxygen
- b) Treating sample gas with ozone
- c) Treating sample gas with oxygen at low pressure
- d) Treating sample gas with water at high pressure

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Answer: a

Explanation: NO is converted into NO<sub>2</sub> for analysis in UV and Visible analyzers by treating sample gas with pressurized oxygen. This is because direct measurement of NO is not possible using UV and Visible analyzers.

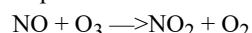
4. How is NO converted to NO<sub>2</sub> for analysis in Chemiluminescent analyser?

- a) Treating sample gas with pressurized oxygen
- b) Treating sample gas with ozone
- c) Treating sample gas with oxygen at low pressure
- d) Treating sample gas with water at high pressure

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Answer: b

Explanation: NO is converted to NO<sub>2</sub> for analysis in Chemiluminescent analyser by treating sample gas with ozone.



5. During analysis of NO<sub>2</sub> using Chemiluminescent analyser, why is NO<sub>2</sub> not made to react with ozone directly?

- a) Less accuracy
- b) It is a slow process
- c) It leads to contamination of the sample
- d) It does not produce luminescence

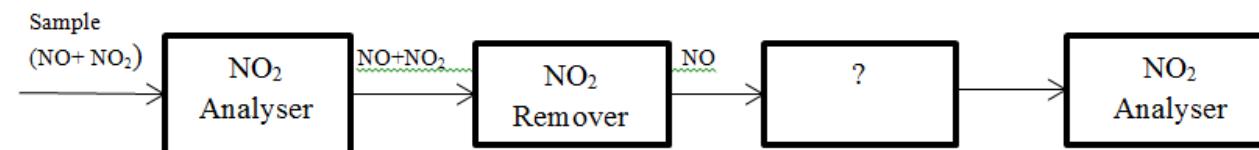
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Answer: b

Explanation: During analysis of NO<sub>2</sub> using Chemiluminescent analyser, NO<sub>2</sub> is not made to react with ozone directly because it is a slow process. Hence, it is converted to NO using catalytic reactions or converters.

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6. The block diagram of series mode analyser of NO and NO<sub>2</sub> is given below. Identify the unmarked procedure.



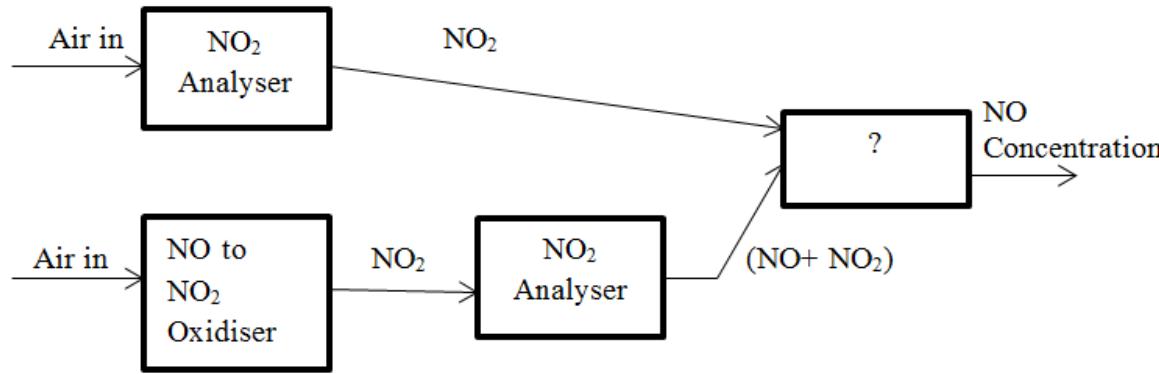
- a) Oxidiser
- b) Reducer
- c) Filter
- d) NO Analyser

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Answer: a

Explanation: The unmarked procedure is NO to NO<sub>2</sub> oxidiser. NO<sub>2</sub> is then analysed by NO<sub>2</sub> analyser.

7. The block diagram for parallel mode analyser of NO and NO<sub>2</sub> is given below. Identify the unmarked block in the diagram.



- a) NO Analyser
  - b) NO<sub>2</sub> to NO reduction
  - c) NO<sub>2</sub> remover
  - d) Difference
- [View Answer](#)

Answer: d

Explanation: The unmarked block is Difference. Difference between the concentration of NO<sub>2</sub> and NO and the concentration of NO<sub>2</sub> alone is determined and the result gives the concentration of NO.

8. The instruments based on chemiluminescence maintain linearity in which of the following ranges?

- a) 1ppb to 100ppb
- b) 100ppb to 1000ppb
- c) 1ppb to 1000ppb
- d) 100ppb to 1000ppb

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Answer: c

Explanation: The instruments based on chemiluminescence maintain linearity between 1ppb to 1000ppb. These are used to measure NO in exhaust gases in vehicles.

9. How can absorption be enhanced while determining NO concentration using CO laser?

- a) By converting NO into NO<sub>2</sub>
- b) By placing NO in a magnetic field
- c) By using proper monochromators
- d) By using choppers

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Answer: b

Explanation: CO laser emits radiation that can absorb NO. Absorption is enhanced by placing NO in a magnetic field.  
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10. Which of the following detectors are generally used for detection in NO analysis using CO laser?

- a) Photomultiplier tube
- b) Photovoltaic cell
- c) Liquid nitrogen cooled Ge-Au element
- d) Photo emissive tube

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Answer: c

Explanation: Liquid nitrogen cooled Ge-Au element is used detection in NO analysis using CO laser. The signal amplitude varied with the concentration of NO.

11. Which of the following analyzers are used to measure trace amounts of nitrogen oxides in the stratosphere?

- a) Chemiluminescence
- b) CO laser method
- c) Laser opto-acoustic spectroscopy
- d) Colorimetry

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Answer: c

Explanation: Laser opto-acoustic spectroscopy is used to measure trace amounts of nitrogen oxides in the stratosphere. It was developed for application in air pollution measurement.

12. A pink coloured dye complex is formed when air containing NO<sub>2</sub> is passed in an absorbing solution consisting of \_\_\_\_\_ and diamine dissolved in the acetic acid medium.

- a) Sulphuric acid
- b) Sulphonyl
- c) Sulphonic acid

d) Sulphanilic acid  
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Answer: d

Explanation: A pink coloured dye complex is formed when air containing  $\text{NO}_2$  is passed in an absorbing solution consisting of sulphanilic acid and diamine dissolved in the acetic acid medium. This is called Saltzman method.

13. In Laser Opto-acoustic spectroscopy, the IR beam excites the molecules to higher states. In which of the following ways do the molecules return to the ground state?

- a) Collisional de-excitation
- b) Random de-excitation
- c) By spontaneous emission
- d) By stimulated emission

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Answer: a

Explanation: The molecules return to the ground state by collisional de-excitation. This results in an increase in temperature.

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14. To monitor oxides of nitrogen in stack effluents, the sample containing oxides of nitrogen is passed through a flask containing solution of  $\text{H}_2\text{O}_2$  in sulphuric acid. Nitric acid is formed. The nitrate ions then react with phenol-disulphonic acid to produce blue colour.

- a) True
- b) False

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Answer: b

Explanation: The nitrate ions react with phenol-disulphonic acid to produce yellow colour. This is measured colorimetrically.

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## Analytical Instrumentation Questions and Answers – H2S Analysers

1. Which of the following is not an advantage of electrochemical cells used for analysis of H<sub>2</sub>S?

- a) Portable battery operated instrument
- b) Pocket sized instrument
- c) No pumps are needed
- d) No interference from background gases

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Answer: d

Explanation: Electrochemical cells are affected by interference from background gases. Some of them are sulphur dioxide, carbon monoxide, nitric oxide and chlorine.

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2. Which of the following methods are mainly used in combustible gas detection equipment?

- a) Lead acetate tape staining method
- b) Solid state sensor
- c) Gold film sensor
- d) Electrochemical cells

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Answer: b

Explanation: Solid state sensors are mainly used in combustible gas detection equipment. It is a semiconductor sensor.

3. Which of the following is not an advantage of solid state sensor used for analysis of H<sub>2</sub>S?

- a) No sampling system
- b) It can be used in conditions involving vibration
- c) It can be used in corrosive atmosphere
- d) No interference from background gases

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Answer: d

Explanation: Solid state sensors are affected by interference from background gases. Some of them are hydrogen, isopropanol and ethyl and methyl mercaptan.

4. Which is the compound that forms the stain in Lead Acetate Tape Staining method used for the analysis of Hydrogen Sulphide and what is the colour of the stain?

- a) Lead Sulphide, red colour
- b) Lead Sulphide, brown colour
- c) Hydrogen acetate, white colour
- d) Hydrogen acetate, green colour

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Answer: b

Explanation: Hydrogen Sulphide reacts with Lead Acetate to form Lead Sulphide which is brown in colour. Hydrogen acetate in other words is acetic acid and is colourless.

5. Which of the following methods is not used for detection of hydrogen sulphide?

- a) Lead acetate tape staining method
- b) Solid state sensor
- c) Chemiluminescence method
- d) Electrochemical cells

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Answer: c

Explanation: Chemiluminescence method cannot be used for the detection of hydrogen sulphide. Others method that are used are using photometric analyser and using gold film sensor.

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6. In solid state sensor, when heated to 150° to 300° which of the following occurs?

- a) Resistance decreases with increase in H<sub>2</sub>S concentration
- b) Resistance increases with H<sub>2</sub>S concentration
- c) No change in resistance occurs
- d) Sensor does not respond in this temperature range

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Answer: a

Explanation: In solid state sensor, when heated to 150° to 300° resistance decreases with increase in H<sub>2</sub>S concentration. The decrease in resistance is a logarithmic function of H<sub>2</sub>S concentration.

7. In the gold film sensor, the change in resistance is proportional to the concentration of H<sub>2</sub>S.

- a) True
- b) False

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Answer: a

Explanation: Gold film sensor works on the principle of absorption. The change in resistance is proportional to the concentration of H<sub>2</sub>S.

8. Which of the following occurs in Electrochemical cells used for the detection of hydrogen sulphide?

- a) Change in resistance
- b) Redox reaction
- c) Oxidation-reduction reaction
- d) Change in colour

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Answer: c

Explanation: In Electrochemical cells, an oxidation-reduction reaction occurs in the presence of hydrogen sulphide. A current starts flowing and it is proportional to the concentration of hydrogen sulphide.

9. Which of the following is not a component of solid state sensor used for detection of hydrogen sulphide?

- a) Heater
- b) Thermistor
- c) Semiconductor film
- d) Photo detector

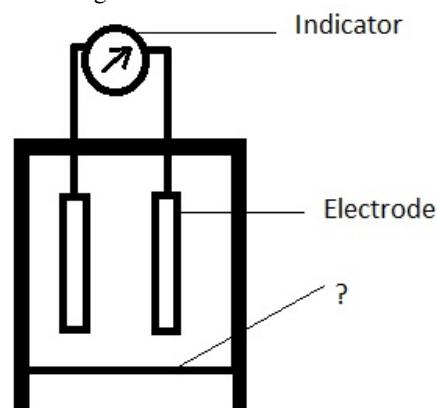
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Answer: d

Explanation: For measuring H<sub>2</sub>S, the sensor must be maintained at a particular temperature. This is done by using a heater. The temperature is monitored using a thermistor.

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10. The diagram of Electrochemical cell used for the detection of hydrogen sulphide is given below. Identify the unmarked component.



a) Filter

b) Gas permeable membrane

c) Elastic layer

d) Electrolyte

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Answer: b

Explanation: The unmarked component is gas permeable membrane. Electrochemical cell is an electrochemical gas diffusion sensor.

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## Analytical Instrumentation Questions and Answers – Infrared Gas Analysers

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Infrared Gas Analysers”.

1. Which of the following is not a detector used in mid Infrared Spectrophotometer?

- a) Thermopile
- b) Thermistor
- c) Pyroelectric cell
- d) Golay cell

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Answer: d

Explanation: Golay cell is not used in mid Infrared Spectrophotometer. It is used in a far infrared spectrometer.

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2. Why is the use of infrared analyzers limited when it comes to the analysis of inorganic compounds?

- a) Slow response occurs
- b) Less accurate results occur
- c) Strong absorption of IR radiation by water
- d) Small range

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Answer: c

Explanation: The use of infrared analyzers is limited when it comes to the analysis of inorganic compounds because of the strong absorption of IR radiation by water. It is particularly used for organic compounds.

3. Which of the following is the chopping frequency used for industrial analyzers in the simple infrared analyser for gas analysis?

- a) 2-10 Hz
- b) 2-50 Hz
- c) 2-100 Hz
- d) 2-150 Hz

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Answer: a

Explanation: The chopping frequency used for industrial analysers in the simple infrared analyzer for gas analysis is 2-10 Hz. The chopper is motor driven.

4. Which of the following is used as a source in the simple infrared analyzer for gas analysis?

- a) Tungsten filament lamp
- b) Nernst glower
- c) Hot-wire spiral
- d) Mercury arc lamp

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Answer: c

Explanation: Hot-wire spiral is used as a source in the simple infrared analyzer for gas analysis. Two sources are used.

5. Vibration excitation occurs only if the sample has hetero-atomic molecules.

- a) True
- b) False

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Answer: a  
Explanation: Vibration excitation occurs only if the sample has hetero-atomic molecules. Hence, infrared analyzers are not used for gases whose molecules are formed by two identical atoms.

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6. Which of the following is the chopping frequency used for medical applications in simple infrared analyser for gas analysis?

- a) 2-10 Hz
- b) 2-50 Hz
- c) 2-100 Hz
- d) 2-150 Hz

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Answer: b

Explanation: The chopping frequency used for medical applications in simple infrared analyser for gas analysis is 2-50 Hz. The chopper is motor driven.

7. The movement of diaphragm in simple infrared analyser for gas analysis results in which of the following?

- a) Variable resistance
- b) Variable inductance
- c) Variable capacitance
- d) Variable conductance

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Answer: c

Explanation: The movement of diaphragm in simple infrared analyser for gas analysis results in variable capacitance. The diaphragm forms one plate of the capacitor.

8. Which of the following is not the drawback of conventional infrared analyzers used for gas analysis?

- a) Cell is difficult to maintain
- b) It is expensive to replace
- c) Detector is vibration sensitive
- d) Only one source is used

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Answer: d

Explanation: Two sources are used in conventional infrared analyzers used for gas analysis. To overcome the drawbacks an improved model was created.

9. Which of the following is used as detector in improved infrared analyzer used for gas analysis?

- a) PbSe
- b) MgCl<sub>2</sub>
- c) ZnCl
- d) CuCl<sub>2</sub>

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Answer: a

Explanation: PbSe is used as detector in improved infrared analyzer used for gas analysis. It is a solid state detector.

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10. In calibration of CO<sub>2</sub> analyser, in order to establish zero calibration which of the following is used as sample?

- a) Oxygen
- b) Hydrogen
- c) Inert gases
- d) Nitrogen

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Answer: c

Explanation: In calibration of CO<sub>2</sub> analyser, in order to establish zero calibration inert gases are used as sample. Generally, room air is also used.

11. Which of the following is not the characteristics of Indium arsenide photovoltaic detector used in infrared analyzers for hydrocarbons?

- a) It operates at ambient temperature
- b) Has maximum detectivity at 3.4μm
- c) Sensitivity increases at longer wavelength
- d) It has no response to radiation of wavelength greater than 4μm

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Answer: c

Explanation: The sensitivity of Indium arsenide photovoltaic detector decreases at longer wavelength. It is insensitive to radiation having a wavelength greater than 4μm.

12. Luft detector cell which uses gas as detection mechanism is not vibration sensitive.

- a) True
- b) False

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Answer: b

Explanation: Luft detector cell which uses gas as detection mechanism is vibration sensitive. It is also subject to cross-talk with other gases.

13. Which kind of filter is used in improved version of infrared gas analyzer at the output end?

- a) Low pass filter
- b) High pass filter
- c) Narrow bandpass filter
- d) Wide bandpass filter

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Answer: c

Explanation: The filter is used in an improved version of infrared gas analyzer at the output end is narrow bandpass filter. The bandpass characteristics are matched with the absorption spectra of the gas of interest.

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# Analytical Instrumentation Questions and Answers – Thermal Conductivity Analysers

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Thermal Conductivity Analyzers”.

1. Thermal conductivity analyzers cannot be used in which of the following measurements?

- a) Hydrogen in blast furnace gases
- b) Determination of argon in oxygen in the process of air decomposition
- c) Sulphur dioxide in roasting gases in production of sulphuric acid
- d) Oxygen from a mixture of oxygen and nitrogen

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Answer: d

Explanation: Thermal conductivity analyzers cannot be used in analysing oxygen from a mixture of oxygen and nitrogen. This is because the thermal conductivity of oxygen and nitrogen is almost the same.

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2. In which of the following conditions can thermal conductivity analyzer be used for multi-component mixtures?
- a) When all the components have same thermal conductivities
  - b) When all the components have very different thermal conductivities
  - c) When all but one component have same thermal conductivities
  - d) When all components have very different thermal conductivities except two of them which are the same

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Answer: c

Explanation: When all but one component have the same thermal conductivities, thermal conductivity analyzer can be used for multi-component mixtures. The mixture is then treated as a binary mixture.

3. Which among the following elements has the highest thermal conductivity?

- a) Nitrogen
- b) Oxygen
- c) Hydrogen
- d) Chlorine

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Answer: c

Explanation: Hydrogen has the highest thermal conductivity. Chlorine has the lowest thermal conductivity in the list.

4. Which of the following materials are generally not used for the construction of filaments in thermal conductivity analyzers?

- a) Tungsten
- b) Gold
- c) Platinum
- d) Kovar

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Answer: b

Explanation: Gold is generally not used for the construction of filaments in thermal conductivity analyzers. The materials used have high temperature-coefficient of resistance.

5. Thermistors have positive temperature-coefficient of resistance.

- a) True
- b) False

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Answer: b

Explanation: Thermistors have negative temperature-coefficient of resistance. RTDs have positive temperature-coefficient of resistance.  
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6. Which of the following is not the characteristic of thermistors used in thermal conductivity analyzers?

- a) High negative temperature coefficient of resistance
- b) Slow response
- c) Extremely sensitive
- d) Low cost

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Answer: b

Explanation: Thermistors have fast response. They are arranged as heat sensing elements in the Wheatstone bridge.

7. How can the high speed of response be obtained in thermal conductivity analyzers?

- a) By increasing the pressure of gas surrounding the filaments
- b) By reducing the pressure of gas surrounding the filaments
- c) By reducing the temperature of gas surrounding the filaments
- d) By increasing the temperature of gas surrounding the filaments

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Answer: b

Explanation: High speed of response be obtained in thermal conductivity analyzers by reducing the pressure of gas surrounding the filaments. It is reduced to a few millimetres of mercury absolute.

8. Which of the following bridges are used in thermal conductivity analyzers?

- a) Wheatstone bridge
- b) Kelvin's bridge
- c) Anderson's bridge
- d) Schering's bridge

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Answer: a

Explanation: Wheatstone bridge is generally used in thermal conductivity analyzers. Themistors or hot-wires can be used as a filament.

9. Which of the following is generally used as indicators in bridges in thermal conductivity analyzers?

- a) Voltmeter
- b) Ammeter
- c) Galvanometer

d) Wattmeter  
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Answer: c

Explanation: Galvanometer is generally used as an indicator in bridges in thermal conductivity analyzers. The galvanometer reading is a measure of the thermal conductivity of the gas.

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10. Changes in the composition of gas stream give rise to changes in thermal conductivity of the gas stream.

- a) True
- b) False

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Answer: a

Explanation: Changes in the composition of gas stream give rise to changes in thermal conductivity of the gas stream. This principle is used in thermal conductivity analyzers.

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## Analytical Instrumentation Questions and Answers – Analysers Based on Gas Density

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Analysers Based on Gas Density”.

1. Which of the following is the relationship between the density of ideal gas and its molecular weight?

- a) Directly proportional
- b) Inversely proportional

c) Linear

d) No relation

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Answer: c

Explanation: Density of an ideal gas has a direct linear relation with the molecular weight of the gas. Density can be used to analyse gases.  
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2. Under which of the following conditions do all real gases behave as ideal gases to some extent?

- a) Low temperature and low pressure
- b) Low temperature and high pressure
- c) High temperature and low pressure
- d) Room temperature and normal pressure

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Answer: d

Explanation: All real gases behave as ideal gases at room temperature and normal pressure. Hence, density can be used to analyse gases.

3. Which of the following detectors are not used in analyzers based on gas density?

- a) Hot wire
- b) Platinum filament
- c) Thermistor
- d) Thermometer

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Answer: d

Explanation: Thermometer is not used as a detector in analyzers based on gas density. Thermistors and hot wires are generally used.

4. When would the recorder indicate a zero base line in analyzers based on gas density?

- a) When the detector on the sample side is cooler than that on the reference side
- b) When the detector on the reference side is cooler than that on the sample side
- c) When flow is unbalanced
- d) When both the detectors are equally cooled

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Answer: d

Explanation: The recorder indicates a zero base line in analyzers based on gas density when a flow is balanced. When a flow is balanced both the detectors are equally cooled.

5. The use of thermistor eliminates the requirement for amplification.

- a) True
- b) False

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Answer: a

Explanation: The use of thermistor eliminates the requirement for amplification. Hence, it is generally used in analyzers based on gas density.  
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6. In analyzers based on gas density, the unbalance of the bridge is linearly proportional to which of the following?

- a) Temperature of sample detector
- b) Pressure at sample detector
- c) Pressure difference between both the detectors
- d) Gas-density difference between both the detectors

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Answer: d

Explanation: In analyzers based on gas density, the unbalance of the bridge is linearly proportional to a gas-density difference between both the detectors. Instruments based on the principle of gas-density balance are commercially available.

7. Which of the following bridges are used in analyzers based on gas density?

- a) Wheatstone bridge
- b) Kelvin's bridge
- c) Anderson's bridge
- d) Schering's bridge

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Answer: a

Explanation: Wheatstone bridge is generally used in analyzers based on gas density. Thermistors or hot-wires can be used as detectors.

8. In analyzers based on gas density, if the sample carries a gas having a higher density than the detector which of the following occurs?

- a) It will cause a net downward flow
- b) It will cause a net upward flow
- c) It splits into two beams
- d) There will be no difference in flow

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Answer: a

Explanation: In analyzers based on gas density, if the sample carries a gas having a higher density than the detector it will cause a net downward flow. It will obstruct flow in the lower path.

9. When hot-wires are used as detectors amplification is not required.

- a) True
- b) False

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Answer: b

Explanation: When hot-wires are used as detectors amplification is required. The amplified signal is given to the recorder.  
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10. Which of the following is the effective sample volume in analyzers based on gas density?

- a) 10 ml
- b) 20 ml
- c) 5 ml
- d) 50 ml

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Answer: c

Explanation: The effective sample volume in analyzers based on gas density is 5ml. Instruments based on the principle of gas-density balance are commercially available.

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## Analytical Instrumentation Questions and Answers – Method Based on Ionization of Gases

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This set of Analytical Instrumentation Questions and Answers for Experienced people focuses on “Method Based on Ionization of Gases”.

1. Gases emit radiation under which of the following conditions which can be used for determination of gases?

- a) When mixed with other gases
- b) When kept at suitable temperature
- c) With sufficient electrical excitation and at suitable pressures

d) When exposed to radiation

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Answer: c

Explanation: Gases emit radiation with sufficient electrical excitation and at suitable pressures. Gases emit radiation in different ways. It can be in the form of spark, arc or glow discharge in different parts of the radiation spectrum.

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2. Which of the following measuring technique is utilized for measuring nitrogen?

- a) By using a method based on gas density
- b) By using paramagnetic analyzers
- c) By using magnetic wind instruments
- d) By using a photospectrometer where a gas sample is analysed and detected with a photocell

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Answer: d

Explanation: By using a photospectrometer gas sample is analysed, for measuring nitrogen. It is then selectively filtered by using a photocell which provides an appropriate electric signal.

3. The characteristic emission of which colour, when discharge takes place in a low pressure chamber containing gas sample, will indicate the presence of nitrogen while using photospectrometer?

- a) Purple
- b) Blue
- c) Pink
- d) Green

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Answer: a

Explanation: The characteristic emission of purple colour, when discharge takes place in a low pressure chamber containing gas sample, will indicate the presence of nitrogen while using photospectrometer. These are usually employed in medical applications.

4. Sample rates of nitrogen meter can be adjusted by doing which of the following?

- a) By modifying the amplifier
- b) With the help of the needle valve
- c) By modifying the detector
- d) By changing chopper frequency

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Answer: b

Explanation: Sample rates of nitrogen meter can be adjusted with the help of a needle valve. Modern nitrogen analyzers have digital displays.

5. Which of the following is the normal sampling rate used in nitrogen meters?

- a) 13 ml/min
- b) 33 ml/min
- c) 3 ml/min
- d) 43 ml/min

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Answer: c

Explanation: The normal sampling rate used in nitrogen meters is 3 ml/min. Modern nitrogen analyzers have digital displays.

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6. Nitrogen meters are calibrated for which of the following to measure nitrogen?

- a) Mixture of nitrogen and air
- b) Water saturated mixture of nitrogen and oxygen
- c) Mixture of nitrogen and hydrogen
- d) Nitrogen

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Answer: b

Explanation: Nitrogen meters are calibrated for water saturated mixture of nitrogen and oxygen. Hence, this calibration cannot be used for dry gases.

7. Why is nitrogen meters generally not calibrated for dry gases while measuring nitrogen?

- a) It causes error
- b) Range decreases
- c) Reading tend to be non-linear
- d) It cannot be measured

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Answer: a

Explanation: Nitrogen meters are generally not calibrated for dry gases because it will lead to error in the reading. The error will be up to 2%.

8. In which of the following ways can nitrogen be calibrated for dry gases?

- a) By modifying the amplifier
- b) By adjusting the needle valve
- c) By modifying the detector

d) By changing chopper frequency

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Answer: b

Explanation: Nitrogen can be calibrated for dry gases by adjusting the needle valve. In this way, the error will be compensated.

9. The voltage required for striking the discharge in the presence of nitrogen is 1500V.

- a) True
- b) False

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Answer: a

Explanation: The voltage required for striking the discharge in the presence of nitrogen is 1500V. This voltage is generated using a DC-DC converter.  
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10. The light output from the discharge tube is interrupted by means of a rotating slotted disc.

- a) True
- b) False

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Answer: a

Explanation: The light output from the discharge tube is interrupted by means of a rotating slotted disc. Hence, a chopped output is obtained.

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## **Analytical Instrumentation Questions and Answers – Sulphur Di-oxide Monitoring**

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Sulphur Dioxide Monitoring”.

1. In West-Gaeke colourimetric procedure, the intensity of the red purple colour is measured photometrically and it is proportional to the concentration of sulphur dioxide. What is the red purple coloured compound?

- a) Sodium tetra chloromercurate
- b) Dicholorosulphitomercurate complex
- c) Ammonia molybdate
- d) Paraosaniline sulphonic acid

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Ans: d

Explanation: Sulphur dioxide reacts with Sodium tetra chloromercurate to form Dicholorosulphitomercurate complex which then reacts with formaldehyde and paraosaniline to form Parapsaniline sulphonic acid which is red purple coloured.

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2. The conductivitmetry method, involves bubbling sulphur dioxide through a solution containing sulphuric acid and which of the following?

- a) Water
- b) Hydrogen peroxide
- c) Iodine
- d) Formaldehyde

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Answer: b

Explanation: The conductivitmetry method, involves bubbling sulphur dioxide through a solution containing sulphuric acid and hydrogen peroxide. It results in the formation of sulphuric acid.

3. Which of the following are not the characteristics of conductivitmetry method used to measure sulphur dioxide?

- a) Fast response
- b) High sensitivity
- c) Free from interference by other gases
- d) Good accuracy

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Answer: c

Explanation: Conductivitmetry instruments are affected by other gases and they cause interference. The other gases may produce or remove ions in the solution.

4. Which of the following are not the characteristics of colorimetry method used to monitor sulphur dioxide?

- a) It is simple
- b) It has high sensitivity
- c) It has good specificity
- d) It is affected by interference from  $H_2SO_4$ ,  $SO_3$ ,  $NH_3$ , etc

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Answer: d

Explanation: Colorimetry method is free from by the interference due to other gases such as It is affected by interference from  $H_2SO_4$ ,  $SO_3$ ,  $NH_3$ , etc. Colour intensity is sensitive to temperature.

5. Which of the following is not true about using gas chromatography for measuring pollutants in the air?

- a) Pollutants react rapidly in the column
- b) Pollutants may not be detected by the detectors
- c) Special column and support materials are required
- d) Pollutants may elude rapidly from the column

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Answer: d

Explanation: Most of the pollutants are extreme reactive materials. Hence, they may not pass through the column and appear at the detector.

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6. The ability of sulphur dioxide to reduce iodine is used in which of the following methods?

- a) Colorimetry
- b) Conductivitmetry
- c) Coulometry
- d) Gas chromatography

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Answer: c

Explanation: The ability of sulphur dioxide to reduce iodine is used in Coulometry method to measure sulphur dioxide. The mass of  $I_2$  reacted per unit time will indicate the amount of sulphur dioxide.

7. Which of the following materials are used as electrodes in the coulometric method for the measurement of sulphur dioxide?

- a) Gold
- b) Silver
- c) Platinum
- d) Nickel

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Answer: c

Explanation: In Coulometric arrangement, the electrodes are made of platinum. These act as the anode and the cathode.

8. Which of the following is the detection limit of the coulometric method used for measurement of sulphur dioxide?

- a) 0.1 ppm
- b) 1 ppm
- c) 2 ppm
- d) 0.01 ppm

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Answer: d

Explanation: The detection limit of the coulometric method is 0.01 ppm. The shift in anode cathode potential is detected by a third electrode.

9. Sensitivity to total sulphur by Flame-photometric detector is which of the following levels?

- a) 0.1 ppm
- b) 1 ppm
- c) 2 ppm
- d) 0.01 ppm

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Answer: d

Explanation: Sensitivity to total sulphur by Flame-photometric detector is 0.01 ppm. Here, sample air is introduced into a hydrogen-rich air flame.  
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10. Which of the following methods are not used for the measurement of sulphur dioxide?

- a) Colorimetric method
- b) Correlation spectroscopy
- c) Paramagnetic analyzers
- d) Flame-photometry

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Answer: c

Explanation: Sulphur di-oxide cannot be analysed using paramagnetic analyzer. This is because sulphur dioxide does not have paramagnetic property.

11. Which of the following is the wavelength of the radiation generated when an air stream containing sulphur dioxide is burned in a hydrogen-rich flame?

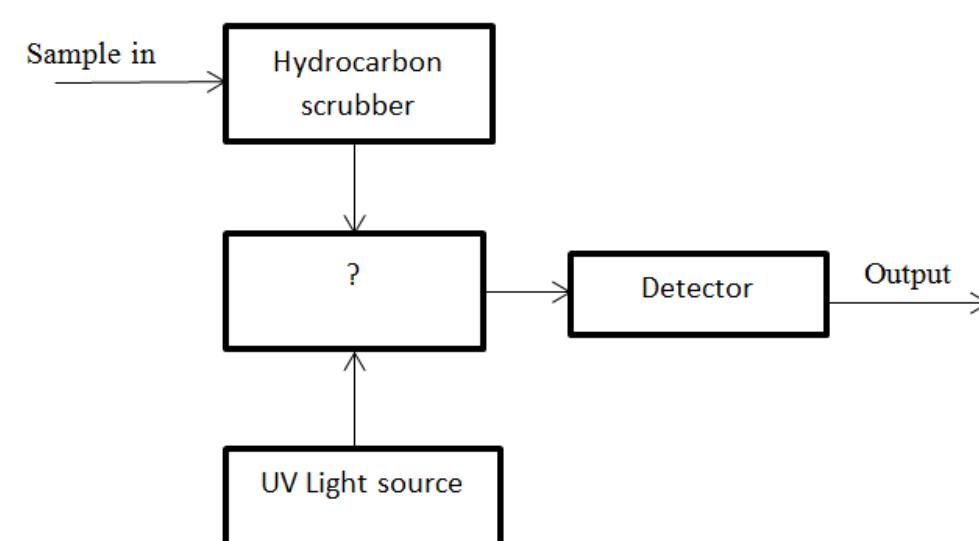
- a) 243 nm
- b) 394 nm
- c) 467 nm
- d) 516 nm

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Answer: b

Explanation: The wavelength of the radiation generated when an air stream containing sulphur dioxide is burned in a hydrogen-rich flame is 394 nm. A narrow band interference filter is used to shield radiations with all other wavelengths.

12. Given below, is the diagram of Ultraviolet Fluorescence method. Identify the unmarked component.



- a) Filter
- b) Electronic circuit
- c) Supply
- d) Fluorescence chamber

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Answer: d

Explanation: The unmarked block is Fluorescence chamber. Here, fluorescence of SO<sub>2</sub> is emitted.

13. In conductivitmetric method, the concentration of sulphur dioxide is proportional to which of the following parameters of the saw-tooth waveform?

- a) Average voltage

- b) Peak voltage
- c) Slope
- d) RMS voltage

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Answer: c

Explanation: In conductivitmetric method, the concentration of sulphur dioxide is proportional to slope of the saw-tooth waveform. Current is recorded every 15 minutes.

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14. In the conductivitmetric method, to measure the conductivity of the cell, 5V \_\_\_\_\_ is applied across the electrodes.

- a) DC
- b) AC
- c) Pulsating DC
- d) DC or AC

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Answer: b

Explanation: In the conductivitmetric method, to measure the conductivity of the cell, 5V alternating current is applied across the electrodes. This is because alternating current avoids polarisation.

15. The response of coulometric method is instantaneous.

- a) True
- b) False

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Answer: b

Explanation: The response of coulometric method is not instantaneous. It may take about 4 minutes for 90 percent of the signal to appear for any concentration of SO<sub>2</sub>.

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# Analytical Instrumentation Questions and Answers – Estimation of Nitrogen Oxides

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Estimation of Nitrogen Oxides”.

1. In Saltzman method, which of the following are formed when air containing  $\text{NO}_2$  is passed in an absorbing solution consisting of the sulphanilic acid and diamine dissolved in the acetic acid medium?

- a) Blue colour dye complex
- b) Green colour dye complex
- c) Pink colour dye complex
- d) Orange colour dye complex

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Answer: c

Explanation: In Saltzman method, a pink colour dye is formed when air containing  $\text{NO}_2$  is passed in an absorbing solution consisting of the sulphanilic acid and diamine dissolved in the acetic acid medium. It is sensitive in the ppm range.

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2. NO can be analysed by converting it into  $\text{NO}_2$  and passing it through potassium permanganate. Which of the following is the main disadvantage of this method?

- a) Less accuracy
- b) Dye formed is unstable
- c) Dye formed is colourless
- d) Quantity of dye is low

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Answer: b

Explanation: NO can be analysed by converting it into  $\text{NO}_2$  and passing it through potassium permanganate. The main disadvantage of this method is that the dye formed is unstable. Hence, it is not suitable for a collection of 24 hours sample.

3. In Jacob-Hochheiser method,  $\text{NO}_2$  is passed through a dilute solution of sodium hydroxide forming the nitrite ion. The nitrite ion is reacted with sulphanilamide and ethylene diamine in which of the following to form the highly coloured azo dye?

- a) Sulphuric acid
- b) Hydrochloric acid
- c) Nitric acid
- d) Phosphoric acid

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Answer: d

Explanation: In Jacob-Hochheiser method,  $\text{NO}_2$  is passed through a dilute solution of sodium hydroxide to form the nitrite ion. The nitrite ion is treated with sulphanilamide and ethylene diamine in phosphoric acid to form the highly coloured azo dye. Then, colorimetric analysis is done.

4. Which of the following methods results in the formation of yellow coloured compound?

- a) Griess-Saltzman method
- b) Phenoldisul phonoic acid method
- c) Chemiluminescence method
- d) West-Gaeke method

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Answer: b

Explanation: Phenoldisul phonoic acid method results in the formation of yellow coloured compound. The intensity of the colour is measured to determine the concentration of  $\text{NO}_x$ .

5. Which of the following is the most common application of Chemiluminescence method used for the analysis of Nitrogen oxides?

- a) In medical applications
- b) In automotive exhaust gases
- c) In manufacturing processes
- d) In chemical industries

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Answer: b

Explanation: The most common application of Chemiluminescence method used for the analysis of Nitrogen oxides is to measure the amount of NO in automotive exhaust gases. Chemiluminescence occurs due to the formation of new chemical bonds.

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6. Which of the following is the wavelength at which CO laser operates?

- a) 1.005  $\mu\text{m}$
- b) 5.307  $\mu\text{m}$
- c) 4.952  $\mu\text{m}$
- d) 6.179  $\mu\text{m}$

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Answer: b

Explanation: CO laser operates at a wavelength of 5.307 μm. It is a DC-excited continuous working laser.

7. CO laser is operated at liquid nitrogen temperature.

- a) True
- b) False

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Answer: a

Explanation: CO laser is operated at liquid nitrogen temperature. It is a DC-excited continuous working laser.

8. The chemiluminescence reactor with ozonator is specific to which of the following compounds?

- a) N<sub>2</sub>
- b) NO
- c) NO<sub>2</sub>
- d) N<sub>2</sub>O

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Answer: b

Explanation: The chemiluminescence reactor with ozonator is specific to NO. Here, the sample containing NO is converted into NO<sub>2</sub> by the ozonator.

9. In which of the following ways can chemiluminescence occur in compounds of nitrogen?

- a) When NO<sub>2</sub> returns to ground state from excited state
- b) When NO reacts with oxygen
- c) When NO reacts with ozone
- d) When NO<sub>2</sub> is reduced to NO

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Answer: a

Explanation: When NO<sub>2</sub> returns to ground state from excited state, chemiluminescence occurs. NO<sub>2</sub> in excited state returns to ground state with the emission of radiant energy.

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10. West-Gaeke colorimetric method is used to analyse oxides of nitrogen.

- a) True
- b) False

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Answer: b

Explanation: West-Gaeke colorimetric method is not used to analyse oxides of nitrogen. It is used to analyse sulphur dioxide.

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# Analytical Instrumentation Questions and Answers – Estimation of Carbon Monoxide

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Estimation of Carbon Monoxide”.

1. Which of the following is the full scale range of Infrared spectroscopy method used for measurement of carbon monoxide?

- a) 0-2 ppm
- b) 0-500 ppm
- c) 0-1 ppm
- d) 0-50 ppm

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Answer: d

Explanation: The full scale range of Infrared spectroscopy method used for measurement of carbon monoxide is 0-50 ppm. It depends on the characteristic absorption of the CO molecule at a particular wavelength.

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2. Which of the following is the full scale range of Gas chromatography method used for measurement of carbon monoxide?

- a) 0-200 ppm
- b) 0-500 ppm
- c) 0-1 ppm
- d) 0-50 ppm

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Answer: a

Explanation: The full scale range of Gas chromatography method used for measurement of carbon monoxide is 0-200 ppm. The detector used in this method is a flame ionization detector.

3. Which of the following are not the characteristics of Non-dispersive infrared analyzer method?

- a) Easy to maintain
- b) High response speed
- c) Effect of interfering components is high
- d) High sensitivity

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Answer: c

Explanation: Effect of interfering components is small for Non-dispersive infrared analyzer method. It depends on the characteristic absorption of the CO molecule at a particular wavelength.

4. Non-dispersive infrared analyzer depends on the characteristic absorption of the CO molecule at a wavelength of \_\_\_\_\_

- a) 5.4  $\mu\text{m}$
- b) 4.6  $\mu\text{m}$
- c) 8.9  $\mu\text{m}$
- d) 10.8  $\mu\text{m}$

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Answer: b

Explanation: Non-dispersive infrared analyzer depends on the characteristic absorption of the CO molecule at a wavelength of 4.6  $\mu\text{m}$ .

5. The zero of the scale is calibrated using which of the following as the sample?

- a) Air
- b) Water
- c) Inert gas
- d) Pure nitrogen

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Answer: d

Explanation: The zero of the scale is calibrated using pure nitrogen as the sample. Optical filters are used to minimize the effects of interfering gases.

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6. The disadvantage of Non-dispersive infrared analyzer is that the effect of flow rate is large.

- a) True

b) False  
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Answer: b

Explanation: In Non-dispersive infrared analyzer, the effect of flow rate is small. Optical filters are used to minimize the effects of interfering gases.

7. A stripper column used in gas chromatography, can be used to retain which of the following when an air sample is passed through it?

- a) CO
- b) Methane
- c) Light hydrocarbons
- d) Heavy hydrocarbons

View Answer

Answer: d

Explanation: A stripper column can be used to retain heavy hydrocarbons when an air sample is passed through it. It passes CO and methane into the column.

8. Which of the following is not a component of the mixture present in the reference cell of Non-dispersive infrared analyzer?

- a) CO
- b) Nitrogen
- c) Water vapour
- d) Hydrogen

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Answer: d

Explanation: The reference cell contains a fixed quantity of gases. It contains CO, nitrogen and water vapour.

9. Hydrogen flame ionization detector can be used to detect only the peak of CO and not methane.

- a) True
- b) False

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Answer: b

Explanation: Hydrogen flame ionization detector can be used to detect the peak of both CO and methane. The accuracy is about 2%.

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10. CO analyzers based on infrared absorption would give greater sensitivity under which of the following conditions?

- a) With larger cell path lengths
- b) With smaller cell path lengths
- c) By changing the gases in the reference cell
- d) By increasing the sample flow rate

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Answer: a

Explanation: CO analyzers based on infrared absorption would give greater sensitivity with larger cell path lengths. If 1m path length is given, the range is from 0 to 50ppm.

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## Analytical Instrumentation Questions and Answers – Estimation of Hydrocarbons

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Estimation of Hydrocarbons”.

1. Which of the following methods cannot be used for the estimation of hydrocarbons?
  - a) Mass spectroscopy
  - b) Chemiluminescence method
  - c) Ultraviolet absorption
  - d) Gas chromatography

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Answer: b

Explanation: Chemiluminescence method cannot be used for the estimation of hydrocarbons. This is because hydrocarbons do not produce chemiluminescence effect.

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2. Which of the following is the most abundant hydrocarbon which is emitted into the atmosphere by biological activity?
  - a) Ethane
  - b) Methane
  - c) Poly Aromatic hydrocarbons
  - d) Pentane

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Answer: b

Explanation: The most abundant hydrocarbon which is emitted into the atmosphere by biological activity is methane. It is also emitted by automobile exhausts, burning of coal, etc.

3. Flame ionization detectors are sensitive to which of the following gases?
  - a) Carbon dioxide
  - b) Methane
  - c) Carbon monoxide
  - d) Sulphur dioxide

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Answer: b

Explanation: Flame ionization detectors are sensitive to methane since they are sensitive to organic compounds. They are insensitive to non-combustible gases. Hence, they are not sensitive to carbon monoxide, carbon dioxide and sulphur dioxide.

4. How can carbon monoxide be detected using flame ionization detectors while using gas chromatography technique?
  - a) By converting it into carbon dioxide
  - b) By converting it into methane
  - c) By mixing it with combustible gases
  - d) It cannot be detected

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Answer: b

Explanation: Carbon monoxide cannot be detected directly using flame ionization detectors while using gas chromatography technique. Hence, it is converted into methane and is then detected.

5. Which of the following organic compounds will have the highest intensity of response when introduced in a flame ionization detector?
  - a) Methane
  - b) Ethane
  - c) Propane
  - d) Butane

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Answer: d

Explanation: Butane will have the highest intensity of response when introduced in a flame ionization detector. This is because the intensity of response will be

6. Propane would give three times the intensity of response as compared to methane.

- a) True
- b) False

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Answer: a

Explanation: Propane would give three times the intensity of response as compared to methane. This is because the intensity of response will be in proportion with the number of carbon atoms in the chain.

7. In flame ionization detectors, which of the following is the range adequate for atmospheric sampling?

- a) 0-1 ppm
- b) 0-2 ppm
- c) 0-20 ppm
- d) 0-100 ppm

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Answer: c

Explanation: In flame ionization detectors, the range adequate for atmospheric sampling is 0-20ppm. It is useful for detecting organic compounds.

8. Which of the following methods make use of pyrolysis while used for detecting methane?

- a) Mass spectroscopy
- b) Flame ionization detector
- c) Ultraviolet absorption
- d) Gas chromatography

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Answer: b

Explanation: Flame ionization detector makes use of pyrolysis while used for detecting methane. It is used to detect organic compounds.

9. In flame ionization detector, the ions collected on the negatively charged grid are amplified at the high impedance amplifier.

- a) True
- b) False

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Answer: b

Explanation: In flame ionization detector, the ions collected on the positively charged grid are amplified at the high impedance amplifier. Its output is given to the chart recorder.

10. Which of the following is not the characteristic of flame ionization detector?

- a) Good linearity
- b) Narrow range of concentration
- c) High sensitivity
- d) Fast response

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Answer: b

Explanation: Narrow range of concentration is not the characteristic of flame ionization detector. It has a broad range of concentration.

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## Analytical Instrumentation Questions and Answers – pH Measurement and Types

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “pH Measurement and Types”.

1. Which of the following is the formula for pH calculation?

- a)  $\log_{10}[\text{H}^+]$
- b)  $-\log_{10}[\text{H}^+]$
- c)  $\log_2[\text{H}^+]$
- d)  $-\log_2[\text{H}^+]$

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Answer: b

Explanation: pH is defined as the negative logarithm of hydrogen ion concentration. Hence, its formula is  $-\log_{10}[\text{H}^+]$ .

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2. Pure water is known to be which of the following?

- a) Weak electrolyte
- b) Strong electrolyte
- c) Neither weak nor strong
- d) Not an electrolyte

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Answer: a

Explanation: Pure water is a weak electrolyte. It dissociates to form hydrogen ions and hydroxyl ions.

3. Which of the following is the value of hydrogen ion concentration of pure water?

- a)  $1 \times 10^7$  moles/litre
- b)  $1 \times 10^5$  moles/litre
- c)  $1 \times 10^6$  moles/litre
- d)  $1 \times 10^8$  moles/litre

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Answer: a

Explanation: The hydrogen ion concentration of pure water is  $1 \times 10^7$  moles/litre. It can be represented as  $[\text{H}^+] = 1 \times 10^7$  moles/litre.

4. Which of the following is the value of hydroxyl ion concentration of pure water?

- a)  $1 \times 10^7$  moles/litre
- b)  $1 \times 10^5$  moles/litre
- c)  $1 \times 10^6$  moles/litre
- d)  $1 \times 10^8$  moles/litre

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Answer: a

Explanation: The hydroxyl ion concentration of pure water is  $1 \times 10^7$  moles/litre. It can be represented as  $[\text{OH}^-] = 1 \times 10^7$  moles/litre.

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5. Which of the following is the relation between hydrogen and hydroxyl ion concentration of pure water?

- a) Value of hydrogen ion concentration is greater
- b) Value of hydroxyl ion concentration is greater
- c) They are both always the same

d) The concentrations keep changing

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Answer: c

Explanation: In water, the value of hydrogen and hydroxyl ion concentrations are the same. It can be represented as  $[H^+] = [OH^-]$ .

6. The Nernst equation is given by which of the following statements?

- a)  $E = E_0 + 2.303 RT/F \log CH$
- b)  $E = E_0 - 2.303 RT/F \log CH$
- c)  $E = E_0 + 2.303 RT \times F \log CH$
- d)  $E = E_0 - 2.303 RT \times F \log CH$

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Answer: a

Explanation: The Nernst equation is represented as,  $E = E_0 + 2.303 RT/F \log CH$ . it is used for measuring the potential of electrodes.

7. Which of the following is the relation between the concentration of hydrogen and hydroxyl ions in an acidic solution?

- a) Value of hydrogen ion concentration is greater
- b) Value of hydroxyl ion concentration is greater
- c) They are both always the same
- d) The concentrations keep changing

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Answer: a

Explanation: In acidic solution, the value of hydrogen ion concentration is greater than that of hydroxyl ion concentration. It can be represented as  $[H^+] > [OH^-]$ .  
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8. Which of the following is the relation between the concentration of hydrogen and hydroxyl ions in a basic solution?

- a) Value of hydrogen ion concentration is greater
- b) Value of hydroxyl ion concentration is greater
- c) They are both always the same
- d) The concentrations keep changing

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Answer: b

Explanation: In basic solution, the value of hydroxyl ion concentration is greater than that of hydrogen ion concentration. It can be represented as  $[H^+] < [OH^-]$ .

9. The measurement of hydrogen ion concentration can be made by measuring the potential developed in an electrochemical cell.

- a) True
- b) False

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Answer: a

Explanation: The measurement of hydrogen ion concentration can be made by measuring the potential developed in an electrochemical cell.

10. Slope factor is independent of temperature.

- a) True
- b) False

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Answer: b

Explanation: Slope factor is dependent on temperature. Slope factor is given by  $-2.303 RT/F$ .

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## Analytical Instrumentation Questions and Answers – Hydrogen and Glass Electrodes

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Hydrogen and Gas Electrodes”.

1. Which of the following is not the characteristic of a reference electrode?
  - a) It must have a known output potential
  - b) It must have a constant output potential
  - c) Its output potential is dependent on the composition of the solution
  - d) It is employed in conjunction with the indicator or working electrode

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Answer: c

Explanation: The output potential of a reference electrode must be insensitive to the composition of the solution.

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2. Why is Standard hydrogen electrode called as the primary reference electrode?
  - a) It has a known output potential
  - b) It has a constant output potential
  - c) Its output potential is independent of the composition of the solution
  - d) Its output potential is zero volts

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Answer: d

Explanation: Standard hydrogen electrode is called the primary reference electrode as its output potential is zero volts. It is employed in conjunction with the indicator or working electrode.

3. Which of the following is the simple and most convenient hydrogen electrode?
  - a) Pascal Hydrogen electrode
  - b) Bourne Hydrogen electrode
  - c) Hilderbant Hydrogen electrode
  - d) West Hydrogen electrode

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Answer: c

Explanation: The hydrogen electrode given by Hilderbant is the simple and most convenient hydrogen electrode. A number of hydrogen electrodes are available.

4. Which of the following is not the disadvantage of hydrogen electrode?
  - a) Platinum can be easily poisoned
  - b) Presence of oxidising agents alters the potential
  - c) It gives a salt error
  - d) H<sub>2</sub> gas at 1 atmospheric pressure is difficult to set up and transport

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Answer: c

Explanation: Hydrogen electrode does not give a salt error. A number of hydrogen electrodes are available.

5. In Hydrogen electrode, the electrode is placed in a solution of \_\_\_\_ M HCl. Fill in the blank.
  - a) 0.5
  - b) 1
  - c) 2

d) 3

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Answer: b

Explanation: In Hydrogen electrode, the electrode is placed in a solution of 1M HCl. H<sub>2</sub> gas at 1 atm pressure is passed through the side arm in such a way that the platinum is half immersed in HCl.

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6. Hydrogen electrode which is the reference electrode can be used as which of the following?

- a) Anode only
- b) Cathode only
- c) Anode or Cathode
- d) Salt bridge

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Answer: c

Explanation: Hydrogen electrode which is the reference electrode can be used as the anode or the cathode. It depends on the half-cell to which it is coupled.

7. If hydrogen electrode acts as cathode, hydrogen is reduced.

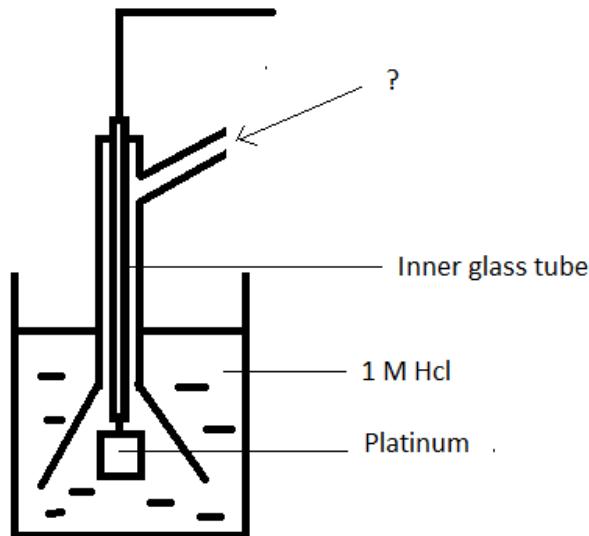
- a) True
- b) False

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Answer: a

Explanation: If hydrogen electrode acts as cathode, hydrogen is reduced. If hydrogen electrode acts as anode, hydrogen is oxidised.

8. Given below is a diagram of hydrogen electrode. Identify the unmarked component.



- a) Hydrogen at 1 atm
- b) Hydrogen at 10 atm
- c) Helium at 1 atm
- d) Helium at 10 atm

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Answer: a

Explanation: Hydrogen at 1 atm is sent through the side tube. The electrode is placed in a solution of 1M HCl.

9. The composition of glass membrane in glass electrode cannot have which of the following?

- a) Sodium silicate
- b) Calcium silicate
- c) Lithium silicate
- d) Barium silicate

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Answer: d

Explanation: Glass electrode consists of either sodium or calcium silicate or lithium silicates containing glass membrane. It has lanthanum and barium ions added to the membrane.

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10. Which of the following is the purpose of added membranes in the glass membrane of the glass electrode?

- a) They act as tighteners
- b) They act as filters
- c) They act as conditioners
- d) They act as collectors

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Answer: a

Explanation: The ions in the added membranes act as tighteners. They reduce the mobility of sodium ion.

11. Which of the following cannot form the inner reference electrode in glass electrodes?

- a) Silver electrode
- b) Copper electrode
- c) Calomel electrode
- d) Silver chloride electrode

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Answer: b

Explanation: Copper electrode cannot form the inner reference electrode in glass electrodes. Inner reference electrode is immersed in a buffer solution.

12. The pH response of glass electrode is limited entirely to the area of the special glass membrane bulb.

- a) True
- b) False

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Answer: a

Explanation: The pH response of glass electrode is limited entirely to the area of the special glass membrane bulb. The response of the electrode is independent of the depth of immersion.

13. Which of the following is not the advantage of glass electrodes?

- a) It gives accurate results for high as well as low pH values
- b) It is simple to operate
- c) It has no salt error
- d) Modern electrodes can withstand severe treatment

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Answer: a

Explanation: It gives accurate results for low pH values only ie. from 0 to 9. For high pH values, the glass becomes responsive to sodium and other cations.  
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14. Which of the following is not the disadvantage of glass electrodes?

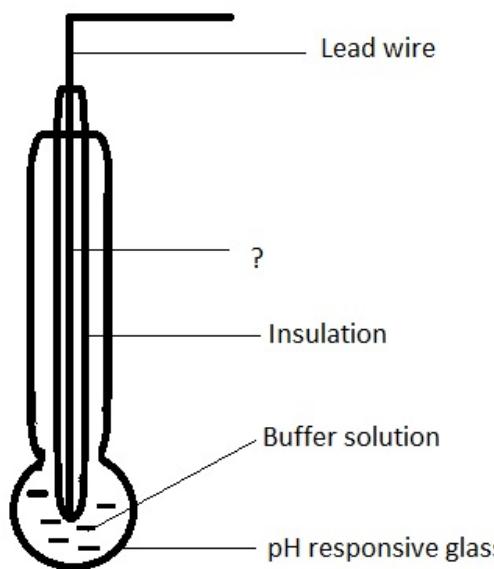
- a) Poor readings are obtained in buffered or unbuffered solutions
- b) The electrode must be washed thoroughly with distilled water to obtain proper results
- c) Materials suspended on glass should be wiped out neatly to obtain proper results
- d) It is affected by oxidation reduction potentials in the solution

[View Answer](#)

Answer: d

Explanation: It is affected by oxidation reduction potentials in the solution. It is an advantage of the glass electrode.

15. Given below is the diagram of glass electrode. Identify the unmarked component.



- a) Platinum leads
- b) Silver wire coated with silver chloride
- c) Copper wire
- d) Platinum reference electrode

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Answer: b

Explanation: The unmarked component is silver wire coated with silver chloride. It forms the inner reference electrode.

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# Analytical Instrumentation Questions and Answers – Secondary Reference Electrodes

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Secondary Reference Electrodes”.

1. Which of the following cannot be used as secondary reference electrode?

- a) Calomel electrode
- b) Silver-silver chloride electrode
- c) Mercury-mercury sulphate electrode
- d) Glass electrode

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Answer: d

Explanation: Glass electrode cannot be used as secondary reference electrode. It is an indicator electrode. It responds to the changes in the activity of the analyte ion.

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2. Which of the following is known as calomel?

- a) Silver chloride
- b) Mercury chloride
- c) Potassium chloride
- d) Mercury sulphate

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Answer: b

Explanation: Mercury chloride is known as calomel. The most important general purpose secondary electrode is calomel electrode.

3. The calomel electrodes are classified based on which of the following?

- a) Materials used in the electrode
- b) Amount of mercury present

- c) Concentration of KCl
- d) Purity of mercury

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**Answer: c**

**Explanation:** Several convenient calomel electrodes are available. They are classified based on the concentration of KCl.

**4. Which of the following calomel electrodes are used for accurate work?**

- a) Saturated calomel electrode
- b) Electrode with 0.1M KCl
- c) Electrode with 1M KCl
- d) Electrode with 2M KCl

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**Answer: b**

**Explanation:** Calomel electrode with 0.1M KCl is used for accurate work. Saturated calomel electrodes are easy to prepare and maintain.

**5. Calomel electrode can behave as which of the following components?**

- a) Anode only
- b) Cathode only
- c) Anode or cathode
- d) Salt bridge

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**Answer: c**

**Explanation:** Calomel electrode can behave as anode or cathode depending upon the half cell. A salt bridge is used for coupling.

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**6. When the calomel electrode acts as the cathode which of the following does not occur?**

- a) Mercury ions are discharged at the electrode
- b) More calomel passes into the solution
- c) There is a decrease in the concentration of chloride ions
- d) There is an increase in the concentration of chloride ions

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**Answer: d**

**Explanation:** When the calomel electrode acts as the cathode, mercury ions are discharged at the electrode. More calomel passes into the solution. Hence, there is an increase in the concentration of chloride ions.

**7. Which of the following is not the characteristics of a calomel electrode?**

- a) The potential of electrode is not temperature dependent
- b) Preparation of electrode is easy
- c) Value of potential or emf is higher for lower concentration of KCl
- d) Value of potential decreases with increasing concentration of KCl

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**Answer: a**

**Explanation:** The potential of calomel electrode is temperature dependent. When temperature changes potential comes to a new value. It cannot be used in places where high temperatures exist.

**8. Which of the following is not the characteristics of silver/silver chloride electrode?**

- a) These electrodes have good electrical and chemical stability
- b) It can be used in temperatures greater than 600°C
- c) It can be used in places or solutions that have strong reducing agents
- d) It should not be used in solutions that contain proteins, sulphide or bromide

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**Answer: c**

**Explanation:** The silver/silver chloride electrode cannot be used in places or solutions that have strong reducing agents. They will reduce the silver ions to silver metal.

**9. While using reference electrodes, the internal liquid level should always be kept above that of the sample solution.**

- a) True
- b) False

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**Answer: a**

**Explanation:** While using reference electrodes, the internal liquid level should always be kept above that of the sample solution. This is done to prevent contamination of the electrolyte solution.

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**10. Which of the following salt bridge solutions must be used for silver/silver chloride electrode?**

- a) Saturated KCl
- b) Saturated K<sub>2</sub>SO<sub>4</sub>
- c) Saturated LiCl

d) Saturated KNO<sub>3</sub>

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Answer: a

Explanation: Saturated KCl is used as the salt bridge solution for silver/silver chloride electrode. It can also be used for calomel electrode.

11. LiCl salt bridge is more suitable in organic solvents than KCl.

a) True

b) False

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Answer: a

Explanation: LiCl salt bridge is more suitable in organic solvents than KCl. It is used for the measurement of non-aqueous solutions.

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## Analytical Instrumentation Questions and Answers – Combination Electrode

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Combination Electrode”.

1. In combination electrode, which of the following electrodes are built together?

- a) Primary electrode, secondary reference electrode
- b) Primary reference electrode, glass electrode
- c) Glass electrode, secondary reference electrode
- d) Glass electrode with another glass electrode

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Answer: c

Explanation: In combination electrode, glass electrode and secondary reference electrode are built together. Internal reference electrode is identical with an external reference electrode.

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2. Which of the following reference electrodes are used as internal and external reference electrodes in combination electrodes?

- a) Silver/silver chloride electrode
- b) Calomel electrode
- c) Mercury/mercury sulphate electrode
- d) Mercury/mercury chloride electrode

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Answer: a

Explanation: Silver/silver chloride electrode is used as internal and external reference electrodes in combination electrodes. Internal reference electrode is identical with an external reference electrode.

3. The reference electrodes in combination electrodes are protected against light using which of the following?

- a) Emerald green glass
- b) Ruby red glass
- c) Sapphire blue glass
- d) Pearl white glass

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Answer: b

Explanation: The reference electrodes in combination electrodes are protected against light using ruby red glass. The ruby red glass absorbs light.

4. Combination electrodes containing the electrolyte in gel format have which of the following advantages over normal ones?

- a) Simple to use
- b) Low maintenance
- c) Low cost
- d) More accurate

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Answer: b

Explanation: Combination electrodes containing the electrolyte in gel format provide the advantage of low maintenance. They are more rugged.

5. Which of the following is not the advantage of gel-filled electrodes?

- a) Low maintenance
- b) Rugged in construction
- c) Easy to maintain
- d) Does not cause clogging

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Answer: d

Explanation: Gel-filled electrodes cause clogging. Hence, the output becomes less accurate.

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6. Good choice for storing combination electrodes is in a buffer solution having which of the following pH?

- a) pH1
- b) pH2
- c) pH3
- d) pH4

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Answer: d

Explanation: Good choice for storing combination electrodes is in a buffer solution having pH4. They can be stored in KCl solutions having particular pH values.

7. The gel used in combination electrodes does not have which of the following characteristic?

- a) Non-toxic
- b) USP grade
- c) Inorganic material
- d) Polyacrylamide

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Answer: c

Explanation: The gel used in combination electrodes is organic. It can also be made of polyacrylamide.

8. Beckman coulter gel filled combination electrodes provide which of the following features to overcome various problems that occur in gel filled electrodes?

- a) Filters
- b) Semi-permeable membrane
- c) Gas-permeable membrane
- d) Micro-pore junction

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Answer: d

Explanation: Beckman coulter gel filled combination electrode provides a special micro-pore junction to overcome various problems that occur in gel filled

electrodes. Here, there is direct contact between the sample and the gel.

9. In which of the following solutions must combination electrodes be soaked after cleaning?

- a) KCl
- b) LiCl
- c) KNO<sub>3</sub>
- d) K<sub>2</sub>SO<sub>4</sub>

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Answer: a

Explanation: Combination electrodes can be soaked in KCl solution after cleaning. This will re-condition the bulb and increases its life.  
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10. Gel filled combination electrodes operate in a wide temperature range.

- a) True
- b) False

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Answer: a

Explanation: Gel filled combination electrodes operate in a wide temperature range. The temperature range is between -5 to 100°C.

11. In combination electrodes, both the electrodes must be maintained at different temperatures.

- a) True
- b) False

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Answer: b

Explanation: In combination electrodes, both the electrodes must be maintained at the same temperature. Measuring error due to small temperature differences between the buffer solution and the sample are negligible.

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# Analytical Instrumentation Questions and Answers – pH Meters

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “pH Meters”.

1. pH meters can be considered as voltage sources with which of the following internal resistances?

- a) Very low resistance
- b) Moderate resistance
- c) Very high resistance
- d) No resistance

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Answer: c

Explanation: pH meters can be considered as voltage sources with very high internal resistance. In order to eliminate errors, no current should flow from the source.

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2. The electrodes used in pH measurement have which of the following internal resistances?

- a) Very low resistance
- b) Moderate resistance
- c) Very high resistance
- d) No resistance

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Answer: c

Explanation: The electrodes used in pH measurement have very high internal resistance. It is of the order of 1000M ohm.

3. Which of the following is not a failure in pH meters?

- a) Defective electrodes
- b) Defective input circuitry
- c) Defective electronic circuitry
- d) Defective calibration

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Answer: d

Explanation: Defective calibration is not a failure in pH meters. Failure occurs due to defective electrodes, defective input circuitry and defective electronic circuitry.

4. Which of the following is the simplest of pH meters?

- a) Null-detector type pH meter
- b) Direct reading type pH meter
- c) Digital pH meter
- d) Modern pH meter

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Answer: a

Explanation: Null-detector type pH meter is the simplest of all pH meters. It is also known as the potentiometer type.

5. In which of the following ways can zero drift be reduced in pH meters?

- a) Using filter
- b) Giving zero adjustment arrangement
- c) Keeping the input impedance high
- d) Using balanced and differential amplifiers

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Answer: d

Explanation: Zero drift be reduced in pH meters using balanced and differential amplifiers. Their response to external signals are additive and to internal noise are subtractive.

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6. Which of the following can be used to provide automatic temperature compensation?

- a) Proper insulation
- b) Calibration for different temperatures
- c) Thermistor
- d) Thermometer

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Answer: c

Explanation: To provide automatic temperature compensation, thermistors must be used. As the temperature of the solution changes, the circuit constants are altered accordingly.

7. Which of the following is not the characteristic of null-detector type pH meter?

- a) It can be battery operated
- b) It has less accuracy

- c) It is easy to maintain
- d) Its electronic circuits are simple

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Answer: b

Explanation: Null-detector type pH meter has greater accuracy than 0.01 pH. pH value is read from the calibrated precision voltage source dial.

8. Which of the following is not the characteristic of direct reading type pH meters?

- a) Simple operation
- b) Quick to use
- c) Continuous indication output
- d) It requires balancing process

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Answer: d

Explanation: Direct reading type pH meters do not require balancing process. Its operation is simple and readings can be read directly.

9. Which of the following is not the characteristic of chopper amplifier pH meter?

- a) Direct voltage from the electrodes is chopped at the main frequency
- b) Using choppers for high-input resistance gives rise to spikes of waveforms at the output
- c) It leads to stability in DC output of phase-sensitive rectifier
- d) Magnitude of surge increases in the glass electrode output

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Answer: c

Explanation: The use of chopper amplifier in pH meter leads to zero instability. It leads to various other problems for high-input resistance.  
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10. In which of the following ways can the disadvantages of chopper amplifier type pH meter be overcome?

- a) Using zero corrected DC amplifier
- b) Using modern design
- c) Using digital design
- d) Using vibrating condenser

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Answer: d

Explanation: The disadvantages of chopper amplifier type pH meter can be overcome using a vibrating condenser. It is used in the place of the mechanical chopper.

11. The zero stability of vibrating condenser amplifier type pH meter is much better than a direct coupled amplifier.

- a) True
- b) False

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Answer: a

Explanation: The zero stability of vibrating condenser amplifier type pH meter is much better than a direct coupled amplifier. The capacity can be changed by vibrating one of its plates.

12. In vibrating condenser amplifier type pH meter, to maintain good performance which of the following has to be done?

- a) Frequency of the vibrator should be stable
- b) Frequency of the vibrator should be constant
- c) Amplitude of the vibrator should be constant
- d) Both frequency and amplitude of the vibrator should be constant and stable

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Answer: d

Explanation: In vibrating condenser amplifier type pH meter, to maintain good performance, both frequency and amplitude of the vibrator should be constant and stable.

13. If an instrument fails to balance at zero, it is most likely that the electrodes are defective.

- a) True
- b) False

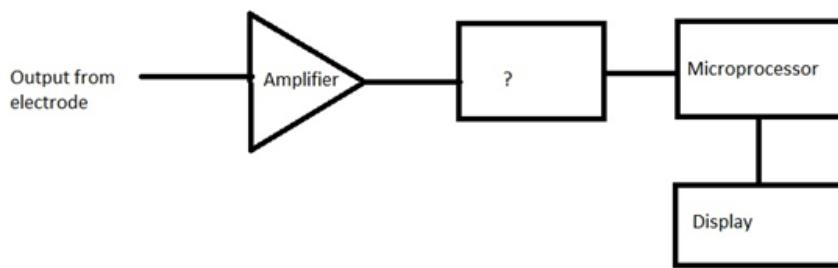
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Answer: b

Explanation: If an instrument fails to balance at zero, it is most likely that the electronic circuitry is defective. Errors may also occur due to leakage of capacitance.

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14. Given below is the block diagram of digital pH meter. Identify the unmarked component.



- a) Filter
- b) Buffer
- c) A/D converter
- d) D/A converter

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Answer: c

Explanation: The unmarked component is A/D converter. Microprocessor operates only on digital data. Electrodes give analog signals. Hence, A/D converter must be present.

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## Analytical Instrumentation Questions and Answers – Ion Selective Electrodes-Principle and Types

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This set of Analytical Instrumentation Interview Questions and Answers focuses on “Ion Selective Electrodes-Principle and Types”.

1. Which of the following is not the characteristic of ion selective electrodes?

- a) It is fragile

- b) Easy to use
- c) Available in different sizes and shapes
- d) It is insensitive to many ions

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Answer: a

Explanation: Ion selective electrode is rugged in construction. It is highly selective to a particular ion.  
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2. In glass membrane electrode, the glass containing 11% Na<sub>2</sub>O, 18% Al<sub>2</sub>O<sub>3</sub>, 71% SiO<sub>2</sub> is highly sensitive to which of the following ions?

- a) Sodium
- b) Hydrogen
- c) Nitrogen
- d) Chlorine

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Answer: a

Explanation: In glass membrane electrode, the glass containing 11% Na<sub>2</sub>O, 18% Al<sub>2</sub>O<sub>3</sub>, 71% SiO<sub>2</sub> is highly sensitive to sodium ions. Glass electrodes can be used to measure various ions by changing the glass membrane composition.

3. In liquid membrane electrode, the liquid ion exchanger is held in a porous disc of \_\_\_\_\_

- a) Solid material
- b) Semi-permeable membrane
- c) Hydrophobic material
- d) Water absorbing material

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Answer: c

Explanation: In a liquid membrane electrode, the liquid ion exchanger is held in a porous disc of hydrophobic material. It is water repelling material.

4. In recent liquid membrane electrodes, the porous liquid membrane is replaced with which of the following?

- a) Polyvinyl chloride
- b) Polyacryl chloride
- c) Polyester membrane
- d) Polyacryl amide

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Answer: a

Explanation: In recent liquid membrane electrodes, the porous liquid membrane is replaced with polyvinyl chloride membrane. The measured potential is a direct measure of the concentration of specific ion.

5. Which of the following is used in potassium electrode in liquid membrane electrodes?

- a) Ionomycin
- b) Valinomycin
- c) Nonactin
- d) Gramicidin

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Answer: b

Explanation: Valinomycin is used in potassium electrode in liquid membrane electrodes. It is a doughnut shaped electron rich pocket.  
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6. In solid state membranes, the body of the electrodes are made of which of the following?

- a) Polyvinyl chloride
- b) Plastic
- c) Polythene
- d) Teflon

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Answer: d

Explanation: In solid state membranes, the body of the electrodes are made of Teflon. The membrane is held in position using epoxy resin.

7. Which of the following is not the characteristic of ion selective electrodes?

- a) Simple to use
- b) Inexpensive
- c) Narrow concentration range
- d) Operates in wide range of temperature

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Answer: c

Explanation: Ion selective electrodes have a wide concentration range. It is highly selective to a particular ion.

8. Ion selective electrode are unaffected by colour or turbidity of the solution.

- a) True
- b) False

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Answer: a  
Explanation: Ion selective electrode are unaffected by colour or turbidity of the solution. It operates in wide range of temperature.

9. Which of the following is not a problem of ion selective electrodes?

- a) Interference with other ions
- b) Output is influenced by ionic strength
- c) Drift in electrode potential during a sequence of measurements
- d) Can measure only positive ions

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Answer: d

Explanation: Ion selective electrodes can measure both positive and negative ions. It is affected by interference from other ions.  
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10. Which of the following is the effective concentration measured at the electrode head?

- a) Selectivity coefficient
- b) Ionic strength
- c) Activity
- d) Activity coefficient

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Answer: c

Explanation: Activity is the effective concentration measured at the electrode head. Concentration is different from the activity.

11. The value of activity coefficient is always in which of the following ranges?

- a) Zero
- b) Less than zero
- c) Less than 1
- d) Greater than 1

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Answer: c

Explanation: The value of activity coefficient is always less than 1. It is the ratio of activity divided by concentration.

12. Which of the following specifies the relation between ionic strength and activity coefficient?

- a) Directly proportional
- b) Inversely proportional
- c) Equal
- d) No particular relation

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Answer: b

Explanation: Activity coefficient and ionic strength are inversely proportional to each other. If the ionic strength increases, the value of activity decreases.

13. The difference between measured activity and actual concentration becomes higher at higher concentration. Is this statement true or false?

- a) True
- b) False

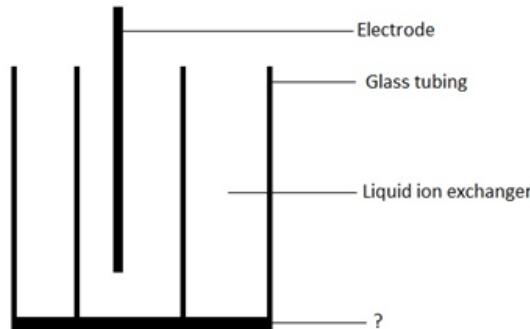
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Answer: a

Explanation: The difference between measured activity and actual concentration becomes higher at higher concentration. Similarly, it decreases at lower concentrations.

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14. Given below is the diagram of liquid membrane electrode. Identify the unmarked component.



- a) Solid material
- b) Semi-permeable membrane
- c) Hydrophobic material
- d) Water absorbing material

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Answer: c

Explanation: The unmarked component is porous hydrophobic material. It holds the liquid ion exchanger.

15. Ion selective electrodes have \_\_\_\_\_ linear range and \_\_\_\_\_ detection limit than the pH electrode.

- a) Lower, lower
- b) Lower, higher
- c) Higher, lower
- d) Higher, higher

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Answer: b

Explanation: Ion selective electrodes have a lower linear range and higher detection limit than the pH electrode. It works on effectively narrow pH.

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## Analytical Instrumentation Questions and Answers – Ammonia and Fluoride Electrode

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Ammonia and Fluoride Electrode”.

1. In Ammonia electrode, diffusion of dissolved ammonia occurs through the membrane until which of the following conditions occur?

- a) Concentration becomes equal on both sides
- b) Activity becomes equal on both sides
- c) Partial pressure becomes equal on both sides
- d) Differential pressure is low

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Answer: c

Explanation: In Ammonia electrode, diffusion of dissolved ammonia occurs through the membrane until partial pressure becomes equal on both sides. Partial pressure is proportional to its concentration.

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2. When electrode potential response is plotted as a function of ammonia concentration on a semi-log graph, the graph obtained will be \_\_\_\_\_

- a) A straight line

- b) Parabolic
  - c) Sigmoidal
  - d) A curve
- [View Answer](#)

Answer: a

Explanation: When electrode potential response is plotted as a function of ammonia concentration, the graph obtained will be a straight line. The slope will be about 58mV per decade.

3. How can samples above 1M in ammonia concentration be measured using ammonia electrode?

- a) It must be diluted and measured
- b) It cannot be measured
- c) The electrode has to be modified for measuring
- d) It can be measured directly

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Answer: a

Explanation: Samples above 1M in ammonia concentration be measured by diluting the solution. Samples having concentrations below that can be measured directly.

4. The dilution of solution must not reduce the level of ammonia below \_\_\_\_\_

- a)  $10^{-2}$  M
- b)  $10^{-5}$  M
- c)  $10^{-8}$  M
- d)  $10^{-9}$  M

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Answer: b

Explanation: The dilution of solution must not reduce the level of ammonia below  $10^{-5}$  M. The total level of dissolved species must be below 1M.

5. Which of the following factors does not the reproducibility of the ammonia electrode?

- a) Temperature
- b) Drift
- c) Noise
- d) Dilution

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Answer: d

Explanation: Dilution does not affect reproducibility. The other three factors affect reproducibility.  
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6. The performance of ammonia electrode is not affected by sample colour and turbidity.

- a) True
- b) False

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Answer: a

Explanation: The performance of ammonia electrode is not affected by sample colour and turbidity. Temperature affects its output.

7. In fluoride ion electrode, the potential corresponding to level of the fluoride ion is described by which of the following equations when E is the measured electrode potential,  $E_o$  is the reference potential and A is the level of fluoride ions in solution?

- a)  $E=E_o+0.0591 \log A$
- b)  $E=E_o-0.0591 \log A$
- c)  $E=E_o+0.0896 \log A$
- d)  $E=E_o-0.0896 \log A$

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Answer: b

Explanation: In fluoride ion electrode, the potential corresponding to level of the fluoride ion is described by the equation,  $E=E_o-0.0591 \log A$ . A is the activity or effective concentration of fluoride ions.

8. What does TISAB which is used to overcome interferences stand for?

- a) Total Isolation Strength Absolute Buffer
- b) Total Ionic Strength Absolute Buffer
- c) Total Ionic Strength Adjustment Buffer
- d) Total Isolation Strength Adjustment Buffer

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Answer: c

Explanation: TISAB stands for ‘Total Ionic Strength Adjustment Buffer’. It is added in excess and in exactly the same amount to each of the solutions that is to be measured.

9. Which of the following causes main interference in Fluoride electrode?

- a)  $H^+$  ions

- b) OH<sup>-</sup> ions
- c) Li<sup>+</sup> ions
- d) Cl<sup>-</sup> ions

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Answer: b

Explanation: The main interference in fluoride ions is caused by OH<sup>-</sup> ions. It has excellent selectivity.  
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10. Crystal membrane of ion selective electrode can be regenerated by washing with which of the following?

- a) Alcohol
- b) Iodine solution
- c) Acidic solution
- d) Basic solution

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Answer: a

Explanation: Crystal membrane of an ion selective electrode can be regenerated by washing with alcohol. It can be gently polished with emery paper to remove deposits.

11. For fluoride electrode, the electrode response curve will not only shift but will change slope with changes in temperature.

- a) True
- b) False

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Answer: a

Explanation: For fluoride electrode, the electrode response curve will not only shift but will change slope with changes in temperature. A 1° change in temperature causes a 2% error.

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# Analytical Instrumentation Questions and Answers – Special Designs of Ion Selective Electrodes

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Special designs of Ion Selective Electrodes”.

1. Which of the following gas permeable membrane is used for ammonia gas sensing electrode?

- a) Silicon rubber
- b) Microporous Teflon membrane
- c) Fluorocarbon
- d) Polythene

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Answer: c

Explanation: Gas permeable membrane used for ammonia sensing electrode is fluorocarbon membrane. For each gas different membranes are used.  
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2. Which of the following gas permeable membrane is used for carbon dioxide gas sensing electrode?

- a) Silicon rubber
- b) PVC membrane
- c) Fluorocarbon
- d) Polythene

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Answer: a

Explanation: Gas permeable membrane used for carbon dioxide sensing electrode is silicon rubber membrane. For each gas different membranes are used.

3. The response time of the biocatalytic membrane electrode is poor when used with complex organic molecules.

- a) True
- b) False

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Answer: b

Explanation: The response time of the biocatalytic membrane electrode is good even when used with complex organic molecules. But, the membrane is costly.

4. Which of the following reference electrode is placed in the solution of carbon dioxide electrode?

- a) Calomel electrode
- b) Silver/silver chloride electrode
- c) Mercury/mercury sulphate electrode
- d) Glass electrode

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Answer: b

Explanation: A silver/silver chloride reference electrode is placed in the solution. A glass electrode is also placed in the solution but it is not a reference electrode.

5. Biocatalytic membrane electrode cannot be used for the measurement of which of the following gases?

- a) Ammonia
- b) Carbon dioxide
- c) Hydrogen
- d) Nitrogen

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Answer: d

Explanation: Biocatalytic membranes cannot be used for the measurement of nitrogen. It can be used for the measurement of other three gases.  
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6. The biocatalytic membrane used in the ammonia selective electrode is which of the following?

- a) Urea
- b) Urease
- c) Acrylamide
- d) Polyacrylamide

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Answer: b

Explanation: The biocatalytic membrane used in the ammonia selective electrode is urease. It is used for the detection of ammonia.

7. Which of the following materials are used as a gel to which biocatalytic membrane is fixed in ammonia selective electrode?

- a) Urea
- b) Urease
- c) Acrylamide
- d) Polyacrylamide

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Answer: c

Explanation: The material used as a gel to which biocatalytic membrane is fixed in ammonia selective electrode is acrylamide. This is attached to the ion selective electrode directly.

8. The biocatalytic membrane is attached to the glass electrode using which of the following materials?

- a) Nylon mesh
- b) Teflon
- c) Silicon rubber
- d) Polythene

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Answer: a

Explanation: The biocatalytic membrane is attached to the glass electrode using nylon mesh. Cellophane film can also be used.

9. The response time of the biocatalytic electrode is a function of the thickness of the enzyme layer.

- a) True
- b) False

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Answer: a

Explanation: The response time of the biocatalytic electrode is a function of the thickness of the enzyme layer. It is also a function of diffusion of the layer in the sample solution.

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10. In carbon dioxide electrode, the membrane separates which of the following?

- a) Sodium carbonate, magnesium chloride
- b) Magnesium hydrogen carbonate, sodium chloride
- c) Sodium hydrogen carbonate, sodium chloride
- d) Magnesium carbonate, magnesium chloride

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Answer: b

Explanation: In carbon dioxide electrode, the membrane separates sodium hydrogen carbonate and sodium chloride. Sodium hydrogen carbonate is the internal electrolyte.

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# Analytical Instrumentation Questions and Answers – Ion Analyser

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Ion Analyser”.

1. If a solid or liquid membrane is placed in pure water, the membrane dissolves slightly, producing an equilibrium concentration of the measured ion. This is represented as \_\_\_\_\_

- a) A constant,  $E_0$
- b) Activity
- c) Blank correction,  $C_b$
- d) Concentration of standard solution,  $C_s$

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Answer: c

Explanation: If a solid or liquid membrane is placed in pure water, the membrane dissolves slightly, producing an equilibrium concentration of the measured ion. This is represented as a blank correction,  $C_b$ . This is the constant background for all measurements.

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2. During which of the following conditions is the blank correction not necessary?

- a) If sample concentration rises in linear response region
- b) If sample concentration falls in linear response region
- c) If sample concentration rises in non-linear response region
- d) If sample concentration falls in non-linear response region

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Answer: b

Explanation: The blank correction is not necessary if sample concentration falls in the linear response region. This is the constant background for all measurements.

3. During which of the following conditions is the blank correction necessary?

- a) If sample concentration rises in linear response region
- b) If sample concentration falls in linear response region
- c) If sample concentration rises in non-linear response region
- d) If sample concentration falls in non-linear response region

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Answer: d

Explanation: The blank correction is necessary if sample concentration falls in non-linear response region. This is the constant background for all measurements.

4. Ion analysers need calibration once in which of the following durations?

- a) Every two or three hours
- b) Every nine or ten hours
- c) Every 24 hours
- d) Every 48 hours

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Answer: a

Explanation: Ion analysers need calibration every two or three hours. Temperature affects the output.

5. In ion analysers, which of the following serve the dual purpose of controlling the operating current of FET and providing current gain?

- a) FET itself does it
- b) SCR
- c) Op-amp
- d) Diode

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Answer: c

Explanation: In ion analysers, op-amp serves the dual purpose of controlling the operating current of FET and providing current gain. Two FETs are operated as source followers.

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6. The presence of dirt or moisture degrades which of the following?

- a) Circuit components
- b) High input impedance of buffer amplifier
- c) Low input impedance of buffer amplifier
- d) Low output impedance of buffer amplifier

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Answer: b

Explanation: The presence of dirt or moisture degrades the high input impedance of the buffer amplifier. Solder flux may also degrade it.

7. Which of the following is not a type of ground in ion analyser?

- a) Chassis and electrostatic ground
- b) Digital ground
- c) Analog ground
- d) Reference ground

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Answer: d

Explanation: There is no such point as a reference ground. Three types of grounding are provided which are chassis and electrostatic ground, digital ground and analog ground.

8. The timing for a microprocessor and for all signals is generated by the CPU clock.

- a) True
- b) False

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Answer: a

Explanation: The timing for a microprocessor and for all signals is generated by the CPU clock. A crystal may be present to provide clock signals.

9. Which of the following is the only operator entry required in PC-based ion analysers?

- a) Hardware set-up
- b) Signal measurement
- c) Calibration
- d) Sample calculation

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Answer: c

Explanation: Calibration is the only operator entry required in PC-based ion analysers. The operator has to enter the concentration of calibration standards.

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10. The analog and digital grounds are connected together in ion analysers.

- a) True
- b) False

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Answer: b

Explanation: The analog and digital grounds are not connected together in ion analysers. This is to ensure that the digital signals never flow through the same conductor as analog signals.

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# Analytical Instrumentation Questions and Answers – Biosensors

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Biosensors”.

1. Which of the following is not a characteristic of the immobilized enzymes?

- a) They cannot be re-used
- b) It produces reproducible results
- c) Stability exists
- d) Same catalytic activity is present for number of analysis

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Answer: a

Explanation: Immobilized enzymes can be reused. This ensures that the same catalytic activity is present for a number of analyses.

2. Which of the following is the physico-chemical component?

- a) Enzymes
- b) Anti-bodies
- c) Transducer
- d) Cells or tissues

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Answer: c

Explanation: Transducer is referred to as the physico-chemical component. Enzymes and anti-bodies are biological components.

3. An example of biosensor, urea electrode makes use of which of the following electrodes?

- a) Carbon dioxide electrode
- b) Ammonia electrode
- c) Fluoride electrode
- d) Ammonium electrode

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Answer: d

Explanation: An example of biosensor, urea electrode makes use of the ammonium electrode. A urease membrane is also present.

4. In glucose electrode, glucose oxidase has been coupled to an electrode by which of the following materials?

- a) Ferrocene derivatives
- b) Urease
- c) Polyacrylamide
- d) Biochips

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Answer: a

Explanation: In glucose electrode, glucose oxidase has been coupled to an electrode by using ferrocene derivatives. It is used to measure blood glucose in diabetic patients.

5. Biosensors measure glucose concentrations between which of the following ranges?

- a)  $10^{-1}$  to  $10^{-2}$  M
- b)  $10^{-2}$  to  $10^{-4}$  M
- c)  $10^{-1}$  to  $10^{-4}$  M
- d)  $10^{-1}$  to  $10^{-7}$  M

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Answer: d

Explanation: Biosensors measure glucose concentrations between  $10^{-1}$  to  $10^{-7}$  M. It is linear in the range of  $10^{-2}$  to  $10^{-4}$  M.

6. Transducers employed in the bulk of enzyme electrodes use which of the following principles?

- a) Amperometric
- b) Optical
- c) Magnetic
- d) Colorimetric

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Answer: a

Explanation: Transducers employed in the bulk of enzyme electrodes use amperometric principle. It may also use the potentiometric principle.

7. Which of these biosensors use the principle of heat released or absorbed by a reaction?

- a) Potentiometric biosensor
- b) Optical biosensors
- c) Piezo-electric biosensors
- d) Calorimetric biosensors

[View Answer](#)

Answer: d

Explanation: Calorimetric biosensors use the principle of heat released or absorbed by a reaction. The heat is measured to determine the concentration.

8. Which of the following biosensors use the movement of electrons produced during redox reactions?

- a) Amperometric biosensor
- b) Potentiometric biosensors
- c) Piezo-electric biosensors
- d) Optical biosensors

[View Answer](#)

Answer: a

Explanation: Amperometric biosensor uses the movement of electrons produced during redox reactions. Redox reactions involve both reduction and oxidation.

9. Nanoscopic optical biosensors have fast response time but the sensitivity is reduced.

- a) True
- b) False

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Answer: b

Explanation: Nanoscopic optical biosensors have a fast response. They also have excellent biochemical sensitivity.

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10. Given below is the diagram of biosensor. Identify the unmarked component.



- a) Microprocessor
- b) Filter
- c) Transducer
- d) A/D converter

[View Answer](#)

Answer: c

Explanation: The biological signals must be converted into electrical signals. Transducers are used for this purpose.

11. In glucose sensor, a measure of change in oxygen value is a measure of the glucose value.

- a) True
- b) False

[View Answer](#)

Answer: a

Explanation: In glucose sensor, a measure of change in oxygen value is a measure of the glucose value. It is then processed and displayed.

12. For constructing the glucose sensor, which of the following is used as a gel?

- a) Urea
- b) Urease
- c) Acrylamide
- d) Polyacrylamide

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Answer: d

Explanation: For constructing the sensor, polyacrylamide is used as the gel. It is used to entrap the glucose oxidase.

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# Analytical Instrumentation Questions and Answers – Dissolved Oxygen Analyser

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This set of Analytical Instrumentation Assessment Questions and Answers focuses on “Dissolved Oxygen Analyser”.

1. Which of the following transducers must be used for dissolved oxygen analyser?

- a) Potentiometric
- b) Polarographic
- c) Ion-selective electrode
- d) Optical transducer

[View Answer](#)

Answer: b

Explanation: Polarographic transducer must be used for dissolved oxygen analyser. Dissolved oxygen is the measure of ability of water to sustain aquatic life.

2. How does solubility of oxygen in water change with respect to temperature?

- a) It decreases with increase in temperature
- b) It increases with increase in temperature
- c) It decreases with decrease in temperature
- d) It does not depend on temperature

[View Answer](#)

Answer: a

Explanation: Solubility of oxygen in water decreases with increase in temperature. Dissolved oxygen is the measure of ability of water to sustain aquatic life.

3. The water to be analysed flows into the condenser through which of the following components?

- a) Filter
- b) Semi-permeable membrane
- c) Throttling device
- d) Platinum filament

[View Answer](#)

Answer: c

Explanation: The water to be analysed flows into the condenser through a throttling device. It is cooled in the condenser.

4. Which of the following is the function of the throttling device?

- a) Filtering
- b) Maintains pH of a water
- c) Purifies water
- d) Maintains constant flow rate

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Answer: d

Explanation: The function of the throttling device is to maintain a constant flow rate. The water then passes into the condenser.

5. Which of the following section plays a major role in maintaining the accuracy of the dissolved oxygen analyser?

- a) Analysing section
- b) Inlet section
- c) Transmitting section
- d) Condensing section

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Answer: c

Explanation: Transmitting section plays a major role in maintaining the accuracy of the dissolved oxygen analyser. It is the section after the analysing section.  
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6. Which of the following bridges are used in dissolved oxygen analyser?

- a) Kelvin's bridge
- b) Wheatstone bridge
- c) Schering's bridge
- d) Anderson's bridge

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Answer: b

Explanation: Wheatstone bridge is used in dissolved oxygen analyser. Initially, the bridge is in a balanced condition.

7. In dissolved oxygen analyser, the electrometer consists of which of the following solutions?

- a) Calcium hydroxide solution
- b) Magnesium hydroxide solution
- c) Potassium hydroxide solution
- d) Calcium oxide solution

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Answer: c

Explanation: In dissolved oxygen analyser, the electrometer consists of potassium hydroxide solution. It produces hydrogen due to the electrolysis process.

8. The dissolved oxygen analyser is based on which of the following meters?

- a) Amperometer
- b) Katharometer
- c) pH meter
- d) Voltmeter

[View Answer](#)

Answer: b

Explanation: The dissolved oxygen analyser is based on katharometer. It works on the principle of thermal conductivity detector.

9. Oxygen content can be controlled by adding which of the following materials with water?

- a) Acidic solution
- b) Basic solution
- c) Iodine
- d) Hydrazine

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Answer: d

Explanation: Oxygen content can be controlled by adding hydrazine with water. It is important to maintain dissolved oxygen content in boilers to reduce corrosion.

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10. In dissolved oxygen analyser, normally more than one condenser is used.

- a) True
- b) False

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Answer: a

Explanation: In dissolved oxygen analyser, normally more than one condenser is used. The condensers are present in the condenser section.

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# Analytical Instrumentation Questions and Answers – Sodium Analyser

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Sodium Analyser”.

1. Which of the following indicate leakages in a condenser?
  - a) The concentration of sodium in steam and condensate are very high
  - b) The concentration of sodium in steam and condensate are very low
  - c) The concentration of sodium in steam and condensate are equal
  - d) The concentration of sodium in steam and condensate are not equal

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Answer: d

Explanation: If the concentration of sodium in steam and condensate are not equal, it means that leakage is present in the condenser. If the values are equal, then it means that no leakage is present.

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2. Which of the following are added for pH adjustment in sodium analyser?

- a) Acidic solution
- b) Basic solution
- c) Hydrazine
- d) Ammonia buffer

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Answer: d

Explanation: Ammonia buffer is added for pH adjustment in sodium analyser. This is added to the reference and sample solutions.

3. Normally, electrodes measure which of the following parameters?

- a) Activity
- b) Activity co-efficient
- c) Blank constant
- d) Ionic co-efficient

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Answer: a

Explanation: Normally, electrodes measure activity of the ion. It is a measure of free ions in the solution.

4. Which of the following represent the concentration of a solution?

- a) Only free ions
- b) Only bound ions
- c) Free ions and bound ions
- d) Either free ions or bound ions

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Answer: c

Explanation: Concentration refers to the sum of free ions and bound ions. Activity refers only to free ions.

5. Sodium selective electrode provides a good response in measurement when the pH is above which of the following values?

- a) 2
- b) 3
- c) 5
- d) 10

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Answer: d

Explanation: Sodium selective electrode provides a good response in measurement when the pH of the solution is above 10. Hence, the buffer solution is used.  
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6. Which of the following are used to free bound ions or liberate bound ions?

- a) Colouring agents
- b) Ammonia Buffer
- c) Reagents
- d) Iodine solution

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Answer: c

Explanation: Reagents are used to free bound ions or liberate bound ions. The addition of reagent prevents unwanted ions from entering into the measurement.

7. In which part of the apparatus is the reference and ion selective electrodes placed?

- a) Head tank
- b) Flow cell
- c) Reservoir
- d) Solenoid valve

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Answer: b

Explanation: The reference and ion selective electrodes are placed in the flow cell. Sample is maintained in the constant head tank.

8. The output of the electrode in sodium analyser is proportional to which of the following parameters?

- a) Activity
- b) Concentration
- c) Negative logarithm of sodium ion concentration
- d) Logarithm of sodium ion concentration

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Answer: d

Explanation: The output of the electrode in sodium analyser is proportional to the logarithm of sodium ion concentration. The value is recorded and indicated.

9. Cleaning process gives accuracy and long life.

- a) True
- b) False

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Answer: a

Explanation: Cleaning process gives accuracy and long life. Spray nozzles can be used to clean the electrodes.

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10. Presence of sodium sulphate in water causes corrosion in boilers.

- a) True
- b) False

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Answer: a

Explanation: Presence of sodium sulphate in water causes corrosion in boilers. Sodium hydroxide and sodium chloride salts also cause corrosion.

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## Analytical Instrumentation Questions and Answers – Silica Analyser

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Silica Analyser”.

1. Which of the following principles are used in silica analyser?

- a) Amperometric principle
- b) Colorimetric principle
- c) Coulometric principle
- d) Magnetic principle

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Answer: b

Explanation: The principle used in silica analyser is colorimetric principle. The colour of the final solution is measured.

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2. Which of the following is not added to the sample during analysis during silica analysis?

- a) Ammonium Molybdate
- b) Sulphuric acid
- c) Reducing solution
- d) Iodine solution

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Answer: d

Explanation: Iodine solution is not added to the sample during analysis. Ammonium molybdate, sulphuric acid and reducing solution are added to the sample.

3. Which of the following detectors are used in silica analyser?

- a) Photovoltaic cell
- b) Photo multiplier
- c) Photo emissive tubes
- d) Flame emission detector

[View Answer](#)

Answer: a

Explanation: Photovoltaic cell is used as a detector in silica analyser. This detector does not need a battery for operation.

4. The output from both the detectors is given to which of the following devices?

- a) Filters
- b) Microprocessor
- c) Recorder

d) Differential Amplifier

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Answer: d

Explanation: The output from both the detectors is given to the differential amplifier. The amplified signal is read through a display.

5. If the differential amplifier gives zero as output then it infers which of the following (Reference output is given to the positive terminal and sample output is given to the negative terminal)?

- a) The concentration of silica in sample and reference solution is equal
- b) The concentration of silica in a reference solution is more than that in the sample solution
- c) The concentration of silica in sample solution is more than that in the reference solution
- d) Further processing is required to come to any conclusion

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Answer: a

Explanation: If the differential amplifier gives zero as output then, it means that the concentration of silica in sample and reference solution is equal. It means that the photodetectors' output is equal.

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6. If the differential amplifier gives a positive output then it infers which of the following (Reference output is given to the positive terminal and sample output is given to the negative terminal)?

- a) The concentration of silica in sample and reference solution is equal
- b) The concentration of silica in a reference solution is more than that in the sample solution
- c) The concentration of silica in sample solution is more than that in the reference solution
- d) Further processing is required to come to any conclusion

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Answer: c

Explanation: If the differential amplifier gives a positive output then, it means that the concentration of silica in sample solution is more than that in the reference solution. It means that the photodetectors' output is not equal.

7. If the differential amplifier gives a negative output then it infers which of the following (Reference output is given to the positive terminal and sample output is given to the negative terminal)?

- a) The concentration of silica in sample and reference solution is equal
- b) The concentration of silica in a reference solution is more than that in the sample solution
- c) The concentration of silica in sample solution is more than that in the reference solution
- d) Further processing is required to come to any conclusion

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Answer: b

Explanation: If the differential amplifier gives a negative output then, it means that the concentration of silica in a reference solution is more than that in the sample solution. It means that the photodetector's output is not equal.

8. Which of the following statements are true?

- a) More light is absorbed if the silica content is high in a solution
- b) More light is transmitted if the silica content is high in a solution
- c) Less light is absorbed if the silica content is high in a solution
- d) More light is absorbed if the silica content is low in a solution

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Answer: a

Explanation: More amount of light is absorbed if the silica content is high in a solution. Less amount of light is transmitted if the silica content is high in a solution.

9. How will the photodetector output be if silica content is high in a solution?

- a) The output will be high
- b) The output will be low
- c) The output will be zero
- d) Output cannot be determined

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Answer: b

Explanation: If silica content is high in a solution, the detector output will be low. This is because more light is absorbed by the solution and less amount of light is transmitted.

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10. What will be the final colour of the solution obtained during silica analysis?

- a) Pink
- b) Red
- c) Blue
- d) Yellow

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Answer: c

Explanation: This method works on the principle of molybdenum blue method. Hence, the colour of the final solution will be blue.

11. During the first sequence of the process, sample is added at the last.

- a) True
- b) False

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Answer: a

Explanation: During the first sequence of the process, sample is added at the last. During the second sequence, all the solutions are added in a normal manner.

12. Blank use compensates for the effect of temperature variation.

- a) True
- b) False

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Answer: a

Explanation: Blank use compensates for the effect of temperature variation. It also compensates for various other variables such as ageing of lamps and coloration of the sample.

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# Analytical Instrumentation Questions and Answers – Fundamentals of Radiochemical Methods

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Fundamentals of Radiochemical Methods”.

1. Which of the following are highly effective in producing ion pairs when they pass through the matter?

- a) Alpha particles
- b) Beta particles
- c) Gamma particles

d) X-ray particles  
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Answer: a

Explanation: Alpha particles are highly effective in producing ion pairs when they pass through the matter. They have relatively large mass and charge.  
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2. Which of the following can liberate photo electrons when they fall on certain metals?

- a) Alpha particles
- b) Beta particles
- c) Gamma particles
- d) X-ray particles

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Answer: d

Explanation: X-rays can liberate photo electrons when they fall on certain metals. They penetrate through certain substances that are opaque to ordinary light.

3. Which of these particles are highly penetrating?

- a) Alpha particles
- b) Beta particles
- c) Gamma particles
- d) X-ray particles

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Answer: c

Explanation: Gamma particles are highly penetrating. Upon interaction with matter, they lose energy in three modes.

4. Alpha emission is characteristic of heavier radioactive elements such as thorium, uranium, etc.

- a) True
- b) False

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Answer: a

Explanation: Alpha emission is characteristic of heavier radioactive elements such as thorium, uranium, etc. They are most harmful to human tissue.

5. Which of the following is not a mode by which beta particles lose energy on interaction with matter?

- a) Photoelectric effect
- b) Compton effect
- c) Pair production
- d) Collision effect

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Answer: d

Explanation: Upon interaction with matter, gamma rays lose energy in three modes. They are photoelectric effect, pair production and Compton Effect.  
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6. The stability of the nucleus can be predicted by which of the following?

- a) Electron to neutron ratio
- b) Neutron to proton ratio
- c) Proton to electron ratio
- d) Neutron to electron ratio

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Answer: b

Explanation: The stability of the nucleus can be predicted by neutron to proton ratio. The number of protons will always be equal to the number of electrons.

7. Which of the following is true about radiochemical methods?

- a) Eliminate the need for chemical preparation
- b) Not sensitive
- c) Not accurate
- d) Not specific

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Answer: a

Explanation: Radiochemical methods eliminate the need for chemical preparation. In other methods, chemical preparation has to be done before the measurement.

8. Which of the following formulae gives the expression for half-life of a radioactive isotope when “?” is the decay constant?

- a)  $0.762/?$
- b)  $0.693/?$
- c)  $0.937/?$
- d)  $0.258/?$

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Answer: b

Explanation: The formula to calculate half-life of a radioactive isotope is  $0.693/?$ . It is the time required for half the initial stock of atoms to decay.

9. Which of the following emissions have low ionizing power?

- a) Alpha particles
- b) Beta particles
- c) Gamma particles
- d) X-ray particles

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Answer: c

Explanation: Gamma particle emissions have low ionizing power. They also have high penetrating power.

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10. Which of the following effect occurs when a gamma ray and an electron make an elastic collision?

- a) Photoelectric effect
- b) Compton effect
- c) Pair production
- d) Collision effect

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Answer: d

Explanation: Upon interaction with matter, gamma rays lose energy in three modes. Compton effect occurs when a gamma ray and an electron make an elastic collision.

11. Which of the following effects transfers all the energy of the gamma ray to an electron in the inner orbit of the atom of the absorber?

- a) Photoelectric effect
- b) Compton effect
- c) Pair production
- d) Collision effect

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Answer: a

Explanation: Upon interaction with matter, gamma rays lose energy in three modes. Photoelectric effect transfers all the energy of the gamma ray to an electron in the inner orbit of the atom of the absorber.

12. The basic unit used to describe the energy of a radiation particle is curie.

- a) True
- b) False

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Answer: b

Explanation: The basic unit used to describe the energy of a radiation particle is electron volt (eV). The unit of radioactivity is curie.

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## Analytical Instrumentation Questions and Answers – Radiation Detectors

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Radiation Detectors”.

1. Which of the following is not a type of radiation detectors?

- a) Geiger Muller counter
- b) Proportional counter
- c) Semiconductor detector
- d) Flame emission detector

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Answer: d

Explanation: Flame emission detector is not a type of radiation detector. Radiation can be detected by several methods.

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2. ‘When nuclear radiations pass through, gas ionization is produced.’ This is the principle of which of the following detectors?

- a) Proportional counter
- b) Flow counter
- c) Geiger Muller counter
- d) Scintillation counter

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Answer: c

Explanation: ‘When nuclear radiations pass through, gas ionization is produced.’ This is the principle of which of Geiger Muller counter. It is used to measure the intensity of radioactive radiation.

3. Which of the following acts as quenching gas in Geiger Muller counter?

- a) Alcohol
- b) Argon gas
- c) Krypton
- d) Hydrogen

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Answer: a

Explanation: Alcohol acts as quenching gas in Geiger Muller counter. It is present in a gas tight envelope along with the electrodes.

4. Which of the following acts as ionising gas in Geiger Muller counter?

- a) Alcohol
- b) Argon gas
- c) Krypton
- d) Hydrogen

[View Answer](#)

Answer: b

Explanation: Argon gas acts as ionising gas in Geiger Muller counter. It is present in a gas type envelope along with the electrodes.

5. Which of the detectors is similar to Geiger Muller counter in construction but is filled with heavier gas?

- a) Proportional counter
- b) Flow counter
- c) Semiconductor detector
- d) Scintillation counter

[View Answer](#)

Answer: a

Explanation: Proportional counter is similar to Geiger Muller counter in construction but is filled with heavier gas. The output is proportional to the intensity of radiation incident on it.

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6. Which of the following gases are used in the proportional counter as the ionising gas?

- a) Alcohol
- b) Argon gas
- c) Krypton

d) Hydrogen  
View Answer

Answer: c

Explanation: Proportional counter is filled with krypton. It acts as ionising gas. Xenon can also be used.

7. Which of the following is the main disadvantage of solid state semiconductor detector?

- a) Low accuracy
- b) Low sensitivity
- c) It should be maintained at low temperature
- d) High pressure has to be produced

View Answer

Answer: c

Explanation: The main disadvantage of solid state semiconductor detector is that it must be maintained at low temperature. This is necessary to reduce noise and to prevent deterioration of detector characteristics.

8. Scintillation detector is a large flat crystal of which of the following materials?

- a) Sodium chloride
- b) Sodium iodide
- c) Sodium sulphate
- d) Sodium carbonate

View Answer

Answer: a

Explanation: Scintillation detector is a large flat crystal of sodium iodide. It is coated with thallium doping.

9. When X-ray enters the solid state detector it produces ion pair rather than electron-hole pair.

- a) True
- b) False

View Answer

Answer: b

Explanation: When X-ray enters the solid state detector it produces electron-hole pair rather than an ion pair. The output signal is taken from an aluminium layer.

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10. Which of the following materials are used as the insulation between the inner and outer electrodes of the ion chamber?

- a) Polythene
- b) Plastic
- c) Polytetrafluoroethylene
- d) Polyacrylamide

View Answer

Answer: c

Explanation: Polytetrafluoroethylene is used as the insulation between the inner and outer electrodes of the ion chamber. The material has very high resistance.

11. Liquid samples must be counted using ionization chamber by placing them in which of the following?

- a) Test tube
- b) Curvette
- c) Ampoules
- d) Flask

View Answer

Answer: c

Explanation: Liquid samples must be counted using ionization chamber by placing them in ampoules. The ampoules are placed in the chamber.

12. Gaseous compounds containing radioactive sources can be directly introduced into the ionization chamber.

- a) True
- b) False

View Answer

Answer: a

Explanation: Gaseous compounds containing radioactive sources can be directly introduced into the ionization chamber. Liquid samples cannot be introduced directly.

13. Liquid Scintillators are used for which of the following materials?

- a) Low energy beta materials
- b) High energy beta materials
- c) Low energy gamma materials
- d) High energy gamma materials

View Answer

Answer: a

Explanation: Liquid Scintillators are used for low energy beta materials. Solid scintillators are used for high energy beta materials.

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14. Given below is the block diagram of proportional counter. Identify the unmarked component.



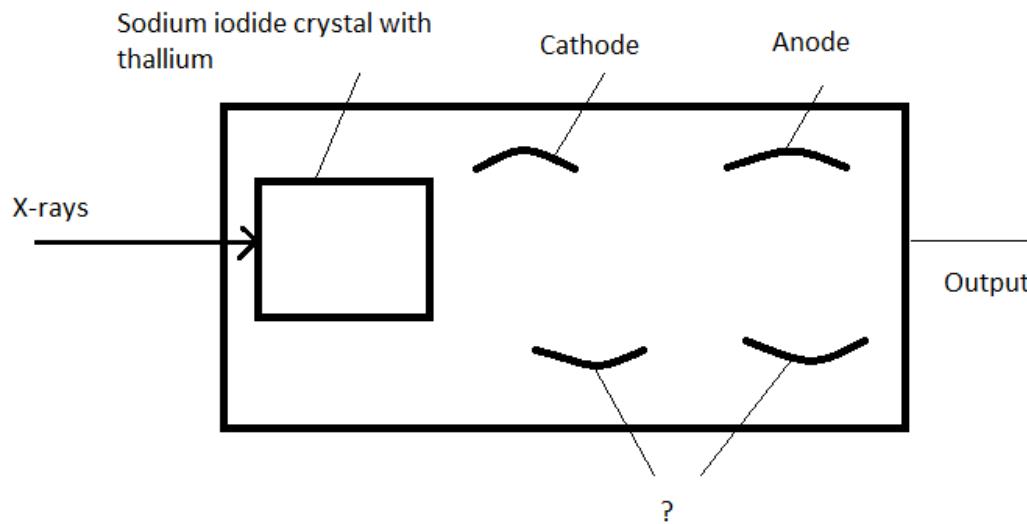
- a) Collimator
- b) Detector crystal
- c) Pre-amplifier
- d) Position logic circuit

[View Answer](#)

Answer: c

Explanation: The unmarked component is pre-amplifier. There are two amplifiers namely pre-amplifier and main amplifier.

15. Given below is a diagram of Scintillation detector. Identify the unmarked component.



- a) Lens
- b) Collimator
- c) Dynodes
- d) Focussing cup

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Answer: c

Explanation: The unmarked components are dynodes. Scintillation detector is a combination of scintillator and photo multiplier tube.

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## Analytical Instrumentation Questions and Answers – Gamma Camera

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Gamma Camera”.

1. The first gamma camera is also known by which of the following names?

- a) Hal camera
- b) Anger camera
- c) Muller camera
- d) West camera

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Answer: b

Explanation: The first gamma camera is also known as an Anger camera. It was developed by Hal Anger.

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2. Which of the following is not a component of gamma camera?

- a) Collimator
- b) Detector crystal
- c) Pre-amplifier
- d) Position logic circuit

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Answer: c

Explanation: Pre-amplifier is not a component of the gamma camera. It is an imaging device commonly used in medical applications.

3. Which of the following is the first object that an emitted gamma photon encounters after exciting the body?

- a) Collimator
- b) Detector crystal
- c) Photo multiplier tubes
- d) Position logic circuit

[View Answer](#)

Answer: c

Explanation: Collimator is the first object that an emitted gamma photon encounters after exciting the body. In the conventional method, the collimator is placed over the detector crystal.

4. Which of the following is a pattern of holes through gamma ray absorbing material, usually lead or tungsten?

- a) Collimator
- b) Detector crystal
- c) Photo multiplier tubes
- d) Position circuitry

[View Answer](#)

Answer: a

Explanation: Collimator is a pattern of holes through gamma ray absorbing material, usually lead or tungsten. In the conventional method, the collimator is placed over the detector crystal.

5. When the energy of an absorbed gamma photon is released, a flash of light is produced. This is similar to which of the following effects?

- a) Photoelectric effect
- b) Compton effect
- c) Pair production
- d) Collision effect

[View Answer](#)

Answer: a

Explanation: The given effect is similar to the photoelectric effect. It occurs in a scintillation detector.

6. Which of the following components adds all the signals and determines where each scintillation event occurred in the detector?

- a) Collimator
- b) Detector crystal
- c) Photo multiplier tubes
- d) Position circuitry

[View Answer](#)

Answer: d

Explanation: Position circuitry adds all the signals and determines where each scintillation event occurred in the detector. It is an electronic circuit and it receives all the signals from photo multiplier tube.

7. Gamma camera uses one scintillation detector.

- a) True
- b) False

[View Answer](#)

Answer: b

Explanation: Gamma camera uses multiple scintillation detectors. Hence, it is also known as scintillation camera.

8. Gamma camera uses which of these components to produce a position intensity picture of a radioactive area?

- a) Collimator
- b) Scintillation detector
- c) Photo multiplier tubes
- d) Position circuitry

[View Answer](#)

Answer: b

Explanation: Gamma camera uses a scintillation detector to produce a position intensity picture of a radioactive area. It is an imaging device commonly used in medical applications.

9. Which of the following is known as a scintillation counter?

- a) Scintillator
- b) Scintillator along with a photo multiplier tube
- c) Scintillator along with the crystal
- d) Scintillator along with position circuitry

[View Answer](#)

Answer: b

Explanation: Scintillation detector along with a photo multiplier tube is known as scintillation counter. Scintillation is the process of turning radioactive energy into light using a scintillator.

10. Straight bore collimator is used for thyroid work in the medical field.

- a) True
- b) False

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Answer: b

Explanation: Straight bore collimator is used for liver, brain, etc. Pinhole collimator is used for thyroid work.

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## Analytical Instrumentation Questions and Answers – Liquid Scintillation Counters

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Detection System of Liquid Chromatography”.

1. In liquid scintillation counter, which of the following is a fluorescent substance?

- a) Solvent
- b) Solute
- c) Crystal
- d) Reagent

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Answer: b

Explanation: In liquid scintillation counter, a mixture of solvent and solute is used. The solute is a fluorescent substance.

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2. When UV light is absorbed by the fluor molecules the light emitted is in which of the following colours?

- a) Pink
- b) Red
- c) Green
- d) Blue

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Answer: d

Explanation: When UV light is absorbed by the fluor molecules the light emitted is in blue colour. Light is emitted when the molecules return to the ground state.

3. In liquid scintillation counter, which of the following is used to convert light into electrical signals?

- a) Photo multiplier tube
- b) Photo emissive tube
- c) Photo voltaic cell
- d) Photo reflector

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Answer: a

Explanation: The photo multiplier tube converts light into electrical signals in a liquid scintillation counter. Two photo multiplier tubes are used in the liquid scintillation counter.

4. The reduction in counting efficiency of the scintillation detector is called as \_\_\_\_\_

- a) Disintegration
- b) Decay
- c) Quenching
- d) Reduction

[View Answer](#)

Answer: c

Explanation: The reduction in counting efficiency of the scintillation detector is called as quenching. Substances added to the counting vial can reduce efficiency.

5. Which of the following is not a type of quenching?

- a) Chemical quench
- b) Interference quench
- c) Colour quenching

d) Self-absorption  
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Answer: b

Explanation: There are three types of quenching. Interference quench is not a type of quenching.

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6. In which type of quenching, the radiation emitted by the isotope is not detected due to absorption of the radiation by the sample itself?

- a) Chemical quench
- b) Interference quench
- c) Colour quenching
- d) Self-absorption

View Answer

Answer: d

Explanation: In self-absorption, the radiation emitted by the isotope is not detected due to the absorption of the radiation by the sample itself. It may occur due to precipitates.

7. Variation of gain with temperature does not cause instability.

- a) True
- b) False

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Answer: b

Explanation: Variation of gain with temperature causes instability. There are various other factors that cause instability.

8. Due to the presence of red, green and yellow colour in the vial, which of the following occurs?

- a) Chemical quench
- b) Interference quench
- c) Colour quenching
- d) Self-absorption

View Answer

Answer: c

Explanation: Scintillators emit light in the blue region of the spectrum. Due to the presence of other colours, colour quenching may occur.

9. A quench curve can be constructed by plotting the counting efficiency versus \_\_\_\_\_

- a) Q-number
- b) Quench factor
- c) H-number
- d) Disintegrations

View Answer

Answer: c

Explanation: A quench curve can be constructed by plotting the counting efficiency versus H-number. This is done using a set of samples with known activity.

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10. Photomultipliers used in Liquid scintillation detectors are a source of instability.

- a) True
- b) False

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Answer: a

Explanation: Photomultipliers used in Liquid scintillation detectors are a source of instability. Various factors cause instability.

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## Analytical Instrumentation Questions and Answers – Pulse Height Analyser

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Pulse Height Analyser”.

1. A discriminator circuit is which of the following circuits?

- a) Wheatstone bridge
- b) Instrumentation amplifier
- c) Astable multivibrator
- d) Schmitt trigger

[View Answer](#)

Answer: d

Explanation: A discriminator circuit is a Schmitt trigger circuit. There are two discriminator circuits in pulse height analyser.

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2. Which of the following is the function of the discriminator?

- a) Rejects signals below a certain voltage
- b) Rejects signals above a certain voltage
- c) Rejects signal in a range alone
- d) Filters noise alone

[View Answer](#)

Answer: a

Explanation: The discriminator can be set to reject signals below a certain voltage. This is required for excluding scattered radiation and noise.

3. The difference between the pulses having amplitudes between the two triggering levels is called \_\_\_\_\_

- a) Pulse width
- b) Energy gap
- c) Window width
- d) Amplitude variation

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Answer: c

Explanation: The difference between the pulses having amplitudes between the two triggering levels is called as window width. It is also called the channel width.

4. The pulses having amplitudes between the two triggering levels are given by which of the following components?

- a) Pre-amplifiers
- b) Linear amplifiers
- c) Anti-coincidence circuits
- d) Discriminators

[View Answer](#)

Answer: d

Explanation: The pulses having amplitudes between the two triggering levels are given by discriminators. There are two discriminators.

5. Schmitt triggers are followed by which of the following components?

- a) Pre-amplifier
- b) Linear amplifier
- c) Anti-coincidence circuit

d) Discriminator  
View Answer

Answer: c

Explanation: Schmitt triggers are followed by anti-coincidence circuits. The output of the anti-coincidence circuit is given to counters.  
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6. Which of the following components cancels all the pulses which trigger both the discriminators?

- a) Pre-amplifier
- b) Linear amplifier
- c) Anti-coincidence circuit
- d) Discriminator

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Answer: c

Explanation: Anti-coincidence circuit cancels all the pulses which trigger both the discriminators. The output of the anti-coincidence circuit is given to counters.

7. Which of the following is used when the number of channels is ten or less?

- a) Two discriminators in series
- b) Two discriminators in parallel
- c) Series array of discriminators
- d) Parallel array of discriminators

View Answer

Answer: d

Explanation: Parallel array of discriminators are used when the number of channels is ten or less. If the number is more than ten this is not preferred.

8. If number of channels is more than ten, the problems of stability of discrimination voltages arise.

- a) True
- b) False

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Answer: a

Explanation: If number of channels is more than ten, the problems of stability of discrimination voltages arise. Problems also arise with an increase of adequate differential non-linearity.

9. The signal reaching which of the following components is the one lying in the window of pulse height analyser?

- a) Pre-amplifier
- b) Linear amplifier
- c) Counter
- d) Discriminator

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Answer: c

Explanation: The signal reaching the counter is the one lying in the window of pulse height analyser. Scalar and counter follow the anti-coincidence circuit.  
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10. The measurement of pulse height is useful for energy determination.

- a) True
- b) False

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Answer: a

Explanation: The measurement of pulse height is useful for energy determination. This is accomplished by the pulse height analyser.

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## Analytical Instrumentation Questions and Answers – Instrumentation of X-Ray Spectroscopy

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Instrumentation of X-Ray Spectroscopy”.

1. In X-ray spectrometers, the specimen or the sample is placed after which of the following components?

- a) X-ray tube
- b) Monochromator
- c) Collimator
- d) Detector

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Answer: a

Explanation: In X-ray spectrometers, the specimen or the sample is placed after the X-ray tube. The X-ray tube is the source of the X-ray.

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2. Which of the following components are used to generate X-rays?

- a) Meyer tube
- b) West tube
- c) Anger tube
- d) Coolidge tube

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Answer: d

Explanation: Coolidge tube is used to generate X-rays. It is the source of X-rays. Coolidge tube requires stabilised current and high voltage.

3. Using which of the following components is the generated x-rays focussed upon the specimen?

- a) X-ray tube
- b) Monochromator
- c) Collimator
- d) Detector

[View Answer](#)

Answer: c

Explanation: Collimator is used to focus the generated x-rays upon the specimen. The collimator is in between the specimen under analysis and the Coolidge tube.

4. The cathode in the Coolidge tube is made of which of the following elements?

- a) Quartz
- b) Iron
- c) Tungsten
- d) Barium

[View Answer](#)

Answer: c

Explanation: The cathode in the Coolidge tube is made of tungsten. The anode is made of copper.

5. The cathode in the Coolidge tube is kept in an inclined manner.

- a) True
- b) False

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Answer: b

Explanation: The anode in the Coolidge tube is kept in an inclined manner. The anode is made of copper.  
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6. Which of the following is not a target metal used in the Coolidge tube?

- a) Rhodium
- b) Cobalt
- c) Gold
- d) Silver

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Answer: c

Explanation: Gold is not used as a target metal in the Coolidge tube. The other target metals are copper, molybdenum and chromium.

7. How can the resolution of the collimator be increased?

- a) By reducing the separation between the metal plates of the collimator
- b) By increasing the separation between the metal plates of the collimator
- c) By increasing the number of metal plates
- d) By decreasing the number of metal plates

[View Answer](#)

Answer: a

Explanation: The resolution of the collimator can be increased by reducing the separation between the metal plates of the collimator. Collimator has a series of closely spaced parallel metal plates.

8. When x-rays emitted from molybdenum are allowed to pass through a zirconium filter, which of the following occurs?

- a) It absorbs radiation of shorter wavelength
- b) It absorbs radiation of longer wavelength
- c) It allows radiation of shorter wavelength to pass through
- d) It allows radiation in a particular band to pass through

[View Answer](#)

Answer: b

Explanation: When x-rays emitted from molybdenum are allowed to pass through a zirconium filter, it absorbs radiation of shorter wavelength. It allows radiation of a stronger wavelength to pass through.

9. When compared to filters, monochromators provide much signal to noise ratio.

- a) True
- b) False

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Answer: a

Explanation: When compared to filters, monochromators provide much signal to noise ratio. Monochromators are used for removal of unwanted wavelengths.  
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10. Which of the following crystals are not suited for x-ray grating?

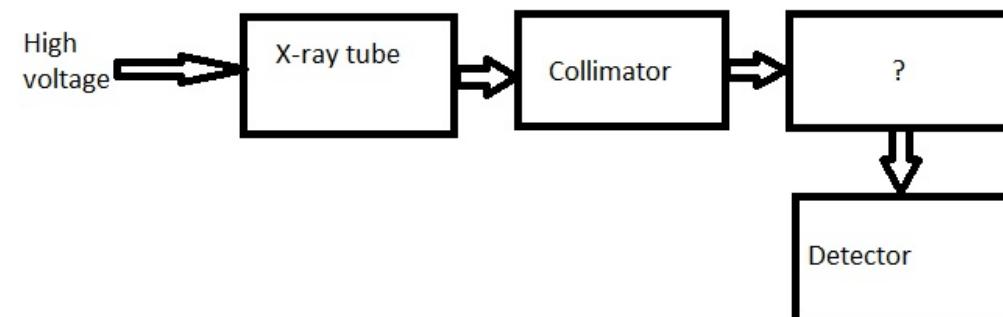
- a) Topaz
- b) Lithium fluoride
- c) Calcium fluoride
- d) Sodium fluoride

[View Answer](#)

Answer: d

Explanation: The crystal which is not suited for x-ray grating is sodium fluoride. Other crystals which are suitable for x-ray grating are gypsum and sodium chloride.

11. Given below is the block diagram of X-ray spectrometer. Identify the unmarked component.



- a) Filter
- b) Monochromator
- c) Specimen
- d) Amplifier

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Answer: c

Explanation: The unmarked component is specimen. It is the sample under analysis.

12. The x-rays generated come out of the Coolidge tube through which of the following?

- a) Beryllium window
- b) Tungsten window
- c) Collimator
- d) Target material

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Answer: a

Explanation: The x-rays generated come out of the Coolidge tube through a beryllium window. Some energy is lost as heat.

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## Analytical Instrumentation Questions and Answers – X-Ray Diffractometers

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “X-Ray Diffractometers”.

1. X-ray diffractometers are not used to identify the physical properties of which of the following?

- a) Metals
- b) Liquids
- c) Polymeric materials
- d) Solids

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Answer: b

Explanation: X-ray diffractometers are not used to identify the physical properties of liquids. It is used to identify the physical properties of metals, solids and

2. X-ray diffractometers provide \_\_\_\_\_ information about the compounds present in a solid sample.

- a) Quantitative
- b) Qualitative
- c) Quantitative and qualitative
- d) Either quantitative or qualitative

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Answer: c

Explanation: X-ray diffractometers provide quantitative and qualitative information about the compounds present in a solid sample.

3. Using the powder method of diffractometers, which of the following can be determined?

- a) Percentage of K<sup>+</sup>
- b) Percentage of Na<sup>+</sup> and Cl<sup>-</sup>
- c) Percentage of KBr and NaCl
- d) Percentage of Br<sup>-</sup>

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Answer: c

Explanation: Using the powder method of diffractometers, percentage of KBr and NaCl can be determined. Other analytical methods provide the only percentage of K<sup>+</sup>, Na<sup>+</sup>, Cl<sup>-</sup> and Br<sup>-</sup>.

4. In powder method, the powder sample is contained in which of the following?

- a) Thin walled glass capillary tubes
- b) Thin walled test tube
- c) Thin walled curvettes
- d) Thin walled flask

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Answer: a

Explanation: In powder method, the powder sample is contained in thin walled glass capillary tubes. Thin walled cellophane capillary tubes can also be used.

5. Which of the following is the most common instrument for photographic recording of diffraction patterns?

- a) Debye-Scherrer powder camera
- b) Gamma camera
- c) Geiger tube
- d) Scintillation counter

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Answer: a

Explanation: Diffracted x-ray beam can be detected photographically or by using a scintillation counter or Geiger tube. Debye-Scherrer powder camera is the most common instrument for photographic recording of diffraction patterns.

6. With the help of which of the following equations is the distance calculated from a known wavelength of the source and measured angle?

- a) Coolidge equation
- b) Bragg's equation
- c) Debye equation
- d) Scherrer equation

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Answer: b

Explanation: The distance is calculated from a known wavelength of the source and measured angle using Bragg' equation. The diffracted angle is calculated by the spacing between a particular set of plane.

7. In Diffractometer, the identification of a component of the sample from its powder diffraction pattern is based upon the \_\_\_\_\_ of lines and their relative

- a) Number, length
- b) Number, intensity
- c) Position, length
- d) Position, intensity

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Answer: d

Explanation: The identification of a component of the from its powder diffraction pattern is based upon the position of lines and their relative intensities. Diffractometers are used for powder diffraction.

8. When certain geometric requirements are met, X-rays scattered from a crystalline solid can constructively interfere with each other and produce a diffracted beam.

- a) True
- b) False

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Answer: a

Explanation: When certain geometric requirements are met, X-rays scattered from a crystalline solid can constructively interfere with each other and produce a

diffracted beam. The relationship among different factors is given by Bragg's law.

9. Diffractometers are similar to which of the following?

- a) Optical grating spectrometer
- b) Prism spectrometer
- c) Photo multiplier
- d) Photovoltaic cell

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Answer: a

Explanation: Diffractometers are similar to optical grating spectrometers. The differences are that lenses and mirrors are not used with X-rays.  
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10. In Diffractometers, line intensities depend on \_\_\_\_\_ and kind of atomic reflection centres in each set of plates.

- a) Number
- b) Position
- c) Length
- d) Distance between lines

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Answer: a

Explanation: In Diffractometers, line intensities depend on number and kind of atomic reflection centres in each set of plates. Diffraction is a wave property of electromagnetic radiation.

11. In Diffractometers, the intensities of the diffraction peaks of a given compound in a mixture are proportional to the fraction of the material in the mixture.

- a) True
- b) False

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Answer: a

Explanation: In Diffractometers, the intensities of the diffraction peaks of a given compound in a mixture are proportional to the fraction of the material in the mixture. Hence, they are used in qualitative analysis.

12. In powder diffractometer, the sharpness of the lines is greatly determined by which of the following?

- a) Quality of the sample, size of the slit
- b) Quality of the slit, size of the sample
- c) Thickness of the slit, amount of the sample
- d) Number of slits, composition of the sample

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Answer: b

Explanation: In powder diffractometer, the sharpness of the lines is greatly determined by the quality of the slit and the size of the sample. The slit should be able to produce a fine beam.

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## Analytical Instrumentation Questions and Answers – X-Ray Absorption Meter

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This set of Analytical Instrumentation test focuses on “X-Ray Absorption Meter”.

1. Absorption meter is \_\_\_\_\_ and \_\_\_\_\_ of the chemical state of the element concerned.
- a) Non-destructive, independent
  - b) Destructive, independent
  - c) Non-destructive, dependent
  - d) Destructive, dependent

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Answer: a

Explanation: Absorption meters give information about the absorbing material. It is non-destructive and independent of the chemical state of the element concerned.

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2. X-ray absorption meters have which of the following major disadvantages?

- a) Low accuracy
- b) Low range
- c) Low sensitivity
- d) It is destructive

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Answer: c

Explanation: Absorption meters give information about the absorbing material. X-ray absorption meters have low sensitivity.

3. The applications of X-ray absorption meters are limited when compared with X-ray emission procedures.

- a) True
- b) False

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Answer: a

Explanation: The applications of X-ray absorption meters are limited when compared with X-ray emission procedures. They are also limited when compared with fluorescence procedures.

4. In absorption meter, which of the following is placed between the cell and the X-ray tube?

- a) Collimator
- b) Filter
- c) Chopper
- d) Attenuator

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Answer: c

Explanation: In Absorption meter, chopper is placed between the cell and the X-ray tube. It interrupts the half of the X-ray beam.

5. In absorption meter, which of the following is placed between the chopper and the reference cell?

- a) Collimator
- b) Filter
- c) Photomultiplier tube
- d) Attenuator

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Answer: d

Explanation: In absorption meter, attenuator is placed between the chopper and the reference cell. A variable thickness aluminium attenuator is used.

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6. In absorption meter, the two halves of the X-ray beam are allowed to fall on which of the following components?

- a) Collimator

- b) Filter
  - c) Photomultiplier tube
  - d) Attenuator
- [View Answer](#)

Answer: c

Explanation: In absorption meter, the two halves of the X-ray beam are allowed to fall on the photomultiplier tube. One beam passes through the sample and the other beam passes through the reference.

7. The photomultiplier tube used in absorption meter is coated with which of the following materials?

- a) Sodium
- b) Potassium
- c) Phosphorous
- d) Chlorine

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Answer: c

Explanation: The photomultiplier tube used in absorption meter is coated with phosphorous. Only one photomultiplier tube is commonly present for both the beams.

8. In absorption meter, which of the following is adjusted until the absorption of two X-ray beams are brought into balance?

- a) Collimator
- b) Filter
- c) Photomultiplier tube
- d) Attenuator

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Answer: d

Explanation: In absorption meter, the attenuator is adjusted until the absorption of two X-ray beams are brought into balance. A variable thickness aluminium attenuator is used.

9. In absorption meter, the change in thickness of aluminium required for different samples is a function of the difference in which of the following parameters?

- a) Amount
- b) Concentration
- c) Colour
- d) Composition

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Answer: d

Explanation: In absorption meter, the change in thickness of aluminium required for different samples is a function of the difference in composition. A variable thickness attenuator used allows this function.

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10. Absorption meters cannot be used to detect broken bones.

- a) True
- b) False

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Answer: b

Explanation: Absorption meters can be used to detect broken bones. It can also be used to locate trace elements.

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## Analytical Instrumentation Questions and Answers – X-Ray Fluorescence Spectrometry – Introduction

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “X-Ray Fluorescence Spectrometry – Introduction”.

1. If the absorption of electromagnetic radiation by matter results in the emission of radiation of the same or longer wavelengths for a long or a short time, the phenomenon is termed as which of the following?

- a) Luminescence
- b) Fluorescence
- c) Phosphorescence
- d) Spontaneous emission

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Answer: a

Explanation: If the absorption of electromagnetic radiation by matter results in the emission of radiation of the same or longer wavelengths for a short or a long time, the phenomenon is termed as luminescence. Usually, absorption of electromagnetic radiation results in the emission of radiation.

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2. If the absorption of electromagnetic radiation by matter results in the emission of radiation of the same or longer wavelengths for a short time, the phenomenon is termed as which of the following?

- a) Luminescence
- b) Fluorescence
- c) Phosphorescence
- d) Spontaneous emission

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Answer: b

Explanation: If the absorption of electromagnetic radiation by matter results in the emission of radiation of the same or longer wavelengths for a short time, the phenomenon is termed as fluorescence. Fluorescence emissions are characteristic of the particular element.

3. If the absorption of electromagnetic radiation by matter results in the emission of radiation of the same or longer wavelengths for a long time, the phenomenon is termed as which of the following?

- a) Luminescence
- b) Fluorescence
- c) Phosphorescence
- d) Spontaneous emission

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Answer: c

Explanation: If the absorption of electromagnetic radiation by matter results in the emission of radiation of the same or longer wavelengths for a long time, the phenomenon is termed as phosphorescence. Phosphorescence is a type of luminescence.

4. Prompt emission of X-ray by an atom ionised by a higher energy X-ray is a type of which of the following phenomena?

- a) Luminescence
- b) Fluorescence
- c) Phosphorescence
- d) Spontaneous emission

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Answer: b

Explanation: Prompt emission of X-ray by an atom ionised by a higher energy X-ray is a type of fluorescence. Fluorescence emissions are characteristic of the particular element.

5. The measurement of intensity of fluorescent X-rays provide a simple and \_\_\_\_\_ way of \_\_\_\_\_ analysis.

- a) Destructive, quantitative
- b) Non-destructive, quantitative
- c) Destructive, qualitative
- d) Non-destructive, qualitative

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Answer: b

Explanation: The measurement of an intensity of fluorescent X-rays provide a simple and non-destructive way of quantitative analysis.  
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6. The energy of the emitted X-rays depends upon the \_\_\_\_\_ of the atom and their intensity depends upon the \_\_\_\_\_

- a) Atomic number, amount of sample
- b) Mass number, amount of sample
- c) Mass number, concentration of atoms
- d) Atomic number, concentration of atoms

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Answer: d

Explanation: The energy of the emitted X-rays depends upon the atomic number of the atom and their intensity depends upon the concentration of atoms in the sample. X-ray fluorescence spectroscopy is based on this principle.

7. Which of the following is Moseley's equation if 'C' is the speed of light, 'a' is proportionality constant, 's' is a constant which depends on electronic transition series, 'Z' is the atomic number and '?' is the wavelength?

- a)  $C? = a(Z-s)^2$
- b)  $C/? = a(Z-s)^2$
- c)  $C(Z-s)^2 = a?$
- d)  $C(Z-s)^2 = a/?$

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Answer: b

Explanation: The Moseley's equation is,  $C/? = a(Z-s)^2$ .

It gives the relationship between the speed of light, reciprocal of wavelength and atomic number.

8. The problem of spectral interference is not severe in X-ray spectroscopy.

- a) True

- b) False

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Answer: a

Explanation: The problem of spectral interference is not severe in X-ray spectroscopy. This is due to the relative simplicity of the X-ray spectra.

9. In X-ray fluorescence spectrometer, the relationship between the excitation intensity and the intensity of fluorescence does not depend on which of the following?

- a) Spectrum of the incident radiation
- b) Angle of radiance
- c) Molecular weight
- d) Incident angle

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Answer: d

Explanation: In X-ray fluorescence spectrometer, the relationship between the excitation intensity and the intensity of fluorescence does not depend on the incident angle. It depends on the absorption of path length.

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10. Fluorescent X-ray spectrometers would require only moderate-intensity X-ray tubes.

- a) True

- b) False

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Answer: b

Explanation: Fluorescent X-ray spectrometers would require high-intensity X-ray tubes. They also require sensitive detectors and suitable X-ray optics.

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# Analytical Instrumentation Questions and Answers – X-Ray Fluorescent Spectrometer

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “X-Ray Fluorescent Spectrometer”.

1. Which of the following components of the X-ray fluorescent spectrometer induces fluorescent radiation?

- a) Excitation source
- b) Energy analyser
- c) X-ray spectrometer
- d) Detection System

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Answer: a

Explanation: Excitation source induces fluorescent radiation in X-ray fluorescent spectrometer. A mono-energetic source is required for this purpose.

2. Why is a mono-energetic radiation source required in X-ray fluorescent spectrometer?

- a) To provide good sensitivity
- b) To provide high accuracy
- c) To provide a proper range
- d) To reduce unwanted background

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Answer: d

Explanation: Mono-energetic radiation source is required in X-ray fluorescent spectrometer to reduce unwanted background. This occurs due to the scattering occurring over a broad range of wavelengths.

3. Which of the following does not make the X-ray tube nearly monochromatic?

- a) Transmission-anode X-ray tube
- b) Secondary fluorescence target
- c) Slit
- d) Filters

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Answer: c

Explanation: Slits do not make the X-ray tube nearly monochromatic. The most commonly used source is X-ray tubes.

4. Which of the following components make use of a thin metal foil to isolate a nearly mono-energetic excitation beam?

- a) Transmission-anode X-ray tube
- b) Secondary fluorescence target
- c) Slit

d) Filters  
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Answer: d

Explanation: Filters make use of a thin metal foil to isolate a nearly mono-energetic excitation beam. Nickel is one of the metals that is used in filters.

5. Energy dispersive system uses which of the following detectors?

- a) Optical detector
- b) Semiconductor detector
- c) Thermistor
- d) Bolometer

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Answer: b

Explanation: Energy dispersive system uses semiconductor detectors. It consists of an excitation source and a sample.

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6. In Energy dispersive system, the energy level and the number of pulses is related to which of the following?

- a) Amount of sample, element involved
- b) Element involved, concentration of the element
- c) Concentration of the element, element involved
- d) Number of atoms, amount of sample

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Answer: b

Explanation: In Energy dispersive system, the energy level is related to the element involved. The number of pulses is related to the concentration of the element involved.

7. The analysis of X-ray beam by diffraction is similar to spectrum analysis carried out with a diffraction grating.

- a) True
- b) False

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Answer: a

Explanation: The analysis of X-ray beam by diffraction is similar to spectrum analysis carried out with a diffraction grating. Wavelength dispersive type of meter derives its name from this fact.

8. The crystal used as X-ray grating has \_\_\_\_\_ dimensional lattice arrays.

- a) One
- b) Two
- c) Three
- d) Four

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Answer: c

Explanation: The crystal used as X-ray grating has three dimensional lattice arrays. Photons can be coherently scattered using the crystals.

9. Which of the following can be done to avoid loss of intensities of X-rays due to the absorption of long wavelength X-rays?

- a) Apparatus must be contained in a chamber
- b) Air in the chamber must be replaced by helium
- c) Inert gas atmosphere must be provided
- d) Proper slits must be used

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Answer: b

Explanation: Air in the chamber must be replaced by helium to avoid loss of intensities of X-rays due to the absorption of long wavelength X-rays. Vacuum chambers can also be used.

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10. In curved crystal arrangement, angular velocity of the crystal is twice that of the detector.

- a) True
- b) False

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Answer: b

Explanation: In curved crystal arrangement, angular velocity of the detector is twice that of the crystal. This arrangement is suitable for the analysis of small specimens.

11. Which of the following is the disadvantage of silicon semiconductor detector?

- a) Low stable
- b) Can be operated only at low temperatures
- c) Have low count-rate
- d) Low resolution

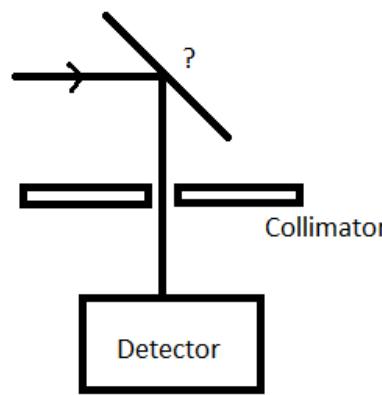
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Answer: b

Explanation: The disadvantage of silicon semiconductor detector is that they can be operated only at low temperatures. They have high stability, high count-rate

and adequate resolution.

12. Given below is the diagram of energy dispersive system. Identify the unmarked component.



- a) Lens
- b) Specimen
- c) Sample holder
- d) Energy analyser

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Answer: b

Explanation: The unmarked component is specimen. This system consists of source, sample and detector.

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# Analytical Instrumentation Questions and Answers – Total Reflection X-Ray Fluorescence Spectrometer

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This set of Analytical Instrumentation Quiz focuses on “Total Reflection X-Ray Fluorescence Spectrometer”.

1. In total reflection X-ray fluorescence spectrometer, the specimen is excited by the primary X-ray beam at a grazing angle \_\_\_\_\_ the critical angle.

- a) Greater than
- b) Less than
- c) Equal to
- d) Which is a complement of

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Answer: b

Explanation: In total reflection X-ray fluorescence spectrometer, the specimen is excited by the primary X-ray beam at a grazing angle less than the critical angle. Total internal reflection occurs at the critical angle.

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2. The x-ray beam produced by the primary x-ray tube passes through which of the following components to produce the incident radiation?

- a) Detector
- b) Slit-collimator arrangement
- c) Sample reflector
- d) Monochromator

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Answer: b

Explanation: The x-ray beam produced by the primary x-ray tube passes through the slit-collimator arrangement. This forms the incident radiation.

3. Which of the following crystals are polished to act as the cut-off reflector?

- a) Quartz
- b) Beryllium
- c) Silicon
- d) Lithium

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Answer: c

Explanation: Quartz crystals are polished to act as the cut-off reflector. It is mounted on the first reflector stage.

4. The suppression of high energy bremsstrahlung radiation improves which of the following?

- a) Signal to background ratio
- b) Accuracy
- c) Sensitivity
- d) Coherence

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Answer: a

Explanation: The suppression of high energy bremsstrahlung radiation improves the signal to background ratio. Hence, it is performed in total reflection X-ray fluorescence spectrometer.

5. Which of the following components are used as the sample carrier?

- a) Curvette
- b) Flask
- c) Capillary tube
- d) Float glass

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Answer: d

Explanation: Float glass is used as the sample carrier. It is mounted as the second reflector stage.

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6. Which of the following devices are used as a detector?

- a) Thermistor
- b) Optical detector
- c) Solid state detector
- d) Golay cell

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Answer: c

Explanation: The detection system comprises of peltier cooled solid state detector. It also has a spectroscopy amplifier.

7. Which of the following happens when a large solid angle is intercepted as the detector is placed close to the sample?

- a) Maximum efficiency increases
- b) Maximum efficiency decreases

- c) Efficiency is not affected
  - d) Process response becomes fast
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Answer: a

Explanation: When the detector is placed very close to the sample, the maximum efficiency increases. This is because large angle is intercepted.

8. To monitor the primary beam, which of the following is used?

- a) Scintillation counter
- b) GM counter
- c) Gamma counter
- d) Proportional counter

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Answer: b

Explanation: To monitor the primary beam, Gm counter is used. It is placed in the specular reflection direction.

9. The major problem associated with sample preparation is which of the following?

- a) Preparing sample in the right quantity
- b) Choosing sample holders
- c) Matrix effects
- d) Reflection by holders

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Answer: c

Explanation: The major problem associated with sample preparation is matrix effects. The primary and emitted radiation is absorbed by the element present along with the elements of interest.

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10. Computer-controlled corrective iteration is the only reliable method of matrix effects correction.

- a) True
- b) False

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Answer: a

Explanation: Computer-controlled corrective iteration is the only reliable method of matrix effects correction. This is used in places where an unknown matrix occurs.

11. In computer-controlled corrective iteration method, which of the following is used to estimate absorption corrections?

- a) Initial raw intensity data
- b) Elemental composition
- c) Amount of sample
- d) Amount of radiation

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Answer: a

Explanation: In the computer-controlled corrective iteration method, initial raw intensity data is used to estimate absorption corrections. Elemental composition is used to calculate absorption corrections.

12. Total reflection X-ray fluorescence spectrometer is attractive for elements which lack reliable wet chemical methods.

- a) True
- b) False

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Answer: a

Explanation: Total reflection X-ray fluorescence spectrometer is attractive for elements which lack reliable wet chemical methods. Example for such elements are tantalum and rare earth metals.

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# Analytical Instrumentation Questions and Answers – Electron Probe Microanalyser

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Electron Probe Microanalyser”.

1. Which of the following is not a type of optics employed in electron probe microanalyser?

- a) Electron optics
- b) Light optics
- c) X-ray optics
- d) Gamma optics

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Answer: d

Explanation: Gamma optics is not a type of optics used in electron probe microanalyser. Electron optics, light optics and X-ray optics are employed.

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2. The electron optics consists of an electron gun followed by which of the following components?

- a) Collimator
- b) Slit
- c) Amplifier
- d) Electron beam probe

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Answer: d

Explanation: The electron optics consists of an electron gun followed by an electron beam probe. This is formed by two electro-magnetic lenses.

3. The specimen is mounted inside which of the following components?

- a) Test tube
- b) Glass capillary tube
- c) Vacuum column
- d) Curvette

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Answer: c

Explanation: The specimen is mounted inside the vacuum column in the instrument. It is under the beam as the target.

4. The electrons are accelerated by voltages in which of the following ranges?

- a) 5 and 50kV
- b) 50 and 500kV
- c) 500 and 5000kV
- d) 25 and 250kV

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Answer: a

Explanation: The whole system operates in a vacuum. The electrons are accelerated by voltages in the range of 5 and 50kV.

5. Electron probe microanalyser is a method of destructive elemental analysis.

- a) True
- b) False

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Answer: a

Explanation: Electron probe microanalyser uses a finely focussed electron beam to excite the X-rays. It is a method of destructive elemental analysis.  
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6. Which of the following is the effective resolution limit in electron probe microanalyser?

- a) 1mm
- b) 10mm
- c) 100mm
- d) 1000mm

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Answer: a

Explanation: The electrons spread laterally and longitudinally in the sample by approximately 1mm. Hence, the effective resolution limit is 1mm.

7. Micro probe analyser cannot be used on inhomogeneous material.

- a) True
- b) False

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Answer: b

Explanation: Micro probe analyser can be used on inhomogeneous material. It can also be focussed on a very small area.

8. X-ray emission must be analysed against a background of \_\_\_\_\_ radiation.

- a) Blue
- b) Yellow
- c) White
- d) Green

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Answer: c

Explanation: X-ray emission must be analysed against a background of white radiation. Microprobe has poorer sensitivity than XRF spectrometer.

9. Which of the following is the limit of detectability of electron microprobe analyser?

- a) 10-14 g
- b) 10-140 g
- c) 10-7 g
- d) 10-70 g

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Answer: a

Explanation: Electron microprobe analyser allows the analysis of extremely small objects. The limit of detectability is 10-14 g.  
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10. The alternative method using laser does not analyse vapours by which of the following methods?

- a) Mass spectrometer
- b) Optical emission
- c) Absorption photometry
- d) X-ray photometry

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Answer: d

Explanation: The alternative method using laser does not analyse vapours by X-ray photometry. This method is gaining popularity.

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## Analytical Instrumentation Questions and Answers – Principle of Nuclear Magnetic Resonance Spectrometer

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This set of Analytical Instrumentation MCQs focuses on “Principle of Nuclear Magnetic Resonance Spectrometer”.

1. NMR spectroscopy is used for determining structure in which of the following materials?

- a) Radioactive materials
- b) Insoluble chemical compounds
- c) Liquids
- d) Gases

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Answer: c

Explanation: NMR spectroscopy is used for determining structure in liquids. It is also used for determining the structure in soluble chemical compounds.

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2. NMR is the study of the absorption of \_\_\_\_\_ by nuclei in a magnetic field.

- a) Radioactive radiation
- b) IR radiation
- c) Radio frequency radiation
- d) Microwaves

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Answer: c

Explanation: NMR is the study of absorption of radio frequency radiation by nuclei in a magnetic field. For a particular nucleus, an NMR absorption spectrum may consist of one to several groups of absorption lines.

3. NMR spectrometer provides \_\_\_\_\_ and \_\_\_\_\_ method of determining structure in soluble chemical compounds.

- a) Accurate, destructive
- b) Accurate, non-destructive
- c) Inaccurate, destructive
- d) Inaccurate, non-destructive

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Answer: b

Explanation: NMR spectrometer provides an accurate and non-destructive method of determining structure in soluble chemical compounds. For a particular nucleus an NMR absorption spectrum may consist of one to several groups of absorption lines.

4. NMR spectroscopy indicates the chemical nature of the \_\_\_\_\_ and spatial positions of \_\_\_\_\_

- a) Electrons, Protons
- b) Neutrons, electrons
- c) Nuclei, electrons
- d) Nuclei, neighbouring nuclei

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Answer: d

Explanation: NMR spectroscopy indicates the chemical nature of the nuclei and spatial positions of neighbouring nuclei. It is one of the most powerful techniques for chemical analysis.

5. In NMR spectroscopy, the spinning nuclei in a strong magnetic field must be irradiated by which of the following?

- a) Perpendicular and stronger field
- b) Perpendicular and weaker field
- c) Parallel and stronger field
- d) Parallel and weaker field

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Answer: b

Explanation: In NMR spectroscopy, the spinning nuclei in a strong magnetic field must be irradiated by a weaker field which is perpendicular to it. This permits the identification of atomic configurations in molecules.

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6. Interaction between matter and electromagnetic radiation can be observed by subjecting a substance to magnetic fields in which of the following manner?

- a) Both fields should be stationary
- b) Both fields should be varying
- c) One field should be stationary and the other should be varying
- d) It must be subjected to only one field

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Answer: c

Explanation: Interaction between matter and electromagnetic radiation can be observed by subjecting a substance to two magnetic fields. One magnetic field must be stationary and the other field must be varying at some radio frequency.

7. When energy is absorbed by the sample, the absorption can be observed as a change in signal developed by which of the following components?

- a) Amplifier
- b) Photodetector
- c) GM counter
- d) Radiofrequency detector

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Answer: d

Explanation: When energy is absorbed by the sample, the absorption can be observed as a change in signal developed by a radiofrequency detector. It is then given to an amplifier.

8. Which of the following are considered to be the lowest form of Electromagnetic radiation?

- a) IR radiation
- b) Micro waves
- c) UV radiation
- d) Radio waves

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Answer: d

Explanation: Radio waves are considered to be the lowest form of Electromagnetic radiation. NMR uses radio frequency radiation for detection of the structure of substances.

9. The amount of energy available in radio frequency radiation is sufficient for which of the following?

- a) Excite an atom
- b) Vibrate an atom
- c) Vibrate a molecule
- d) Affect the nuclear spin of an atom

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Answer: d

Explanation: The amount of energy available in radio frequency radiation is sufficient for affecting the nuclear spin of an atom. It constitutes the most fundamental part of spectroscopy.

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10. Nuclei having either the number of protons or neutrons as odd have \_\_\_\_\_ spin.

- a) Integral spin
- b) Half integral spin
- c) Zero spin
- d) Positive spin

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Answer: b

Explanation: Nuclei having either the number of protons or neutrons as odd have half-integral spin. Examples are H1 and B11.

11. If the number of protons or neutrons is even the spin of the nucleus will be which of the following?

- a) Integral spin
- b) Half integral spin
- c) Zero spin
- d) Positive spin

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Answer: c

Explanation: If the number of protons or neutrons is even the spin of the nucleus will be zero. Examples are C12 and O16.

12. The difference between the field necessary for resonance in the sample and in some arbitrary chosen compound is which of the following?

- a) Field shift
- b) Matrix effects
- c) Chemical shift
- d) Resonance shift

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Answer: c

Explanation: The difference between the field necessary for resonance in the sample and in some arbitrary chosen compound is called a chemical shift. Chemical shift is expressed in parts per million.

13. Chemical shift allows a chemist to obtain the idea of how atoms are joined together.

- a) True
- b) False

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Answer: a

Explanation: Chemical shift allows a chemist to obtain the idea of how atoms are joined together. It is also possible to know the number of particular atoms present in a molecule.

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14. Elementary particles such as electrons and nucleus have the property of spin.

- a) True
- b) False

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Answer: a

Explanation: Elementary particles such as electrons and nucleus have the property of spin. They are known to behave as if they rotate about an axis.

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## **Analytical Instrumentation Questions and Answers – Types of NMR Spectrometers**

This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Types of NMR Spectrometers”.

1. Which of the following is not a type of NMR spectrometer?

- a) Minimal type
- b) Maximal type
- c) Multipurpose type
- d) Wideline type

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Answer: b

Explanation: Maximal type is not a type of NMR spectrometer. Minimal type, Multipurpose type and Wideline type are types of NMR spectrometer.  
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2. Which of the following NMR spectrometers have stressed reliability and ease of operation?

- a) Minimal type
- b) Maximal type
- c) Multipurpose type
- d) Wideline type

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Answer: a

Explanation: Minimal type has stressed the reliability and ease of operation. It uses a permanent magnet.

3. Which of the following type of NMR spectrometer uses a frequency synthesizer to generate RF fields?

- a) Minimal type
- b) Maximal type
- c) Multipurpose type
- d) Wideline type

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Answer: c

Explanation: Wideline type NMR spectrometer uses a frequency synthesizer to generate RF fields. It is a type of continuous wave NMR spectrometer.

4. In wideline NMR spectrometers, which of the following has to be supplied to the electromagnet?

- a) Slowly varying low voltage
- b) Rapidly varying low voltage
- c) Slowly varying scan voltage
- d) Rapidly varying scan voltage

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Answer: c

Explanation: In wideline NMR spectrometers, slowly varying scan voltage has to be supplied to the electromagnet. This is injected using a regulator.

5. Which among the following NMR spectrometer is the more diverse spectrometer?

- a) Minimal type
- b) Maximal type
- c) Multipurpose type
- d) Wideline type

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Answer: c

Explanation: Multipurpose type NMR spectrometer is more diverse. These instruments are designed mainly for research.  
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6. Permanent magnet cannot be used in wideline type NMR spectrometer.

- a) True
- b) False

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Answer: b

Explanation: Permanent magnet can be used in wideline type NMR spectrometer. Compact, light-weight electromagnet can also be used.

7. Which of the following NMR spectrometer emphasises on high performance versatility with cost being a secondary consideration?

- a) Minimal type
- b) Maximal type
- c) Multipurpose type
- d) Wideline type

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Answer: c

Explanation: Multipurpose type is mainly used for research. Hence, it emphasises on high performance versatility with cost being a secondary consideration.

8. Which of the following NMR spectrometer does not require a power supply and cooling system?

- a) Minimal type
- b) Maximal type

- c) Multipurpose type
- d) Wideline type

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Answer: a

Explanation: Minimal type NMR spectrometer uses a permanent magnet. Hence, it does not require a power supply and cooling system.

9. Minimal type of NMR spectrometer is inexpensive.

- a) True
- b) False

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Answer: a

Explanation: Minimal type of NMR spectrometer is inexpensive. It uses a permanent magnet and does not require a power supply.  
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10. Which of the following is used as a coolant for magnets in continuous-wave NMR spectrometer?

- a) Water
- b) Liquid He
- c) Liquid Na
- d) Heavy water

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Answer: a

Explanation: Water is used as a coolant for magnets in continuous-wave NMR spectrometer. Liquid He is used for FT-NMR spectrometers.

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## **Analytical Instrumentation Questions and Answers – Continuous Wave NMR Spectroscopy**

1. Which of the following components are used to separate the nuclear spin energy states?

- a) RF channels
- b) Magnet
- c) Sample probe
- d) Sweep generator

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Answer: b

Explanation: A magnet is used to separate the nuclear spin energy states. Permanent magnet or electromagnets can be used.  
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2. In frequency sweep method, which of the following parameters are varied continuously?

- a) Magnetic field
- b) RF signal
- c) Sample concentration
- d) Amplification factor

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Answer: b

Explanation: In frequency sweep method, magnetic field is held constant. RF signal is swept or varied continuously.

3. In field sweep method, which of the following parameters are varied continuously?

- a) Magnetic field
- b) RF signal
- c) Sample concentration
- d) Amplification factor

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Answer: a

Explanation: In frequency sweep method, RF signal is held constant. Magnetic field is swept or varied continuously.

4. Which of the following statements are not true about permanent magnets?

- a) They are simple
- b) They are inexpensive
- c) They don't require shielding
- d) They don't require power supply

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Answer: c

Explanation: Permanent magnets are simple and inexpensive. But, permanent magnets require extensive shielding.

5. Which of the following is not true of electromagnets?

- a) They are expensive
- b) They require a power supply
- c) They don't require a cooling system
- d) They don't require extensive shielding

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Answer: c

Explanation: Electromagnets require a power supply. They also require cooling systems.  
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6. For high resolution work the magnetic field over the entire sample volume must be maintained uniform in space and time.

- a) True
- b) False

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Answer: a

Explanation: For high resolution work the magnetic field over the entire sample volume must be maintained uniform in space and time. To do this all the components must be kept in specified conditions.

7. Which of the following must not be done to maintain the magnetic field over the sample uniform in space and time?

- a) Large pole pieces need to be used
- b) Pole faces must be polished
- c) Wide pole gap must be present
- d) Magnets can be permanent or electromagnet

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Answer: c

Explanation: Narrow pole gap must be present to maintain the magnetic field over the sample uniform in space and time. The pole faces must be polished to optical tolerances.

8. The sample is contained in which of the following components?

- a) Flask
- b) Capillary tube

- c) Curvette
- d) Bore glass tube

[View Answer](#)

Answer: d

Explanation: The sample is contained in a bore glass tube. It should be cylindrical and thin-walled.

9. The single coil probe supplies the RF radiation to the sample and also serves as a part of which of the following circuits?

- a) RF channels
- b) Magnet
- c) Detector
- d) Sweep generator

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Answer: c

Explanation: The single coil probe supplies the RF radiation to the sample and also serves as a part of the detector circuit. It has only one coil.  
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10. Nuclear induction probes' one coil is used for signal detection. What is the function of the other coil?

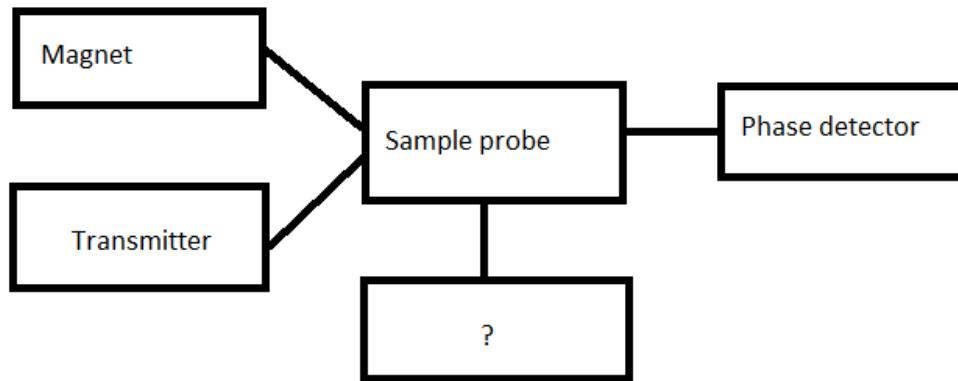
- a) Sample irradiation
- b) Magnet
- c) Detector
- d) Sweep generator

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Answer: a

Explanation: Crossed coil probes are also called nuclear induction probes. One coil is used for irradiating the sample. The other coil is mounted orthogonally for signal detection.

11. Given below is the diagram of Cw NMR spectrometer. Identify the unmarked component.



- a) Recorder
- b) RF channel
- c) Receiver
- d) Sweep generator

[View Answer](#)

Answer: d

Explanation: The unmarked component is sweep generator. Either field or frequency can be swept.

12. The voltage generated by the receiver coil is small and it must be amplified.

- a) True
- b) False

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Answer: a

Explanation: The voltage generated by the receiver coil is small and it must be amplified. It is then fed to the recorder or oscilloscope.

13. The amplification required for continuous-wave NMR is of the order of which of the following?

- a)  $10^1$
- b)  $10^2$
- c)  $10^3$
- d)  $10^5$

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Answer: d

Explanation: The amplification required for continuous-wave NMR is of the order of  $10^5$ . The spectrum can be recorded after amplification.  
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14. Which of the following can be used instead of magnets to produce the magnetic field?

- a) Inductor
- b) Motor
- c) Generator
- d) Superconducting solenoids

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Answer: d

Explanation: Superconducting solenoids can be used instead of magnets to produce the magnetic field. The magnet must be stable and homogeneous.

15. How is the inhomogeneity of magnetic fields compensated?

- a) With large magnetic fields
- b) With small magnetic fields
- c) By using two or more magnets
- d) By providing required insulation

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Answer: b

Explanation: The magnet must be stable and homogeneous. The inhomogeneity of magnetic fields is compensated with small magnetic fields.

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# Analytical Instrumentation Questions and Answers – Fourier Transform NMR Spectroscopy

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Fourier Transform NMR Spectroscopy”.

1. Fourier transform NMR spectrometer allows NMR transitions to be observed simultaneously.

- a) True

b) False  
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Answer: a

Explanation: Fourier transform NMR spectrometer is a type of NMR spectrometer. It allows samples to be observed simultaneously instead of serially.  
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2. Fourier transform NMR spectrometer has which of the following characteristics?

- a) Increased sensitivity, long time to obtain data
- b) Decreased sensitivity, long time to obtain data
- c) Increased sensitivity, reduced time to obtain data
- d) Decreased sensitivity, reduced time to obtain data

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Answer: c

Explanation: Fourier transform NMR spectrometer has increased sensitivity. It takes less time to obtain NMR data.

3. Which of the following cannot be done due to the multiplex advantage?

- a) Repetitive signals can be summed
- b) Repetitive signals can be averaged
- c) Increases signal to noise ratio
- d) Decreases signal to noise ratio

View Answer

Answer: d

Explanation: The multiplexing advantage allows improvement of the signal to noise ratio. It also allows repetitive signals to be summed and averaged.

4. Two coils are necessary for Fourier transform NMR spectroscopy.

- a) True
- b) False

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Answer: b

Explanation: Only one coil is necessary for Fourier transform NMR spectroscopy. The coil serves as both antenna for transmitting and receiving RF radiation.

5. Which of the following is the disadvantage of conventional mode of spectrometer or continuous-wave NMR spectrometer?

- a) They are unstable
- b) Maintenance is difficult
- c) High operating cost
- d) Excitation is inefficient

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Answer: d

Explanation: The disadvantage of conventional mode of a spectrometer or continuous-wave NMR spectrometer is that the excitation is inefficient. Only a narrow band of frequencies are contributing to the signal at a time.

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6. Which of the following must be done to improve sensitivity?

- a) Frequency sweep mode must be preferred
- b) Field sweep mode must be preferred
- c) Single channel excitation must be preferred
- d) Multichannel excitation must be preferred

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Answer: d

Explanation: Sweep techniques have less sensitivity. To improve sensitivity, multichannel excitation must be preferred.

7. Which of the following is the disadvantage of multichannel excitation?

- a) Low sensitivity
- b) Low resolution
- c) Small number of frequencies is present
- d) Uneconomical

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Answer: d

Explanation: Large number of frequencies is present in multichannel excitation. This is uneconomical since a receiver is required for each channel.

8. How can the need for an array of narrow-band filters and detectors be eliminated?

- a) By using multi-channel excitation
- b) By using a detector for each frequency
- c) By reducing the number of detectors
- d) By using Fourier transform

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Answer: d

Explanation: Fourier transform plays the role of a multichannel receiver. Hence, the need for array of narrow-band filters can be eliminated

9. Fourier transform can be accomplished by using which of the following components?

- a) Spin decoder
- b) Detector
- c) Spectrum analyser
- d) Oscilloscope

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Answer: c

Explanation: Fourier transform can be accomplished by using a spectrum analyser. Any complex waveform can be converted to frequencies using Fourier transform.

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10. A 15.4 MHz crystal generates the \_\_\_\_\_ resonance frequency.

- a) Hydrogen
- b) Deuterium
- c) Tritium
- d) Helium

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Answer: b

Explanation: A 15.4 MHz crystal generates the deuterium resonance frequency. This resonance signal is used to lock the magnetic signal to clock frequency.

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## Analytical Instrumentation Questions and Answers – Sensivity Enhancement for NMR Spectroscopy

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Sensitivity Enhancement for NMR Spectroscopy”.

1. Sensitivity is the ratio of peak signal amplitude to which of the following?

- a) Time

- b) Rms noise
  - c) Average noise
  - d) Peak-to-peak noise
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Answer: b

Explanation: Sensitivity is the ratio of peak signal amplitude to rms noise. It is a measure of the ability of an instrument to differentiate signal from surrounding noise.

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2. Which of the following is not an operating technique for sensitivity enhancement?

- a) Optimization of sample volume
- b) Optimization of instrumental parameters
- c) Optimization of noise
- d) Time averaging

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Answer: c

Explanation: There are only three operating techniques for sensitivity enhancement. Optimization of noise is not an operating technique for sensitivity enhancement.

3. Which of the following techniques do not enhance sensitivity by a factor of 10 at normal operating conditions?

- a) Optimization of sample volume
- b) Optimization of instrumental parameters
- c) Optimization of noise
- d) Time averaging

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Answer: d

Explanation: Time averaging techniques does not enhance sensitivity by a factor of 10. The other two techniques enhance sensitivity by a factor of 10 at normal operating conditions.

4. The most common spherical cells have which of the following dimensions?

- a) 4mm diameter
- b) 40mm diameter
- c) 8mm diameter
- d) 80mm diameter

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Answer: a

Explanation: The most common spherical cells have 4mm diameter. A 1mm capillary cell is centred along the axis of the coil.

5. Better sensitivity with good resolution can be achieved by concentrating the sample inside which of the following?

- a) Sample cell
- b) Micro cell
- c) Sample tube
- d) Cylindrical tube

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Answer: b

Explanation: Better sensitivity with good resolution can be achieved by concentrating the sample inside a specially designed NMR microcell. It could be a spherical cell or a capillary cell.

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6. Frequency spectrum of noise occupies a band that is \_\_\_\_\_ the signal spectrum. Choose the most appropriate option.

- a) Narrow than
- b) Wider than
- c) Different from
- d) Same as

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Answer: b

Explanation: Frequency spectrum of noise occupies a band that is wider than the signal spectrum. Filters operate on this concept.

7. Suppression of frequencies which contain no signal does which of the following?

- a) Increases S/N ratio
- b) Decreases S/N ratio
- c) S/N ratio is kept constant
- d) S/N ratio becomes 1

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Answer: a

Explanation: Suppression of frequencies which contain no signal increases S/N ratio. The noise decreases.

8. The amplitude of the NMR signal caused by the absorption of RF energy at the radio frequency does not depend upon the power of the RF energy applied.

- a) True

b) False  
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Answer: b

Explanation: The amplitude of the NMR signal caused by the absorption of RF energy at the radio frequency depends on the power of the RF energy applied. It also depends on the sweep rate selected.

9. Which of the following is not involved in signal averaging?

- a) A system to repeatedly scan the spectral region of interest
- b) Some storage device to store information
- c) A system to coherently add individual spectra
- d) Sweep generator

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Answer: d

Explanation: Sweep generator is not involved in signal averaging. This is usually accomplished using a small computer.  
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10. In order to have a long measuring time for increasing sensitivity, it is better to have several fast scans than a single slow scan.

- a) True
- b) False

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Answer: a

Explanation: In order to have a long measuring time for increasing sensitivity, it is better to have several fast scans than a single slow scan. The sensitivity increases by the square root of a number of scans.

11. In Spin Decoupler, the output of the DC amplifier is applied to which of the following to control the power supplied to the oven heaters?

- a) Power diode
- b) Power transistor
- c) Power MOSFET
- d) Power IGBT

View Answer

Answer: b

Explanation: In Spin Decoupler, the output of the DC amplifier is applied to the power transistor to control the power supplied to the oven heaters. The temperature is maintained at plus or minus 1oC.

12. In Spin Decoupler, the difference frequency circuit provides a means of mixing two signals and a filter to recover which of the following?

- a) Low-frequency component
- b) High-frequency component
- c) Low-voltage component
- d) High-voltage component

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Answer: a

Explanation: In Spin Decoupler, the difference frequency circuit provides a means of mixing two signals and a filter to recover the low-frequency component. It is included to provide a read-out frequency.

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## Analytical Instrumentation Questions and Answers – Principle of operation of Mass Spectrometer

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This set of Analytical Instrumentation Multiple Choice Questions & Answers focuses on “Principle of operation of Mass Spectrometer”.

1. Mass spectrometers are used to determine which of the following?

- a) Composition in sample
- b) Concentration of elements in sample
- c) Relative mass of atoms
- d) Properties of sample

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Answer: c

Explanation: Mass spectrometers are used to determine the relative mass of atoms and molecules. Aston made the instrument more accurate.

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2. Who invented mass spectrometers?

- a) J.J Thompson
- b) Goldstein
- c) Nikola Tesla
- d) Aston

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Answer: a

Explanation: J.J Thompson introduced mass spectrometers. Aston modified the instrument to make it more accurate.

3. In mass spectrometer, the sample that has to be analysed is bombarded with which of the following?

- a) Protons
- b) Electrons
- c) Neutrons
- d) Alpha particles

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Answer: b

Explanation: In mass spectrometer, the sample which is to be analysed is bombarded with electrons. As a result, ions are produced.

4. Mass spectrometer separates ions on the basis of which of the following?

- a) Mass
- b) Charge
- c) Molecular weight
- d) Mass to charge ratio

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Answer: d

Explanation: Mass spectrometer separates ions on the basis of mass to charge ratio. Most of the ions are singly charged. Hence, the mass to charge ratio is equal to the mass.

5. In mass spectrometer, the ions are sorted out in which of the following ways?

- a) By accelerating them through electric field
- b) By accelerating them through magnetic field
- c) By accelerating them through electric and magnetic field
- d) By applying a high voltage

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Answer: c

Explanation: In mass spectrometer, the ions are sorted out by accelerating them through an electric and magnetic field. A record of number of different kinds of ions is called mass spectrum.

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6. No two molecules will be fragmented and ionized in exactly the same manner.

- a) True
- b) False

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Answer: a

Explanation: No two molecules will be fragmented and ionized in exactly the same manner. This is how different molecules are identified in a complex mixture.

7. The procedure for mass spectroscopy starts with which of the following processes?

- a) The sample is bombarded by electron beam
- b) The ions are separated by passing them into electric and magnetic field
- c) The sample is converted into gaseous state
- d) The ions are detected

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Answer: c

Explanation: The procedure for mass spectroscopy starts with converting the sample into a gaseous state. This is done by chemical processes.

8. In a mass spectrometer, the ion currents are measured using which of the following?

- a) Scintillation counter
- b) Ion counter
- c) Electrometer tube
- d) Electric fields

[View Answer](#)

Answer: c

Explanation: The ion currents are measured using a sensitive electrometer tube. The ions reaching the collecting plate are measured.

9. Which of the following ions pass through the slit and reach the collecting plate?

- a) Negative ions of all masses
- b) Positive ions of all masses
- c) Negative ions of specific mass
- d) Positive ions of specific mass

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Answer: d

Explanation: Positive ions of specific mass pass through the slit and reach the collecting plate. These ions are measured.

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10. Which of the following statements is not true about mass spectrometry?

- a) Impurities of masses different from the one being analysed interferes with the result
- b) It has great sensitivity
- c) It is suitable for data storage
- d) It is suitable for library retrieval

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Answer: a

Explanation: Impurities of masses different from the one being analysed does not interfere with the result in mass spectroscopy. This is a major advantage of this technique.

11. In mass spectrometer, the sample gas is introduced into the highly evacuated spectrometer tube and it is ionised by electron beam.

- a) True
- b) False

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Answer: a

Explanation: The sample gas is introduced into the highly evacuated spectrometer tube and it is ionised by an electron beam. The sample has to be in a gaseous state.

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# Analytical Instrumentation Questions and Answers – Components of Mass Spectrometer

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Components of Mass Spectrometer”.

1. Which of the following is not a component of mass spectrometer?

- a) Inlet system
- b) Sweep generator
- c) Ion transducer
- d) Mass analyser

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Answer: b

Explanation: Sweep generator is not a component of a mass spectrometer. It is a component of NMR spectrometer.

2. Which of the following can be introduced into the ionization chamber directly?

- a) Solid samples with low vapour pressure
- b) Solid samples with high vapour pressure
- c) Liquid samples with low density
- d) Liquid samples with high density

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Answer: a

Explanation: Solid samples with low vapour pressure can be introduced into the ionization chamber directly.

3. Inlet system is also known as which of the following?

- a) Initial system
- b) Sample reservoir
- c) Sample handling system
- d) Element injection system

[View Answer](#)

Answer: c

Explanation: Inlet system introduces the sample into the ion source. Hence, it is called a sample handling system.

4. Which of the following is normally done to convert the sample into the gaseous state?

- a) Sample is pressurized
- b) Chemical reactions are made to occur

- c) Sample is heated
  - d) Sample is cooled
- [View Answer](#)

Answer: c

Explanation: The sample must always be in the gaseous state. Hence, the liquid sample must be heated before introducing them into the ionization chamber.

5. Which of the following probes are used for the introduction of the sample?

- a) Silica
- b) Quartz
- c) Graphite
- d) Silver

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Answer: a

Explanation: Solid samples with low vapour pressure are introduced into the entrance of the chamber. They are introduced using silica or platinum probe.

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6. Which of the following is not a type of ionisation?

- a) Field ionisation
- b) Spontaneous ionisation
- c) Spark ionisation
- d) Chemical ionisation

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Answer: b

Explanation: Spontaneous ionisation is not a type of ionisation. In mass spectrometer, ionisation is brought about by thermal or electrical energy.

7. Mass analyser is similar to which of the following in optical spectrometer?

- a) Source
- b) Monochromator
- c) Detector
- d) Sample

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Answer: b

Explanation: Mass analyser is similar to monochromator in an optical spectrometer. It separates ions according to their mass/charge ratio.

8. Which of the following is not one of the types of mass analyser?

- a) Magnetic sector analyser
- b) Frequency sweep analyser
- c) Double focussing spectrometer
- d) Time of flight analyser

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Answer: b

Explanation: Frequency sweep analyser is not a type of mass analyser. There are many devices available for mass analysis.

9. Which of the following is not a type of ion detector used in mass spectrometers?

- a) Electron multiplier
- b) Flame emission detector
- c) Faraday cup collector
- d) Photographic plates

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Answer: b

Explanation: Flame emission detector is not a type of ion detector used in mass spectrometers. Ion detectors produce a current on the output side when there are ions on the input side.

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10. Which of the following is used to inject liquid samples?

- a) Hypodermic needle
- b) Glass bulb
- c) Capillary tube
- d) Curvette

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Answer: a

Explanation: Liquid samples are injected through hypodermic needles. It is vaporized at low pressure.

11. Under which of the following temperatures is the ionisation chamber maintained?

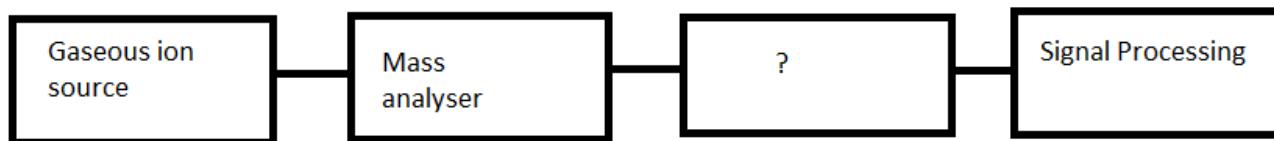
- a) 100°C
- b) 200°C
- c) 300°C
- d) 400°C

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Answer: b

Explanation: The ionisation chamber is maintained at 200°C. It is also maintained at low pressure.

12. Given below is the block diagram of mass spectrometer. Identify the unmarked component.



- a) Inlet system
- b) Ionisation chamber
- c) Vacuum system
- d) Ion transducer

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Answer: d

Explanation: The unmarked component is ion transducer. It will give current at the output side when ions are present on the input side.

13. Which of the following is not a characteristic of nebulizers that are commonly used?

- a) Low cost
- b) Low uptake rate
- c) High efficiency
- d) High uptake rate

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Answer: d

Explanation: Commonly used nebulizers have a low uptake rate. They also have low cost and high efficiency.  
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14. In glow discharge ion source, the sample is atomised by which of the following process?

- a) Evaporation
- b) Sputtering
- c) Heating
- d) Annealing

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Answer: b

Explanation: In glow discharge ion source, the sample is atomised by the process of sputtering. It not only atomizes the sample but also provides means by which these atoms are ionized.

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# Analytical Instrumentation Questions and Answers – Magnetic Deflection Mass Spectrometer

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Magnetic Deflection Mass Spectrometer”.

1. Which of the following produces the electron beam in magnetic deflection mass spectrometer?

- a) Tungsten filament
- b) Quartz rod
- c) Silica
- d) Rhodium filament

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Answer: a

Explanation: Tungsten filament produces the electron beam in magnetic deflection mass spectrometer. The electrons are produced by the heated filament.

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2. In magnetic deflection mass spectrometer, in which of the following ways is acceleration applied to the direction of motion?

- a) In random manner
- b) Parallel to it
- c) Perpendicular to it
- d) Along it

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Answer: c

Explanation: Acceleration in the mass spectrometer, is applied perpendicular to the direction of motion. The velocity of the object remains constant.

3. Direct focussing is obtained by deflecting the ion beam along a \_\_\_\_\_ trajectory through the magnetic field.

- a) 120°
- b) 150°
- c) 190°
- d) 180°

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Answer: d

Explanation: Direct focussing is obtained by deflecting the ion beam along a 180° trajectory through a magnetic field. The gap between the poles must be large enough to contain the ion source.

4. Which of the following separate the ions according to their mass-to-charge?

- a) Ion source
- b) Detector
- c) Magnetic sector
- d) Electric sector

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Answer: c

Explanation: Magnetic sector will separate the ions according to their mass-to-charge. The magnet will decide the mass to charge ratio.

5. Mattauch-Herzog geometry involves a deflection of which of the following radians in a radial electrostatic field analyser?

- a) v2?
- b) ?/2
- c) ?/3v4
- d) ?/4v2

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Answer: d

Explanation: Mattauch-Herzog geometry involves a deflection of ?/4v2 radians in a radial electrostatic field analyser. It is followed by a magnetic deflection of ?/2 radians.

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6. Which of the following leads to the limitation of resolution?

- a) All ions do not have same energy
- b) All ions do not have same charge
- c) All ions are not of the same size
- d) All ions do not have the same charge

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Answer: a

Explanation: The resolution is limited as all ions do not have the same energy. Hence, the ions would not have the same velocity.

7. The electric sector field is not subject to hysteresis.

- a) True
- b) False

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Answer: a

Explanation: The electric sector field is not subject to hysteresis. Hence, the relationship between mass to charge ratio and accelerating voltage is linear.

8. Which of the following components need to be added in order to increase the resolution?

- a) Ion source
- b) Detector
- c) Magnetic sector
- d) Electric sector

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Answer: d

Explanation: Electric sector needs to be added in order to increase the resolution. This compensates for the decrease in resolution due to varying velocities.

9. Which of the following is commonly varied in magnetic deflection mass spectrometer?

- a) Electric sector
- b) Magnetic fold strength
- c) Magnetic constant
- d) Electric constant

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Answer: b

Explanation: Magnetic fold strength is usually varied in magnetic deflection mass spectrometer. Electric sector is kept constant.

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10. Nier-Johnson geometry involves a deflection of which of the following radians in a radial electrostatic field analyser?

- a) ?
- b)  $\pi/2$
- c)  $\pi/3$
- d)  $\pi/4$

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Answer: b

Explanation: Nier-Johnson geometry involves a deflection of  $\pi/2$  radians in a radial electrostatic field analyser. A magnetic deflection of  $\pi/3$  radians follows the analyser.

11. An accuracy of 1 part in  $10^2$  has been obtained in precision mass measurements.

- a) True
- b) False

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Answer: b

Explanation: An accuracy of 1 part in  $10^9$  has been obtained in precision mass measurements. Spectrographs with photographic reading are used for analysis of solids.

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# Analytical Instrumentation Questions and Answers – Time of Flight Mass Spectrometer

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This set of Analytical Instrumentation Questions and Answers for Aptitude test focuses on “Time of Flight Mass Spectrometer”.

1. Which of the following is not a component of the time of flight analyser spectrometer?
  - a) Ion source
  - b) Field free separation region
  - c) Electron multiplication region
  - d) Photo tube

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Answer: d

Explanation: Phototube is not a component of time of flight mass spectrometer. Time of flight mass analyser is a type of mass spectrometer.

2. Time of flight mass spectrometer has an unlimited mass range.
  - a) True
  - b) False

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Answer: a

Explanation: Time of flight mass spectrometer is a type of mass spectrometer. It has unlimited mass range.

3. Which of the following is not an advantage of mass spectrometer?
  - a) Simple
  - b) Rugged
  - c) High sensitivity
  - d) Unlimited mass range

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Answer: c

Explanation: Time of flight mass spectrometers have limited sensitivity and resolution. They are simple and rugged.

4. All the ions entering the tube have the same kinetic energy.
  - a) True
  - b) False

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Answer: a

Explanation: Separation of ions occurs while they are moving from the ion source to the detector. All the ions entering the tube have the same kinetic energy.

5. If all the ions have the same kinetic energy how are their masses related to their velocities?
  - a) Mass and velocity are equal

- b) Mass and velocity are not related
- c) Mass and velocity are directly proportional
- d) Mass and velocity are inversely proportional

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Answer: d

Explanation: If all the ions have the same kinetic energy, mass and velocity are inversely proportional. This is used in the separation of ions.

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6. Which of the following is true about time of flight analyser spectrometers?

- a) Lighter particles arrive at the detector earlier
- b) Heavier particle arrive at the detector earlier
- c) Lighter and heavier particles arrive together at the detector
- d) Lighter particles do not reach the detector

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Answer: a

Explanation: Lighter particles arrive at the detector earlier than the heavier particles. The time difference is used to separate the electrons according to their mass.

7. In the time of flight mass spectrometer, ions are formed by which of the following methods?

- a) Pulsed ionization method
- b) Acceleration method
- c) Dynamic method
- d) Ion excitation method

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Answer: a

Explanation: In the time of flight mass spectrometer, ions are formed by pulsed ionisation method. It is a type of mass spectrometer.

8. The evacuated tube is also known as which of the following?

- a) Pulse tube
- b) Detector tube
- c) Drift tube
- d) Acceleration tube

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Answer: c

Explanation: The evacuated tube is also known as a drift tube. The electrons move from source to detector through the tube.

9. The current produced by ions arriving at the collector necessitates the use of which of the following?

- a) Wide band amplifier
- b) Narrow band amplifier
- c) Wide band filter
- d) Narrow band filter

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Answer: a

Explanation: The current produced by ions arriving at the collector has very short duration. Hence, it necessitates the use of wide band amplifier.

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10. Which of the following is an ion optic device in which ions pass through a mirror and their flight is reversed?

- a) Reversal device
- b) Reflectron
- c) Mirror arrangement
- d) Separation chamber

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Answer: b

Explanation: Reflectron is an ion optic device in which ions pass through a mirror and their flight is reversed. It is used in time of flight mass spectrometer.

11. Which of the following statements about mass spectrometers are not true?

- a) Time of flight mass spectrometer has the ability to record the entire mass spectrum at a time
- b) Time of flight mass spectrometers have poor resolution
- c) Conventional spectrometer detects only one peak at a time
- d) All spectrometers have the ability to record the entire mass spectrum at a time

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Answer: d

Explanation: Conventional spectrometer detects only one peak at a time. Time of flight mass spectrometer has the ability to record the entire mass spectrum at a time.

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# Analytical Instrumentation Questions and Answers – Radiofrequency Mass Spectrometer

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Radiofrequency Mass Spectrometer”.

1. Which of the following is placed just before the detector in a radiofrequency mass spectrometer?

- a) Ion source
- b) Potential energy selector
- c) Ionisation chamber
- d) Reflectron

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Answer: b

Explanation: A potential energy selector is placed before the detector. It balances out the energy of the ion beam.

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2. Which of the following is applied in one or more stages where each stage is a series of three equally spaced parallel grids?

- a) Ionisation field
- b) Reflection
- c) RF field
- d) Acceleration

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Answer: c

Explanation: RF field is applied in one or more stages. Each stage is a series of three equally spaced parallel grids.

3. The alternating voltage rf voltage is applied to which of the following?

- a) All grids
- b) Central grid
- c) Alternate grids
- d) None of the grids

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Answer: b  
Explanation: The alternating voltage rf voltage is applied to the central grid. All the other grids are kept at ground potential.

4. The rf spectrometer contains a magnet.

- a) True
- b) False

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Answer: b

Explanation: Rf spectrometer does not contain a magnet. Rf field is applied for this type of mass spectrometer.

5. The DC ion accelerating voltage is swept from \_\_\_\_\_

- a) 0 to 50 V
- b) 50 to 100 V
- c) 200 to 300 V
- d) 50 to 250 V

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Answer: d

Explanation: The DC ion accelerating voltage is swept from 50 to 250 V. This is done twice per second.  
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6. The resolution of the Bennet tube can be improved by using which of the following?

- a) Sine wave rf signal
- b) Square wave rf signal
- c) Triangular wave rf signal
- d) Random signal

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Answer: b

Explanation: The resolution of the Bennet tube can be improved by using square wave rf signal. Usually, sinusoidal wave signal is used.

7. In Bennet spectrometer, the rf voltage has a fixed frequency.

- a) True
- b) False

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Answer: a

Explanation: In Bennet spectrometer, the rf voltage has a fixed frequency. It is modulated at 10 percent at 1kHz.

8. The spurious lines can be reduced to a minimum by using which of the following?

- a) Single stage tube
- b) Two stage tube
- c) Three stage tube
- d) Reflectron

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Answer: c

Explanation: The spurious lines can be reduced to a minimum by using three stage tubes. Two stage tubes tend to produce spurious lines.

9. Which of the following is the disadvantage of using three stage tubes?

- a) Reduced resolution
- b) Bulky construction
- c) Complex
- d) Heavy

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Answer: a

Explanation: The spurious lines can be reduced to a minimum by using three stage tubes. This results in reduced resolving power.  
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10. Which of the following is not the feature of Bennet type spectrometer?

- a) Lightweight
- b) Simple
- c) Absence of spurious lines
- d) Moderate resolution

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Answer: c

Explanation: Absence of spurious lines is not a feature of Bennet type spectrometer. Spurious lines can be reduced by adding new features.

11. The resolving power of Bennet type spectrometer is primarily based on which of the following?

- a) Distance between detector and reflectron
- b) Difference between the individual rf accelerating stages
- c) Length of the drift tube
- d) Laser beam used

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Answer: b

Explanation: The resolving power of Bennet type spectrometer is primarily based on the difference between the individual rf accelerating stages.

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## Analytical Instrumentation Questions and Answers – Quadrupole Mass Spectrometer

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Quadrupole Mass Spectrometer”.

1. Which of the following is not a feature of quadrupole mass spectrometer?

- a) Low cost
- b) Light weight
- c) Low speed electronic scanning
- d) Simple in construction

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Answer: c

Explanation: In quadrupole mass spectrometer, electronic scanning takes place. The scanning takes place at high speed.

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2. Which of the following is not a component of quadrupole mass filter?

- a) Electrodes
- b) Choke
- c) DC potential
- d) Detector

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Answer: d

Explanation: Detector is not a part of the filter. The filter uses DC potential.

3. The mass selection scheme uses a dc potential and not a radio frequency potential.

- a) True
- b) False

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Answer: b

Explanation: The mass selection scheme uses a dc potential. It also uses radio frequency potential.

4. If to one pair of electrodes one potential with one sign is applied, which of the following is applied to the other pair of electrodes?

- a) Same potential with same sign
- b) Different potential with same sign
- c) Different potential with different sign
- d) Same potential with different sign

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Answer: d

Explanation: If to one pair of electrodes one potential with one sign is applied, same potential with a different sign is applied to the opposite electrodes.

5. Which of the following is the heart of quadrupole instrument?

- a) Electrodes
- b) Choke
- c) DC potential
- d) Detector

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Answer: a

Explanation: Electrodes are the heart of quadrupole instrument. Opposite electrodes are electrically connected.

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6. Which of the following has to be done to increase the resolution of the quadrupole mass spectrometer?

- a) Increasing distance between detector and reflectron
- b) Increasing difference between the individual rf accelerating stages
- c) Increasing the length of the drift tube
- d) Increasing the rod length of the electrode

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Answer: d

Explanation: The resolution depends upon the electrode. The length of the electrode has to be increased for increasing the resolution.

7. Which of the following does not affect the resolution of the instrument?

- a) Changing length of electrode
- b) Changing slope of scan line
- c) Quality of machining of the rods
- d) Changing length of drift tube

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Answer: d

Explanation: Changing length of drift tube does not affect the resolution of the instrument. Increase in resolution results in an increase in the number of ions reaching the detector.

8. In cases where differentiation is required between very similar substances, which of the following techniques making use of quadrupole principle is preferred?

- a) Evaporation mass spectrometry
- b) Pyrolysis mass spectrometry
- c) Plasma mass spectrometry
- d) Trapped ion mass spectrometry

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Answer: b

Explanation: In cases where differentiation is required between very similar substances, pyrolysis mass spectrometry is used. The sample is usually solid or involatile liquid in this case.

9. In pyrolysis spectrometry, heating is done until which of the following is reached?

- a) Curie point
- b) Boiling point
- c) Until production of superheated vapour
- d) Until 100°C

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Answer: a

Explanation: In pyrolysis spectrometry, heating is done until curie point is reached. At this point, magnetic permeability drops abruptly.

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10. Which of the following is used to cool the ion source?

- a) Liquid sodium shield
- b) Liquid nitrogen shield
- c) Water
- d) Freon

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Answer: b

Explanation: Liquid nitrogen cooled shield is used to cool the ion source. It reduces source contamination.

11. In quadrupole mass spectrometer, the ratio u/v is mass dependent, where ‘u’ is the DC voltage and ‘v’ is the peak amplitude.

- a) True
- b) False

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Answer: b

Explanation: In quadrupole mass spectrometer, the ratio u/v is mass independent, where ‘u’ is the DC voltage and ‘v’ is the peak amplitude. This ratio is kept constant.

12. When a value of q is kept constant, the value of m/e is proportional to which of the following when ‘m’ is the mass number, ‘e’ is the electric charge, ‘u’ is the DC potential, ‘v’ is the peak amplitude and ‘f’ is the frequency?

- a) u/v ratio
- b) u
- c) v
- d) f

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Answer: c

Explanation: When a value of q is kept constant, the value of m/e is proportional to ‘v’. By variation of rf amplitude the m/e ratio varies.

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# Analytical Instrumentation Questions and Answers – Ion Transducers

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Ion Transducers”.

1. Which of the following is not an ion transducer or detector?

- a) Faraday cup collector
- b) Channeltron
- c) Micro-channel plate
- d) Flame ionization detector

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Answer: d

Explanation: Flame ionization detector is not an ion transducer. It is a detector used in chromatography.

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2. Which of the following is similar to photo multiplier transducer?

- a) Faraday cup collector
- b) Channeltron
- c) Micro-channel plate
- d) Electron multiplier transducer

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Answer: d

Explanation: Electron multiplier transducer is similar to photo multiplier transducer. The difference is that its primary cathode detects ions rather than photons.

3. Which of the following is used in places where ion currents are very low?

- a) Faraday cup collector
- b) Channeltron
- c) Micro-channel plate
- d) Electron multiplier transducer

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Answer: d

Explanation: Electron multiplier transducer is used in places where ion currents are very low. Its primary cathode detects ions.

4. Discrete type electron multiplier transducers can provide current gain upto which of the following?

- a)  $10^2$
- b)  $10^5$
- c)  $10^7$
- d)  $10^{11}$

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Answer: c

Explanation: Discrete type electron multiplier transducers can provide current gain upto  $10^2$ . Upto 20 dynodes need to be used for this purpose.

5. Continuous dynode electron multiplier transducer is a trumpet shaped device made with which of the following?

- a) Glass doped with lead
- b) Steel doped with bronze
- c) Phosphor bronze doped with iron
- d) Iron doped with calcium

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Answer: a

Explanation: Continuous dynode electron multiplier transducer is a trumpet shaped device made of glass. It is heavily doped with lead.

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6. The potential maintained across the continuous dynode multiplier transducer is which of the following?

- a) 1 to 5kV
- b) 5 to 10kV
- c) 2.5 to 6.2kV
- d) 1.8 to 2kV

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Answer: d

Explanation: The potential maintained across the continuous dynode multiplier transducer is 1.8 to 2kV. Electrons cascade down the tube.

7. Which of the following are not the characteristics of an electron multiplier transducer?

- a) Rugged
- b) Reliable
- c) Microsecond of response time required
- d) High current gain

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Answer: c  
Explanation: Electron multiplier transducer requires the only nanosecond of response time. It provides a high current gain.

8. Which of the following are true about dynodes used in discrete dynode electron multiplier?

- a) The dynodes are all kept at same voltage
- b) Successive dynodes are held at lower potential
- c) Successive dynodes are held at higher potential
- d) All dynodes are held at very low potential

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Answer: c

Explanation: In discrete dynode electron multiplier, successive dynodes are held at higher potential. Dynodes are metal plates with copper or beryllium surfaces.

9. In which of the following detectors, the collector is placed in an inclined manner?

- a) Faraday cup collector
- b) Channeltron
- c) Micro-channel plate
- d) Electron multiplier transducer

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Answer: a

Explanation: The collector is placed in an inclined manner in a faraday cup collector. This is to reflect the ions away from the entrance of the cup.  
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10. Which of the following is the least sensitive ion detector?

- a) Faraday cup collector
- b) Channeltron
- c) Micro-channel plate
- d) Electron multiplier transducer

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Answer: a

Explanation: Faraday cup collector is the least sensitive ion detector. It is used in places where great sensitivity is not required.

11. Photographic plates are coated with which of the following?

- a) Lead
- b) Quartz
- c) Silver bromide
- d) Mercuric sulphate

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Answer: c

Explanation: Photographic plates are coated with silver bromide. These are sensitive to energetic ions.

12. Which of the following detectors are well suited for spark source instruments?

- a) Faraday cup collector
- b) Photographic plates
- c) Micro-channel plate
- d) Electron multiplier transducer

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Answer: b

Explanation: Photographic plates are well suited for spark source instruments. It has great sensitivity.

13. Photographic plates have greater sensitivity and resolution than electron multipliers.

- a) True
- b) False

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Answer: a

Explanation: Photographic plates have greater sensitivity and resolution than electron multipliers. This is because they integrate the ion signals over a period of time.

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14. Which of the following detectors consist of an array of glass capillaries?

- a) Faraday cup collector
- b) Photographic plates
- c) Micro-channel plate
- d) Electron multiplier transducer

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Answer: c

Explanation: Micro-channel plate consists of an array of glass capillaries. They are coated with electron emissive materials.

15. Which of the following detectors can be used for ions with short life time?

- a) Faraday cup collector
- b) Photographic plates

- c) Micro-channel plate
- d) Electron multiplier transducer

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Answer: b

Explanation: Photographic plates can be used for ions with short life time. This is because they integrate the ion signal over a period of time.

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## Analytical Instrumentation Questions and Answers – Inductively Coupled Plasma Mass Spectrometer

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This set of Analytical Instrumentation online test focuses on “Inductively Coupled Plasma Mass Spectrometer”.

1. ICP's principle is similar to which of the following?

- a) Flame emission spectroscopy
- b) Fourier transforms spectroscopy
- c) Atomic emission spectroscopy
- d) Absorption spectroscopy

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Answer: c

Explanation: ICP's principle is similar to atomic emission spectroscopy. Samples are decomposed to neural elements in argon plasma in this method.

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2. ICP is used to analyse samples in which of the following states?

- a) Solids
- b) Liquids
- c) Gases
- d) Solids and liquids

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Answer: d

Explanation: ICP is used to analyse samples in both solid and liquid states. Atomic emission spectrometer is used to analyse only solid samples.

3. Solid samples are introduced into the ICP spectrometer using which of the following?

- a) Nebulizer
- b) Curvette having glass windows
- c) Probe
- d) Laser ablation system

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Answer: d

Explanation: ICP spectrometer can be used for solid samples. They are introduced using a laser ablation system.

4. Liquid samples are introduced into the ICP spectrometer using which of the following?

- a) Nebulizer
- b) Curvette having glass windows
- c) Probe
- d) Laser ablation system

[View Answer](#)

Answer: a

Explanation: ICP spectrometer can be used for liquid samples. Aqueous samples are introduced using the nebulizer.

5. Atomisation or ionisation occurs at which of the following conditions?

- a) Vacuum pressure
- b) Atmospheric pressure
- c) Low pressure
- d) High pressure

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Answer: d

Explanation: Atomization or ionisation occurs at atmospheric pressure. The interface between the ICP and MS components are crucial in creating a vacuum.  
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6. Ions flow is pumped into the vacuum system using which of the following?

- a) Orifice
- b) Nozzle
- c) Venturi meter
- d) Dall tube

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Answer: a

Explanation: Ions flow is pumped into the vacuum system using orifice. It expands in the vacuum system.

7. Which of the following is not the characteristic of ICP spectrometer?

- a) Easy sample introduction
- b) It can trace multiple elements
- c) High detection limits
- d) Accurate

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Answer: c

Explanation: ICP spectrometer has low detection limits of a mass spectrometer. It is capable of tracking multiple elements.

8. ICP spectrometer is a sequential multi-element analyser that has scan times less than \_\_\_\_\_ for one sweep.

- a) 10ms
- b) 20ms
- c) 50ms
- d) 100ms

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Answer: b

Explanation: ICP spectrometer is a sequential multi-element analyser that has scan times less than 20ms for one sweep. Quadrupole mass analyser gives a better unit mass resolution.

9. Double focussing section analysers offer better resolution than ICP spectrometry system.

- a) True
- b) False

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Answer: a

Explanation: Double focussing section analysers offer better resolution than ICP spectrometry system. Their disadvantage is that they are large and have a high capital cost.

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10. The most common type of ion detector found in ICP system is which of the following?

- a) Faraday cup collector

- b) Channeltron
- c) Micro-channel plate
- d) Flame ionization detector

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Answer: b

Explanation: The most common type of ion detector found in ICP system is channeltron electron multiplier. It is a cone or horn shaped tube.

11. Which of the following is the most accurate method of determination of elemental composition?

- a) Spectroscopy
- b) Isotope dilution
- c) Isobar dilution
- d) Chromatography

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Answer: b

Explanation: The most accurate method of determination of elemental composition is isotope dilution. It permits the calculation of the concentration of an element.

12. Which of the following is the disadvantage of ICP mass spectroscopy?

- a) Incapable of multi-element analysis
- b) Less sensitivity
- c) Impossible to obtain isotopic information
- d) Not useful for detection of non-metals

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Answer: d

Explanation: ICP mass spectroscopy has a multi-element capability and high sensitivity. It is not capable of multi-element analysis.

13. The isobaric interference is not caused in which of the following elements?

- a) Argon
- b) Oxygen
- c) Helium
- d) Nitrogen

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Answer: c

Explanation: The isobaric interference is not caused due to isotopes of helium. It is caused by isotopes of argon, oxygen and nitrogen.

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# Analytical Instrumentation Questions and Answers – Gas Chromatograph-Mass Spectrometer

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Gas Chromatograph- Mass Spectrometer”.

1. Which of the following is the most sensitive of the spectral methods?

- a) Absorption spectroscopy
- b) Mass spectroscopy
- c) Flame emission spectroscopy
- d) Atomic emission spectroscopy

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Answer: b

Explanation: Mass spectroscopy is the most sensitive of the spectral methods. It permits direct introduction of a gas effluent's stream.

2. Which of the following is the disadvantage of gas chromatography?

- a) It is not a good method
- b) It cannot be used for qualitative analysis
- c) It cannot be used for the separation of volatile components
- d) It does not provide direct identification

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Answer: d

Explanation: Gas chromatography is a very good method for separation of components of a mixture. It does not provide direct identification.

3. Cold tray is provided for liquid N<sub>2</sub> or CO<sub>2</sub> but is used only for extremely small samples.

- a) True
- b) False

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Answer: a

Explanation: Cold tray is provided for liquid N<sub>2</sub> or CO<sub>2</sub>. It is used only for mass spectral analysis of very small samples.

4. Which of the following is most often used in the chromatograph in gas chromatograph MS?

- a) Curvette
- b) Paper support
- c) Capillary tube
- d) Flask

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Answer: c

Explanation: Capillary tube is most often used in the chromatograph in gas chromatograph MS. This is because low pressure has to be maintained.

5. GC- MS has been developed for which of the following systems?

- a) Packed column
- b) Open tubular column
- c) Capillary column
- d) Porous layer column

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Answer: a

Explanation: GC- MS has been developed for packed column system. These allow for analyte molecules to be dynamically extracted from the carrier gas stream.

6. Which of the following problems occur when combining gas chromatography and mass spectroscopy?

- a) Difference in operating pressures
- b) Reduction in sensitivity
- c) Direct identification is not possible
- d) It does not permit direct introduction of the effluent

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Answer: a

Explanation: The problem that occurs when combining gas chromatography and mass spectroscopy is the difference in operating pressures. The pressure at the

exit of the GC column is atmospheric.

7. The carrier gas with low molecular weight would diffuse at a higher rate than the higher molecular weight sample.

- a) True
- b) False

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Answer: a

Explanation: The carrier gas with low molecular weight would diffuse at a higher rate than the higher molecular weight sample. The carrier gas would diffuse away from the line of flow.

8. Which of the following is the type of separator used in commercial GC-MS systems?

- a) Jet type molecular separator
- b) Porous tube
- c) Teflon tube
- d) Flow type separator

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Answer: a

Explanation: Jet type molecular separator is the type of separator used in commercial GC-MS systems. Other methods are porous tube and Teflon tube.

9. The system for measurement of ion intensity in GS-MS system consists of which of the following?

- a) Electrometer
- b) Ion meter
- c) Ion transducer
- d) Intensity meter

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Answer: a

Explanation: The system for measurement of ion intensity in GS-MS system consists of electrometer. It feeds a direct writing recorder.

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10. The system for measurement of ion intensity in GS-MS system consists of which of the following?

- a) Band pass amplifier
- b) Narrow band amplifier
- c) Wide band amplifier
- d) Low pass amplifier

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Answer: c

Explanation: The system for measurement of ion intensity in GS-MS system consists of a wide band amplifier. It feeds a direct writing recorder.

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## Analytical Instrumentation Questions and Answers – Liquid Chromatograph- Mass Spectrometer

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Liquid Chromatograph- Mass Spectrometer”.

1. Introduction of total HPLC effluent into MS is feasible.

- a) True
- b) False

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Answer: b

Explanation: Introduction of total HPLC effluent into MS is not feasible. The simplest method is the introduction of liquid from LC to the MS ion source region.  
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2. The gas burden from conventional LC flow rates creates nearly \_\_\_\_\_ times more gas than cryo-pumped vacuum system can handle.

- a) 5
- b) 10
- c) 20
- d) 40

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Answer: c

Explanation: The gas burden from conventional LC flow rates creates nearly 20 times more gas than cryo-pumped vacuum system can handle.

3. Which of the following should be in a position to split the effluent?

- a) Interface
- b) Ion source
- c) Makeup gas
- d) Microbore

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Answer: a

Explanation: Interface should be in a position to split the effluent. LC-MS is a very advantageous method.

4. Which of the following is the most commonly used interface?

- a) Nebulizer
- b) Chopper
- c) Filter
- d) Vapourising chamber

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Answer: a

Explanation: Nebulizer is the most commonly used interface. The nebulizer gas and the make-up gas are introduced coaxially into the heated nebulization region.

5. Only \_\_\_\_\_ percent of the effluent of the liquid chromatography must be introduced in the mass spectrometer.

- a) 1-2 %
- b) 1-5 %
- c) 1-20 %
- d) 1-15 %

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Answer: b

Explanation: Only 1-5 percent of the effluent of the liquid chromatography must be introduced in the mass spectrometer. Therefore, the total effluent must be split.

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6. Which of the following is the normal nebuliser temperature used in LC mass spectrometry?

- a) 50-100°C
- b) 100-200°C
- c) 125-150°C

d) 150-200°C  
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Answer: c

Explanation: 125-150°C is the normal nebuliser temperature used in LC mass spectrometry. It is suitable for a variety of applications.

7. The ions are focussed and de-clustered through which of the following regions?

- a) Dry helium region
- b) Wet oxygen region
- c) Wet chlorine region
- d) Dry nitrogen region

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Answer: d

Explanation: The ions are focussed and de-clustered through a dry nitrogen region. It is then sent into the high vacuum analyser.

8. The ions are passed into the high vacuum analyser through which of the following?

- a) Orifice
- b) Nozzle
- c) Nebulizer
- d) Venturi tube

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Answer: a

Explanation: The ions are sent into the high vacuum analyser through an orifice. It is then mass analysed.

9. Using an interface would reduce detection limit and sensitivity.

- a) True
- b) False

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Answer: a

Explanation: The total effluent must be split. Using an interface would reduce detection limit and sensitivity.

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10. Gas burden from conventional LC flow rates is which of the following?

- a) 1ml/min of water produces 1.2 l/mm of gas
- b) 1ml/min of water produces 2.4 l/mm of gas
- c) 2ml/min of water produces 3.2 l/mm of gas
- d) 1ml/min of water produces 4.2 l/mm of gas

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Answer: a

Explanation: In LC-mass spectrometry, 1ml/min of water produces 1.2 l/mm of gas. This is the gas burden that conventional flow rates produced.

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# Analytical Instrumentation Questions and Answers – Tandem Mass Spectroscopy

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This set of Analytical Instrumentation Questions and Answers for Campus interviews focuses on "Tandem Mass Spectroscopy".

1. Tandem mass spectroscopy combines which of the following devices?

- a) Mass spectrometer and gas-solid chromatograph
- b) Mass spectrometer and gas-liquid chromatograph
- c) Mass spectrometer and gas chromatograph
- d) Mass spectrometer and mass spectrometer

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Answer: d

Explanation: Tandem mass spectroscopy combines two mass spectrometers. It is represented as MS/MS.

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2. In tandem spectroscopy, the first stage separation device is a mass spectrometer.

- a) True
- b) False

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Answer: a

Explanation: In tandem spectroscopy, the first stage separation device is a mass spectrometer. It is represented as MS/MS.

3. Which of the following is used to separate a single mass that is characteristic of a given analyte in a mixture?

- a) First mass spectrometer
- b) Second mass spectrometer
- c) Filter
- d) Precursor

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Answer: a

Explanation: First mass spectrometer is used to separate a single mass that is characteristic of a given analyte in a mixture. The single mass is known as the precursor.

4. The mass-selected ions are activated in which of the following ways that cause them to fall apart to produce product ions?

- a) Collisional activation
- b) Evaporational activation
- c) Inert gas activation
- d) Thermal activation

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Answer: a

Explanation: The mass-selected ions are activated by some means that cause them to fall apart to produce product ions. They are activated by collisional activation.

5. The final MS/MS spectrum consists only of product ions from the selected precursor.

- a) True
- b) False

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Answer: a

Explanation: The final MS/MS spectrum consists only of product ions from the selected precursor. The chemical background and other mixture components are absent.

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6. In reverse-geometry mass spectrometer which of the following precedes the electric sector?

- a) Nebulizer
- b) Orifice
- c) Magnetic sector

d) Mass spectrometer

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Answer: c

Explanation: In reverse-geometry mass spectrometer magnetic sector precedes the electric sector. Early work on MS/MS was done with reverse-geometry double focussing mass spectrometer.

7. A magnetic sector alone can be used as a mass spectrometer, with roughly \_\_\_\_\_ resolution.

- a) Low
- b) High
- c) Unit
- d) Infinite

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Answer: c

Explanation: A magnetic sector alone can be used as a mass spectrometer, with roughly unit resolution. Early work on MS/MS was done with reverse-geometry double focussing mass spectrometer.

8. What does the acronym 'MIKES' stand for?

- a) Mass-analysed ion kinetic energy spectrometer
- b) Mass-based induced kinetic energy spectrometer
- c) Mass invasive kinetic electric spectrometer
- d) Mass-analyser in a kinetic energy-type spectrometer

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Answer: a

Explanation: 'MIKES' stands for mass-analysed ion kinetic energy spectrometer. It is related to spectrometers having magnetic field sectors.

9. In MIKES experiments which of the following are measured?

- a) Product ions
- b) Product ion kinetic energies
- c) Product ions mass to charge ratio
- d) Product ions masses

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Answer: b

Explanation: In MIKES experiments, mass to charge ratios are not measured. Product ion kinetic energies are measured in these experiments.

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10. All ions with the same number of charges will have \_\_\_\_\_

- a) Same kinetic energy
- b) Different kinetic energies
- c) Same mass
- d) Different mass

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Answer: a

Explanation: All ions with the same number of charges will have the same kinetic energy. It is assumed that all ions have a single charge.

11. A tandem mass spectrometer has which of the following analysers?

- a) Time of flight mass analyser
- b) Magnetic deflection analyser
- c) Radiofrequency analyser
- d) Quadrupole analyser

[View Answer](#)

Answer: a

Explanation: A tandem mass spectrometer has a filter. The filter is followed by a time of flight mass analyser.

12. Which of the following filters are used in tandem spectrometer?

- a) Quadrupole mass filter
- b) Low energy filter
- c) High energy filter
- d) Time of flight mass filter

[View Answer](#)

Answer: a

Explanation: A tandem mass spectrometer has a quadrupole mass filter. The filter is followed by an analyser.

13. B/E scan is which of the following scans?

- a) Product ion scan
- b) Precursor ion scan
- c) Mass scan
- d) Charge scan

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Answer: a

Explanation: B/E ratio can be chosen to select ions with a given velocity. It is a product ion scan.  
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14. Which of the following is located in the region between two analysers?

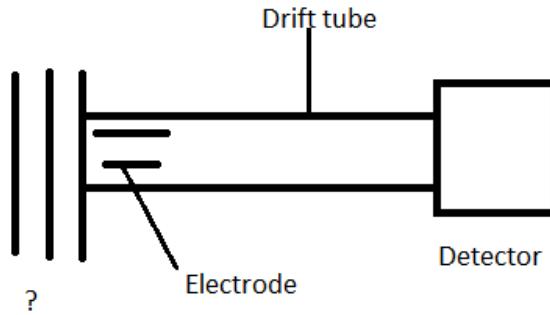
- a) Nebuliser
- b) Collision cell
- c) Filter
- d) Vacuum chamber

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Answer: b

Explanation: Collision cell is located in the region between two analysers. Low energy parent ions are mass analysed.

15. Given below is the diagram of the drift tube of a tandem quadrupole/time of flight instrument. Identify the unmarked component.



- a) Nebuliser
- b) Filter
- c) Chopper
- d) Acceleration lens

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Answer: d

Explanation: The unmarked component is acceleration lens. A collision cell is located before the acceleration lens.

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# Analytical Instrumentation Questions and Answers – Surface Spectroscopic Techniques

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Surface Spectroscopic Techniques”.

1. Surface is usually more than \_\_\_\_\_ atomic layer deep and is a region of \_\_\_\_\_ atomic potentials.

- a) One, uniform
- b) One, non-uniform
- c) Two, uniform
- d) Two, non-uniform

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Answer: b

Explanation: Surface is more than one atomic layer deep and is a region of non-uniform atomic potentials. The outermost layer of atoms is called a surface.

2. Surface analysis can provide information that classic methods like microscopic cannot.

- a) True
- b) False

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Answer: a

Explanation: Surface analysis can provide information that classic methods like microscopic cannot. It is better than reflectivity, adsorption isotherms, etc.

3. In surface spectrometer, which of the following beam is analysed?

- a) Reflected beam
- b) Absorbed beam
- c) Refracted beam
- d) Incident beam

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Answer: a

Explanation: When a beam is focussed on a surface, one beam enters the material and a second beam is reflected. The reflected beam is analysed.

4. Which of the following is a type of electron spectroscopy?

- a) MIKES
- b) Auger spectroscopy
- c) Secondary ion mass spectroscopy
- d) Ion scattering spectroscopy

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Answer: b

Explanation: Auger spectroscopy is a type of electron spectroscopy. Electron spectroscopy for chemical analysis is also a type of electron spectroscopy.

5. Surface analysis cannot provide any chemical information directly.

- a) True
- b) False

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Answer: b

Explanation: Surface analysis can provide chemical information. Electron and ion spectroscopic techniques are types of surface analysis.

6. Which of the following is also known as X-ray photoelectron spectroscopy?

- a) Auger electron spectroscopy
- b) Electron impact spectroscopy
- c) Electron spectroscopy for chemical analysis
- d) Secondary ion mass spectroscopy

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Answer: c

Explanation: Electron spectroscopy for chemical analysis is also known as X-ray photoelectron spectroscopy. It is an effective technique for detecting the elements.

7. Which of the following methods utilizes the emission of low energy electrons in a process?

- a) Auger electron spectroscopy

- b) Electron impact spectroscopy
- c) Electron spectroscopy for chemical analysis
- d) Secondary ion mass spectroscopy

[View Answer](#)

Answer: a

Explanation: Auger electron spectroscopy utilizes the emission of low energy electrons in auger process. It is one of the commonly employed techniques.

8. Which of the following is the abbreviation of ESCA?

- a) Electron scattering chemical analysis
- b) Emission spectroscopy combination analysis
- c) Electron spectroscopy for chemical analysis
- d) Electron spectrum chemically analysed

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Answer: c

Explanation: The abbreviation of ESCA is Electron spectroscopy for chemical analysis. It is a type of electron spectroscopy.

9. Which of the following methods use soft X-rays to eject electrons from inner shell orbitals?

- a) Auger electron spectroscopy
- b) Electron impact spectroscopy
- c) Electron spectroscopy for chemical analysis
- d) Secondary ion mass spectroscopy

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Answer: c

Explanation: Electron spectroscopy for chemical analysis using soft X-rays to eject electrons from inner shell orbitals. It is a type of electron spectroscopy.  
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10. Which of the following is the abbreviation of SIMS?

- a) Secondary ion mass spectroscopy
- b) Spectrum ionization mass spectroscopy
- c) Scattering ions mass spectroscopy
- d) Spectral ionization mass spectroscopy

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Answer: a

Explanation: Secondary ion mass spectroscopy is the abbreviation of SIMS. It is a type of ion spectroscopy.

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# Analytical Instrumentation Questions and Answers – Electron Spectroscopy for Chemical Analysis

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Electron Spectroscopy for Chemical Analysis”.

1. The kinetic energy of the photoelectron energies is dependent on \_\_\_\_\_ of the atom, which makes XPS useful to identify the oxide state.

- a) Mass
- b) Charge
- c) Chemical environment
- d) Volume

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Answer: c

Explanation: The kinetic energy of the photoelectron energies is dependent on the chemical environment of the atom, which makes XPS useful to identify the oxide state. It also helps to identify the ligands of the atom.

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2. Ion etching techniques provides the depth profiling from the surface.

- a) True
- b) False

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Answer: a

Explanation: Ion etching techniques provides the depth profiling from the surface. Binding energy can also be used.

3. Electron spectroscopy is based on the ionization phenomenon.

- a) True
- b) False

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Answer: a

Explanation: Electron spectroscopy is based on the ionization phenomenon. It can be ionization of photon or electron.

4. The kinetic energy of the ejected photoelectron is dependent upon the energy of which of the following?

- a) Ions around
- b) Photons around
- c) Material
- d) Impinging photon

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Answer: d

Explanation: The kinetic energy of the ejected photoelectron is dependent upon the energy of an impinging photon. A free electron is ejected.

5. ESCA gives sufficient chemical information up to a depth about \_\_\_\_\_ armstrong in metals.

- a) 5-20
- b) 15-40
- c) 40-100
- d) 100-200

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Answer: a

Explanation: ESCA gives sufficient chemical information up to a depth about 5-20 armstrong in metals. ESCA is also known as X-ray photoelectron spectroscopy.

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6. ESCA gives sufficient chemical information up to a depth about \_\_\_\_\_ armstrong in polymers.

- a) 5-20
- b) 15-40
- c) 40-100
- d) 100-200

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Answer: c

Explanation: ESCA gives sufficient chemical information up to a depth about 40-100 armstrong in polymers. ESCA is also known as X-ray photoelectron spectroscopy.

7. ESCA gives sufficient chemical information up to a depth about \_\_\_\_\_ armstrong in oxide.

- a) 5-20
- b) 15-40
- c) 40-100
- d) 100-200

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Answer: b

Explanation: ESCA gives sufficient chemical information up to a depth about 15-40 armstrong in oxide. ESCA is also known as X-ray photoelectron spectroscopy.

8. ESCA can identify elements in the periodic table above which of the following?

- a) Carbon
- b) Boron
- c) Helium
- d) Potassium

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Answer: c

Explanation: ESCA can identify elements in the periodic table above helium. Adjacent elements are clearly distinguished.

9. Discrete electrons cannot be observed in electron ionization of an atom due to which of the following reasons?

- a) Environmental disturbances
- b) Same mass
- c) Same charge
- d) Electron- electron interaction

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Answer: d

Explanation: Discrete electrons cannot be observed in electron ionization of an atom because of electron-electron interaction. Therefore, ESCA cannot be observed when using electron ionization.

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10. ESCA focusses on which of the following information?

- a) Mass of the electron
- b) Charge of the electron
- c) Binding energy of the electron
- d) Mass of atoms

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Answer: c

Explanation: ESCA focusses on binding energy of the electrons. It focusses on the binding energy which the electrons had before they left the atom.

11. In the spectrum, two main peaks at \_\_\_\_\_ and \_\_\_\_\_ are observed.

- a) 284.6, 532.5
- b) 248.6, 523.5
- c) 264.8, 535.2
- d) 246.8, 553.2

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Answer: a

Explanation: In the spectrum, two main peaks at 284.6 and 532.5 are observed. The unit for counting energy is electron-volt.

12. 284.6 eV matches which of the following specific atom type?

- a) Carbon
  - b) Oxygen
  - c) Nitrogen
  - d) Argon
- [View Answer](#)

Answer: a

Explanation: Each energy matches a specific atom type. 284.6 eV matches carbon.

13. 532.5 eV matches which of the following specific atom type?

- a) Carbon
- b) Oxygen
- c) Nitrogen
- d) Argon

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Answer: b

Explanation: Each energy matches a specific atom type. 532.5 eV matches carbon.

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14. By studying which of the following can we determine if the surface corresponds to C-O or C=O chemical form?

- a) Mass of the electron
- b) Energy of the carbon peak

- c) Binding energy
- d) Charge of electron

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Answer: b

Explanation: By studying energy of the carbon peak it can be determined if the surface corresponds to C-O or C=O chemical form. Thus, the specimen chemical composition can be obtained.

15. Which of the following is the detection limit of ESCA?

- a) 0.1% monolayer
- b) 0.5% monolayer
- c) 1% monolayer
- d) 2% monolayer

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Answer: a

Explanation: The detection limit of ESCA is 0.1% monolayer. It has no x-y resolution.

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## Analytical Instrumentation Questions and Answers – Auger Electron Spectroscopy

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Auger Electron Spectroscopy”.

1. The characterisation of auger spectroscopy can be achieved up to which of the following depths?

- a) 1 nm
- b) 2 nm
- c) 4 nm

d) 8 nm  
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Answer: a

Explanation: The characterisation of auger spectroscopy can be achieved up to a depth of 1nm. Best instruments can characterise few nm.  
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2. Auger electron spectroscopy can be used for surface chemical analysis in a way similar to which of the following?

- a) ESCA
- b) SIMS
- c) ISS
- d) Ion spectroscopy

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Answer: a

Explanation: Auger electron spectroscopy can be used for surface chemical analysis in a way similar to ESCA. ESCA is also known as X-ray photoelectron spectroscopy.

3. AES is limited when it comes to very high resolution studies.

- a) True
- b) False

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Answer: a

Explanation: AES is limited when it comes to very high resolution studies. It is very characteristic for various elements.

4. Qualitative chemical analysis is very often performed using which of the following?

- a) ESCA
- b) SIMS
- c) AES
- d) Ion spectroscopy

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Answer: c

Explanation: Qualitative chemical analysis is very often performed using AES. Auger nomenclature follows the old x-ray notation.

5. Electron ionization can produce which of the following?

- a) ESCA electron
- b) Auger electron
- c) Ion
- d) Photon

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Answer: b

Explanation: Electron ionization can produce Auger electron. Photo-ionisation can also produce Auger electron.  
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6. Electron ionisation can produce ESCA electrons.

- a) True
- b) False

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Answer: b

Explanation: Electron ionisation cannot produce ESCA electrons. It can produce only Auger electrons.

7. Which of the following is an Auger transition starting from a hole in 1s levels which would be filled up from the 2p level?

- a) KLM transition
- b) KLL transition
- c) LMN transition
- d) LLM transition

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Answer: b

Explanation: KLL transition is an Auger transition starting from a hole in 1s levels which would be filled up from the 2p level. 2p electron would also be emitted.

8. In ESCA process, the photon ejects which of the following?

- a) 1s electron
- b) 1p electron
- c) 2s electron
- d) 2p electron

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Answer: a

Explanation: In ESCA process, the photon ejects 1s electron. For X-ray, an electron drops from the 2p orbit.

9. In Auger process, an electron drops to fill which of the following?

- a) 1s hole
- b) 1p hole
- c) 2s hole
- d) 2p hole

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Answer: a

Explanation: In Auger process, an electron drops to fill 1s hole. It expels a 2p electron.

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10. Auger electron spectroscopy involves the irradiation of the surface to be analysed with a beam of electrons of energy in the \_\_\_\_\_ range.

- a) 1-2 KeV
- b) 2-4 KeV
- c) 4-8 KeV
- d) 1-8 KeV

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Answer: a

Explanation: Auger electron spectroscopy involves the irradiation of the surface to be analysed with a beam of electrons of energy in the 1-2 KeV range. Auger and X-ray emission are competitive processes.

11. In Auger spectroscopy, beam currents are typically \_\_\_\_\_ in a beam of diameter 0.5mm.

- a) 5-10  $\mu$ A
- b) 5-20  $\mu$ A
- c) 5-30  $\mu$ A
- d) 5-50  $\mu$ A

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Answer: d

Explanation: In Auger spectroscopy, beam currents are typically 5-50  $\mu$ A in a beam of diameter 0.5mm. Auger and X-ray emission are competitive processes.

12. Which of the following is the detection limit of Auger Electron Spectroscopy?

- a) 0.1% monolayer
- b) 0.5% monolayer
- c) 1% monolayer
- d) 2% monolayer

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Answer: b

Explanation: The detection limit of AES is 0.5% monolayer. It has 0.5 $\mu$  x-y resolution.

13. Which of the following denotes the sample destruction that occurs in Auger electron spectroscopy?

- a) None in 95% of sample
- b) None in 99% of sample
- c) None in 100% of sample
- d) Frequent

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Answer: d

Explanation: Frequent sample destruction occurs in Auger electron spectroscopy. It is bad for organics.

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14. How is the specificity of Auger electron spectroscopy?

- a) Very bad
- b) Bad
- c) Good
- d) Very good

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Answer: c

Explanation: The specificity of Auger electron spectroscopy is good. ESCA has very good specificity.

15. AES is more sensitive than XPS because of which of the following factors?

- a) Binding energies of electrons
- b) Kinetic energies of electrons
- c) Mass of electrons
- d) Mass to charge ratio of electrons

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Answer: b

Explanation: AES is more sensitive than XPS because of the difference in kinetic energies of electrons. Ion etching is sometimes necessary for AES.

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# Analytical Instrumentation Questions and Answers – Instrumentation for Electron Spectroscopy

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This set of Analytical Instrumentation online quiz focuses on “Instrumentation for Electron Spectroscopy”.

1. A basic X-ray source includes which of the following components?

- a) Large target anode
- b) Large target cathode
- c) Small target anode
- d) Small target cathode

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Answer: a

Explanation: A basic X-ray source includes a large target anode. It also has a heating element.

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2. The anode is held at \_\_\_\_\_ positive potential and the filament is held at \_\_\_\_\_ potential.

- a) High, ground
- b) Ground, high
- c) Low, high
- d) High, low

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Answer: a

Explanation: The anode is held at high potential and the filament is held at ground potential. Electrons are accelerated from the filament.

3. Which of the following is one of the most commonly used anode material?

- a) Carbon
- b) Tungsten
- c) Magnesium
- d) Cesium

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Answer: c

Explanation: Magnesium is one of the most commonly used anode material. Aluminium is also commonly used.

4. Which is the most intense line in the X-ray spectrum?

- a)  $K\alpha_1$
- b)  $K\alpha_2$
- c)  $K\alpha_{12}$
- d)  $K\alpha_{22}$

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Answer: c

Explanation:  $K\alpha_{12}$  is the most intense line in the X-ray spectrum. Different lines have specific energies.

5. Which of the following must be used with the X-ray source to have high energy resolution?

- a) Chopper
- b) Vacuum chamber
- c) Accelerator
- d) Monochromator

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Answer: d

Explanation: Monochromator must be used with the X-ray source to have high energy resolution. It will also remove the satellite lines.  
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6. Magnetic deflection energy analysers are effective than electrostatic types.

- a) True
- b) False

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Answer: a

Explanation: Magnetic deflection energy analysers are effective than electrostatic types. It is less convenient to design and use.

7. Double-pass cylindrical mirror energy analyser has how many mirrors?

- a) One
- b) Two
- c) Three
- d) Four

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Answer: b

Explanation: Double-pass cylindrical mirror energy analyser has two mirrors. It is commonly used in electron spectroscopy.

8. In spherical sector analyser, \_\_\_\_\_ is detected and plotted as a function of energy.

- a) Mass
- b) Charge
- c) Number of electrons striking the detector
- d) Mass to charge ratio

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Answer: c

Explanation: In spherical sector analyser, the number of electrons striking the detector is detected and plotted as a function of energy. It is detected for a constant potential.

9. Which of the following is the most commonly used detector in ESCA and AES?

- a) Electron multiplier
- b) Dynodes
- c) Photovoltaic cell
- d) Photomultiplier

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Answer: a

Explanation: Electron multiplier is the most commonly used detectors in ESCA and AES. It is similar to photomultiplier.  
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10. Electron detector has a \_\_\_\_\_ doped glass tube with a secondary semiconducting coating.

- a) Quartz
- b) Silica
- c) Lead
- d) Cesium

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Answer: c

Explanation: Electron detector has a lead doped glass tube with a secondary semiconducting coating. It has a high secondary electron shield.

11. The output of the multiplier is fed to which of the following immediately?

- a) Pulse amplifier discriminator

- b) DAC
  - c) ADC
  - d) Multichannel analyser
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Answer: a  
Explanation: The output of the multiplier is fed to pulse amplifier discriminator. It is then fed to a multichannel analyser.

12. Which of the following is the ideal vacuum for electron spectrometers?

- a)  $10^{-6}$  torr
- b)  $10^{-7}$  torr
- c)  $10^{-8}$  torr
- d)  $10^{-9}$  torr

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Answer: a

Explanation:  $10^{-6}$  torr is the ideal vacuum for electron spectrometers. Vacuum below  $10^{-6}$  torr can also be used.

13. Which of the following is the most commonly used magnetic shielding?

- a) Helmholtz coils
- b) Ferro-magnetic shielding
- c) Faraday shield
- d) Magnetometer probe

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Answer: b

Explanation: Ferro-magnetic shielding is the most commonly used magnetic shielding. Helmholtz coil can be used as alternative.  
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14. Charging effect can be suppressed by supplying flood of electrons having which of the following?

- a) Uniform low energy
- b) Uniform low mass
- c) Uniform high energy
- d) Uniform high mass

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Answer: a

Explanation: Charging effect can be suppressed by supplying flood of electrons having uniform low energy. It also results in attainment of additional useful information.

15. Synchrotron radiation has several advantages over conventional radiation.

- a) True
- b) False

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Answer: a

Explanation: Synchrotron radiation has several advantages over conventional radiation. The resolution is very high.

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## Analytical Instrumentation Questions and Answers – Ion Spectroscopy

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Ion Spectroscopy”.

1. In Ion spectroscopy, the primary ion is usually which of the following?

- a) Inert gas ion
- b) Halogen ion
- c) Oxygen group gas ion
- d) Hydrogen

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Answer: a

Explanation: In Ion spectroscopy, the primary ion is usually an inert gas ion. When primary ion having particular kinetic energy is incident on a surface certain phenomena can occur.

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2. The kinetic energy of the primary ion should be in which of the following range?

- a) 0.1-4 keV
- b) 0.2-1 keV
- c) 0.4-2 keV
- d) 0.3-5 keV

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Answer: d

Explanation: The kinetic energy of the primary ion should be 0.3-5 keV. These primary ions are made incident on the surface.

3. If the primary ion is elastically scattered, the kinetic energy of the reflected primary ion will depend on which of the following?

- a) Charge of the primary ion
- b) Charge of the surface ion
- c) Mass of the surface ion
- d) Number of surface ions

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Answer: c

Explanation: If the primary ion is elastically scattered, the kinetic energy of the reflected primary ion will depend on the mass of the surface ion. The reflected ion is measured by ISS.

4. Which of the following causes the phenomena of sputtering?

- a) Primary ion gets embedded in the solid
- b) Primary ion is elastically scattered
- c) Primary ion is reflected
- d) Primary ion is refracted

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Answer: a

Explanation: Primary ion may penetrate through a few layers of the surface and get embedded in the solid. This causes scattering.

5. The fragments formed during sputtering can be either neutral atoms or ions. The ions can only be positive.

- a) True
- b) False

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Answer: b

Explanation: The fragments formed during sputtering can be either neutral atoms or ions. The ions can be positive or negative.

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6. Which of the following is the energy range of ISS?

- a) 1 keV
- b) 2 keV
- c) 4 keV
- d) 8 keV

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Answer: a

Explanation: The energy range of the ISS is 1 keV. ISS stands for ion scattering spectroscopy.

7. Which of the following is the spectral range of SIMS?

- a) 0-10 amu
- b) 0-100 amu
- c) 0-500 amu
- d) 0-1000 amu

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Answer: c

Explanation: The spectral range of SIMS is 0-500 amu. SIMS stands for secondary ion mass spectroscopy.

8. Both ISS and SIMS have depth profiling capability.

- a) True
- b) False

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Answer: a

Explanation: Both ISS and SIMS have depth profiling capability. ISS is slow in depth profiling but SIMS is rapid.

9. Which of the following is denotes the absolute quantitative analysis of SIMS?

- a) 30%
- b) 70%
- c) 50%
- d) Not possible

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Answer: d

Explanation: Absolute quantitative analysis is not possible in SIMS. It is possible in ISS.

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10. Which of the following is the amount of matrix effect that occurs in SIMS?

- a) Very low
- b) Low
- c) Some
- d) Severe

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Answer: d

Explanation: Severe matrix effects occur in SIMS. Some matrix effects occur in ISS.

11. Which of the following is the x-y resolution of ISS?

- a) 1  $\mu$
- b) 10  $\mu$
- c) 100  $\mu$
- d) 1000  $\mu$

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Answer: c

Explanation: The x-y resolution of ISS is 100  $\mu$ . It has a poor x-y resolution.

12. Which of the following is the x-y resolution of SIMS?

- a) 1  $\mu$
- b) 10  $\mu$
- c) 100  $\mu$
- d) 1000  $\mu$

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Answer: a

Explanation: The x-y resolution of SIMS is 1  $\mu$ . It has this resolution when used with ion microprobe.

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# Analytical Instrumentation Questions and Answers – Instrumentation of Ion Spectroscopy

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Instrumentation of Ion Spectroscopy”.

1. In ion spectroscopy, the positive ions are focussed on the sample at which of the following angles?

- a) 20°
- b) 30°
- c) 45°
- d) 90°

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Answer: c

Explanation: In ion spectroscopy, the positive ions are focussed on the sample at 45°. Ions are formed by bombardment.

2. Only those electrons which are in a selected small solid angle are received in the \_\_\_\_\_ electrostatic analyser.

- a) 100°
- b) 127°
- c) 180°
- d) 263°

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Answer: b

Explanation: Only those electrons which are in a selected small solid angle are received in the 127° electrostatic analyser. Ions are scattered in all directions.

3. Which of the following can be used as the detector in ion spectroscopy?

- a) Faraday cup collector
- b) Channel electron multiplier
- c) Micro-channel plate
- d) Flame ionization detector

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Answer: b  
Explanation: Channel electron multiplier can be used as the detector in ion spectroscopy. Solid state detector can also be used.

4. In order to obtain ISS spectra, the backscattered primary ions are sampled by which of the following?

- a) Faraday cup analyser
- b) Photographic analyser
- c) Micro-channel analyser
- d) Cylindrical mirror analyser

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Answer: d

Explanation: In order to obtain ISS spectra, the backscattered primary ions are sampled by cylindrical mirror analyser. Their kinetic energies are then measured.

5. Which of the following is the energy after collision with a surface atom for a scattering angle of  $90^\circ$  when  $E_0$  is the energy of the incident ion,  $M_1$  is the mass of the incident ion and  $M_2$  is the mass of the target surface?

- a)  $E_0(M_2-M_1)/(M_2+M_1)$
- b)  $E_0(M_2+M_1)/(M_2-M_1)$
- c)  $E_0(M_2 \times M_1)/(M_2+M_1)$
- d)  $E_0(M_2-M_1)/(M_2 \times M_1)$

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Answer: a

Explanation:  $E_0(M_2-M_1)/(M_2+M_1)$  is the energy after collision with a surface atom for a scattering angle of  $90^\circ$ . But, this is valid only when  $M_1 < M_2$ .

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6. It is advantageous to use ions from a variety of gases.

- a) True
- b) False

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Answer: a

Explanation: It is advantageous to use ions from a variety of gases. Few gases are chosen to avoid side effects.

7. Which of the following gases is not often used in ion spectroscopy?

- a) Helium
- b) Argon
- c) Nitrogen
- d) Neon

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Answer: c

Explanation: Helium, argon and inert gases are usually chosen for ion spectroscopy. These gases are chosen to avoid side effects.

8. ISS is sensitive to every element heavier than which of the following?

- a) Helium
- b) Hydrogen
- c) Nitrogen
- d) Neon

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Answer: a

Explanation: ISS is sensitive to every element heavier than helium. The lightest isotope used as a primary ion is that of helium.

9. Which of the following is the lightest isotope used as a primary ion?

- a) He
- b)  $^2\text{He}$
- c)  $^3\text{He}$
- d)  $^3\text{H}$

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Answer: c

Explanation:  $^3\text{He}$  is the lightest isotope used as a primary ion. Though hydrogen is lightest it is not used.

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10. The specificity will vary depending on the scattering gas used.

- a) True
- b) False

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Answer: a

Explanation: The specificity will vary depending on the scattering gas used. Only a few gases are preferred to avoid side effects.

11. ISS is less sensitive than which of the following?

- a) SIMS

- b) Auger
- c) ESCA
- d) AES

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Answer: a

Explanation: ISS is less sensitive than SIMS. It is more sensitive than Auger or ESCA.

12. Which of the following is the detection limit of ISS for monolayer?

- a)  $10^{-1}\%$
- b)  $10^{-2}\%$
- c)  $10^{-3}\%$
- d)  $10^{-4}\%$

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Answer: c

Explanation:  $10^{-3}\%$  of the monolayer is the detection limit of ISS. It can be effectively used for depth profiling.

13. After passing through the pre-filter, ions are passed through which of the following?

- a) Quadrupole mass spectrometer
- b) Time of flight mass spectrometer
- c) Radiofrequency mass spectrometer
- d) Magnetic deflection mass spectrometer

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Answer: a

Explanation: After passing through the pre-filter, ions are passed through quadrupole mass spectrometer. Pre-filter is a discriminator.  
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14. Which of the following is the range of quadrupole mass spectrometer used in SIMS?

- a) 100-200 amu
- b) 200-300 amu
- c) 500-1000 amu
- d) 200-500 amu

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Answer: c

Explanation: 500-1000 amu is the range of quadrupole mass spectrometer used in SIMS. SIMS shows good specificity.

15. Which of the following is the resolution of quadrupole mass spectrometer used in SIMS?

- a) 1 amu
- b) 2 amu
- c) 5 amu
- d) 3 amu

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Answer: a

Explanation: 1 amu is the resolution of quadrupole mass spectrometer used in SIMS. SIMS shows good specificity.

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## Analytical Instrumentation Questions and Answers – Electron Spin Resonance

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This set of Analytical Instrumentation Question Bank focuses on “Electron Spin Resonance”.

1. Electron spin resonance involves detecting the detection of a physical phenomenon of \_\_\_\_\_ of electromagnetic radiation.

- a) Adsorption
- b) Absorption
- c) Radiation
- d) Reflection

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Answer: a

Explanation: Electron spin resonance uses the detection of a physical phenomenon of absorption of electromagnetic radiation. Paramagnetic species absorb EM radiation.

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2. Electron spin resonance is also known as which of the following?

- a) Electron paramagnetic resonance
- b) Electron diamagnetic resonance
- c) Electron paramagnetic reoccurrence
- d) Electron diamagnetic reoccurrence

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Answer: a

Explanation: Electron spin resonance is also known as electron paramagnetic resonance. It is a valuable research analysis tool.

3. The value of the magnetic moment is known as which of the following?

- a) Thompson magneton
- b) Bohr magneton
- c) Goldstein magneton
- d) Rutherford magneton

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Answer: b

Explanation: Electron spin resonance is based on the spin associated with the electron. There is a magnetic moment the value of which is known as Bohr magneton.

4. When a strong magnetic field is applied to the unpaired spins of an electron, the electrons will be split into two groups.

- a) True
- b) False

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Answer: a

Explanation: When a strong magnetic field is applied to the unpaired spins of an electron, the electrons will be split into two groups. Electron spin resonance is based on the spin associated with the electron.

5. When the electrons are aligned either parallel or antiparallel to the direction of the external magnetic field, the electrons will precess about the axis at a frequency that is proportional to which of the following?

- a) Applied magnetic field
- b) Electron magnetic moment
- c) Applied magnetic field and electron magnetic moment
- d) Neither applied magnetic field nor electron magnetic moment

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Answer: c

Explanation: When the electrons are aligned either parallel or antiparallel to the direction of external magnetic field, the electrons will start to precess about the axis at a frequency that is proportional to both applied magnetic field and electron magnetic moment.

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6. If a weaker radiofrequency alternating magnetic field, having the frequency of precession of the electron is applied at right angles to fixed magnetic field, which of the following occurs?

- a) Fragmentation
- b) Scattering
- c) Resonance
- d) Absorption

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Answer: c

Explanation: Resonance occurs when a weaker radiofrequency alternating magnetic field with the frequency of precession of the electron is applied at right angles to a fixed magnetic field.

7. If the population of ground state exceeds the population of the excited state a net absorption of \_\_\_\_\_ radiation takes place.

- a) Infrared
- b) Ultraviolet
- c) Microwave
- d) X-ray

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Answer: c

Explanation: If the population of ground state exceeds the population of the excited state a net absorption of microwave radiation takes place. The signal would be proportional to the population difference.

8. The population ratio can be given by which of the following laws?

- a) Bohr law
- b) Beer-Lambert law
- c) Kelvin law
- d) Boltzmann law

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Answer: d

Explanation: The population ratio can be given by Boltzmann law. 'k' is the Boltzmann constant.

9. The sensitivity of measurement is greatly enhanced by using which of the following?

- a) High magnetic field
- b) Low magnetic field
- c) High electric field
- d) Low electric field

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Answer: a

Explanation: The sensitivity of measurement is greatly enhanced by using a high magnetic field. Low magnetic field reduces sensitivity.

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10. ESR sensitivity increases with \_\_\_\_\_ temperature and with \_\_\_\_\_ magnetic field strength.

- a) Increasing, increasing
- b) Increasing, decreasing
- c) Decreasing, increasing
- d) Decreasing, decreasing

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Answer: c

Explanation: ESR sensitivity increases with decreasing temperature and with increasing magnetic field strength. ESR sensitivity means net absorption.

11. ESR is remarkably sensitive when compared with NMR.

- a) True
- b) False

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Answer: a

Explanation: ESR is remarkably sensitive when compared with NMR. NMR stands for Nuclear Magnetic Resonance spectroscopy.

12. Reflex klystron is used in which of the following frequency ranges?

- a) 1000 to 2000 MHz
- b) 1000 to 10000 MHz
- c) 1000 to 15000 MHz
- d) 1000 to 20000 MHz

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Answer: d

Explanation: Reflex klystron is used in the frequency range of 1000 to 20000 MHz. It is a low power device.

13. Under ideal conditions, a commercial X-band spectrometer can detect of the order of which of the following number of spins at room temperature?

- a)  $10^1$
- b)  $10^5$
- c)  $10^{10}$
- d)  $10^{12}$

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Answer: d

Explanation: Under ideal conditions, a X-band spectrometer is capable of detecting of the order of  $10^{12}$  spins at room temperature. ESR is very sensitive.

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14. Waveguides look like \_\_\_\_\_ cross-section pipes with dimensions of the order of the wavelength to be transmitted.

- a) Triangular
- b) Circular
- c) Rectangular
- d) Square

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Answer: c

Explanation: Waveguides look like rectangular cross-section pipes with dimensions of the order of the wavelength to be transmitted. Waveguides cannot be too small or too large.

15. Klystron can generate power in which of the following ranges?

- a) 10 – 100 mW
- b) 10 – 200 mW
- c) 10 – 500 mW
- d) 100 – 400 mW

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Answer: c

Explanation: Klystron can generate power in the range of 10-500 mW. It is a low power device.

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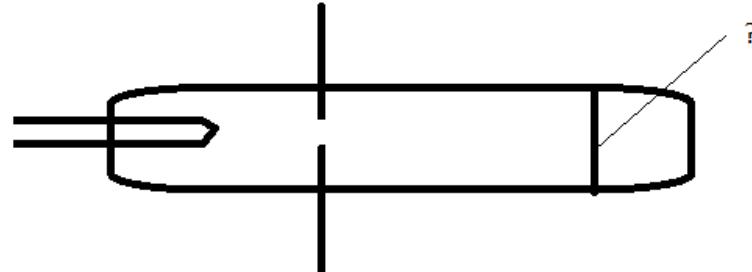
# Analytical Instrumentation Questions and Answers – Basic ESR Spectrometer

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Basic ESR Spectrometer”.

1. Given below is the diagram of Klystron tube. Identify the component.



- a) Cathode
- b) Anode
- c) Grid
- d) Reflector electrode

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Answer: d

Explanation: The component is the reflector electrode. Cathode is on the left side and anode is in the middle.

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2. Microwave frequency can be tuned over a small range by adjusting the distance between which of the following?

- a) Cathode and anode
- b) Anode and the reflector
- c) Cathode and the reflector
- d) Cathode and grid

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Answer: c

Explanation: Microwave frequency can be tuned over a small range by adjusting the distance between anode and the reflector. Reflector voltage can also be adjusted.

3. Microwaves are generated by \_\_\_\_\_ and the power level is adjusted with the \_\_\_\_\_

- a) Triode, rectifier
- b) Pentode, attenuator
- c) Klystron tube, attenuator
- d) Diode, rectifier

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Answer: c

Explanation: Microwaves are generated by klystron tube and the power level is adjusted with the attenuator. Klystron tube is a low power device.

4. Which of the following is also known as reflex oscillator?

- a) Triode
- b) Pentode
- c) Special tube
- d) Klystron tube

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Answer: d

Explanation: Klystron tube is also known as the reflex oscillator. It is a low power device.

5. Microwaves reflected back from the cavity are routed to which of the following?

- a) Attenuator
- b) Klystron
- c) Load
- d) Diode detector

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Answer: d

Explanation: Microwaves reflected back from the cavity are routed to diode detector. Power reflected from diode is absorbed by a load.

6. Which of the following routes are the microwaves entering from the klystron towards the cavity?

- a) Oscillator
- b) Attenuator
- c) Circulator
- d) Reflector

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Answer: c

Explanation: Circulator routes the microwaves entering from the klystron towards the cavity. The sample is mounted in the cavity.

7. By introducing which of the following, signal-to-noise ratio can be improved?

- a) Small amplitude field modulation
- b) Large amplitude field modulation
- c) Small amplitude field attenuation
- d) Large amplitude field attenuation

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Answer: a

Explanation: By introducing small amplitude field modulation, signal-to-noise ratio can be improved. This is because the previous DC measurement is too noisy.

8. Which of the following is adjusted as a fine control for frequency tuning?

- a) Cathode
- b) Anode
- c) Reflector voltage
- d) Grid

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Answer: c

Explanation: Reflector voltage is adjusted as a fine control for frequency tuning. Distance is the coarse frequency adjustment.

9. In basic ESR spectrometer, the cavity length is adjustable.

- a) True
- b) False

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Answer: b

Explanation: In basic ESR spectrometer, the cavity length is not adjustable. It is of one wavelength.

10. The cavity resonant frequency should be equal to which of the following?

- a) Frequency of electric field
- b) Klystron frequency
- c) Frequency of magnetic field
- d) Mechanical frequency

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Answer: b

Explanation: The cavity resonant frequency should be equal to klystron frequency. It must be tuned in this manner.

11. When klystron frequency is close to the cavity resonant frequency, much less power is reflected from the cavity to the diode.

- a) True
- b) False

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Answer: a

Explanation: When klystron frequency is close to the cavity resonant frequency, much less power is reflected from the cavity to the diode. It results in a dip in a power mode.

12. From which of the following are electrons emitted in the klystron tube?

- a) Cathode
- b) Anode
- c) Grid
- d) Reflector electrode

[View Answer](#)

Answer: a

Explanation: The electrons are emitted by the cathode in the klystron tube. The cathode is heated.

13. Which of the following is the operating frequency of the ESR spectrometer?

- a) 1.7 to 3.4 GHz
- b) 1.5 to 4.2 GHz
- c) 3.2 to 5.4 GHz
- d) 8.8 to 9.6 GHz

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Answer: d

Explanation: The operating frequency of the ESR spectrometer is 8.8 to 9.6 GHz. It is an important parameter.  
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14. At which of the following frequencies is the magnetic field at the sample modulated?

- a) 1 kHz
- b) 10 kHz
- c) 100 kHz
- d) 1000 kHz

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Answer: c

Explanation: The magnetic field at the sample is modulated at 100 kHz. The magnetic field is kept at a maximum.

15. The output of the klystron does not pass through which of the following?

- a) Isolator
- b) Reflector
- c) Power leveller
- d) Directional coupler

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Answer: b

Explanation: The reflector is inside the klystron tube. The output passes through the other three components.

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## Analytical Instrumentation Questions and Answers – Instrumentation of ESR Spectrometer

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Instrumentation of ESR Spectrometer”.

1. Which of the following is used as detector crystal in ESR spectrometer?

- a) Silicon rectifier
- b) Silicon tungsten rectifier
- c) Silicon boron rectifier
- d) Silicon quartz rectifier

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Answer: b

Explanation: Silicon tungsten rectifier is used as detector crystal in ESR spectrometer. This is the commonly used detector.  
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2. After detection, the resulting signal will have which of the following frequencies?

- a) 1 kHz
- b) 10 kHz
- c) 100 kHz
- d) 1000 kHz

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Answer: c

Explanation: After detection, the resulting signal will have 100 kHz. It contains ESR information.

3. Which of the following is the modulation amplitude range of ESR spectrometer?

- a) 1mG to 10G
- b) 2mG to 15G
- c) 3mG to 20G
- d) 5mG to 40G

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Answer: d

Explanation: 5mG to 40G is the modulation amplitude range of ESR spectrometer. It is applied in steps.

4. In which of the following ranges will the receiver time constant of the ESR spectrometer lie?

- a) 0 to 10 s
- b) 0.3 to 1 s
- c) 0.03 to 10 s
- d) 0.003 to 100 s

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Answer: d

Explanation: The receiver time constant of the ESR spectrometer lies from 0.003 to 100 s. It is one of the important parameters of ESR spectrometer.

5. Which of the following is the oscilloscope field width of the ESR spectrometer?

- a) 0.2 to 40 G
- b) 0.1 to 20 G
- c) 0 to 10 G
- d) 0.01 to 20 G

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Answer: a

Explanation: The oscilloscope field width of the ESR spectrometer lies between 0.2 to 40 G. it is one of the important parameters.  
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6. The magnet used in ESR spectrometer provides a magnetic field which can be varied from \_\_\_\_\_ to \_\_\_\_\_

- a) 20 m gauss, 100 m gauss
- b) 200 m gauss, 20 k gauss
- c) 20 m gauss, 20 k gauss
- d) 100 m gauss, 10 k gauss

[View Answer](#)

Answer: b

Explanation: The magnet used in ESR spectrometer provides a magnetic field which can be varied from 200 m gauss to 20 k gauss. It is calibrated in steps.

7. Which of the following sensor is used in ESR spectrometer?

- a) Hall-effect sensor
- b) Load cell
- c) Strain gauge
- d) Bourdon gauge

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Answer: a

Explanation: Hall-effect sensor is used in ESR spectrometer. It is given as an input to the summation circuit.

8. Which of the following oscillator is used as 1230 Hz oscillator?

- a) Hartley oscillator
- b) Crystal oscillator
- c) RC oscillator

d) Wien bridge oscillator  
View Answer

Answer: d

Explanation: Wien bridge oscillator is used as 1230 Hz oscillator. The output level is internally regulated.

9. What does AFC stand for?

- a) Auto frequency correct
- b) Automated frequency correct
- c) Automatic frequency control
- d) Automatic frequency circuit

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Answer: c

Explanation: AFC stands for automatic frequency control. A 70 kHz AFC is used.  
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10. Klystron requires \_\_\_\_\_ for the klystron beam and up to \_\_\_\_\_ for the klystron reflector.

- a) +400 V, -730 V
- b) +650 V, -400 V
- c) +200 V, -530 V
- d) +180 V, -270 V

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Answer: b

Explanation: Klystron requires +650 V for the klystron beam and up to -400 V for the klystron reflector. Klystron is also known as reflex oscillator.

11. The klystron body is insulated from ground by an insulating gas casket.

- a) True
- b) False

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Answer: a

Explanation: The klystron body is insulated from ground by an insulating gas casket. It is placed between klystron flange and water cooling flange.

12. The 100 kHz oscillator acts as which of the following?

- a) Transmitter
- b) Receiver
- c) Modulator
- d) Transmitter and receiver

View Answer

Answer: d

Explanation: The 100 kHz oscillator acts as the transmitter and receiver. It is crystal controlled.

13. Which of the following removes residual harmonics from the phase-detected signal?

- a) High-pass filter
- b) Low-pass filter
- c) Band-pass filter
- d) Chopper

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Answer: b

Explanation: Low-pass filter removes residual harmonics from the phase-detected signal. It removes the residual 100 kHz if any.  
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14. The oscilloscope is used to display the klystron mode.

- a) True
- b) False

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Answer: a

Explanation: The oscilloscope is used to display the klystron mode. It provides visual observation of rapidly changing signals.

15. In the sample cell, which of the following is selected to give maximum optical transmission in the UV-visible region?

- a) Tungsten
- b) Quartz
- c) Phosphor
- d) Potassium

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Answer: b

Explanation: In the sample cell, quartz is selected to give maximum optical transmission in the UV-visible region. Aqueous sample cells are specially designed.

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# Analytical Instrumentation Questions and Answers – Digital Circuits

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This set of Analytical Instrumentation Multiple Choice Questions & Answers (MCQs) focuses on “Digital Circuits”.

1. In analytical instrumentation, little circuitry is concerned with the amplification and processing of signals.

- a) True
- b) False

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Answer: b

Explanation: In analytical instrumentation, most circuitry is concerned with the amplification and processing of signals. The signals are usually in analog form.  
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2. Which of the following samples the analog signals to obtain their digital equivalent?

- a) Analog to digital converter
- b) Electronic counter
- c) Comparator
- d) Digital to analog converter

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Answer: a

Explanation: Analog to digital converter samples the analog signals to obtain their digital equivalent. There are different types of analog to digital converters.

3. Which of the following can be used to store information?

- a) Gates
- b) ADC
- c) DAC
- d) Flip-flops

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Answer: d

Explanation: Flip-flops can be used to store information. They are used in sequential circuits.

4. Which of the following is known as a nibble?

- a) 1 bit
- b) 4 bits
- c) 8 bits
- d) 16 bits

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Answer: b

Explanation: 4-bit units are known as nibbles. A byte consists of two nibbles.

5. Which of the following is the binary equivalent of the decimal number 10?

- a) 1100
- b) 1010
- c) 1011
- d) 1110

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Answer: b

Explanation: The binary equivalent of the decimal number 10 is 1010. The base of binary numbers is 2.  
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6. 1001 is a data presented on a set of binary coded decimal output lines. What would be the decimal equivalent of this number in the case of negative logic?

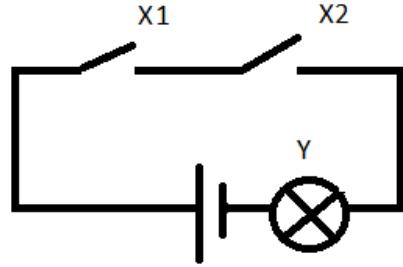
- a) 9
- b) 6
- c) 1
- d) 8

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Answer: b

Explanation: The decimal equivalent of the number 1001 in the case of negative logic is 6. In the case of positive logic, the decimal equivalent will be 9.

7. Given below is the equivalent circuit of a logic gate. Identify the logic gate.



- a) AND gate
- b) OR gate
- c) EX-OR gate
- d) NOT gate

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Answer: a

Explanation: The given circuit is the AND gate. The output of the gate is,  $Y=X_1 \cdot X_2$

8. Two switches are in parallel and are connected with a lamp and supply in series. This represents which of the following logic gate?

- a) AND gate
- b) OR gate
- c) EX-OR gate
- d) NOT gate

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Answer: b

Explanation: Two switches are in parallel and are connected with a lamp and supply in series. This forms the OR gate.

9. The output will be logic '1' only if all the inputs are '0'. Which gate must be used to execute this condition?

- a) AND gate
- b) NAND gate
- c) NOR gate
- d) EX-OR gate

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Answer: b

Explanation: The output will be logic '1' only if all the inputs are '0'. NAND gate must be used to execute this condition.

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10. INHIBIT gate is \_\_\_\_\_ gate with an inhibiting input.

- a) AND gate

- b) OR gate
  - c) EX-OR gate
  - d) NOT gate
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Answer: b

Explanation: INHIBIT gate is OR gate with an inhibiting input. The gate is useful for controlling the inputs with an inhibiting signal.

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## Analytical Instrumentation Questions and Answers – Logic Families

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This set of Analytical Instrumentation Questions and Answers for Entrance exams focuses on “Logic Families”.

1. Which of the following is the most widely employed logic family?

- a) Emitter-coupled logic
- b) Transistor-transistor logic
- c) CMOS logic family
- d) NMOS logic

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Answer: b

Explanation: Transistor-transistor logic is the most widely employed logic family. It is the most popular logic family.

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2. The basic function of TTL gate is which of the following functions?

- a) AND
  - b) OR
  - c) NOR
  - d) NAND
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Answer: d

Explanation: The basic function of TTL gate is a NAND function. It is the most popular logic family.

3. In TTL logic, the input transistor has a number of \_\_\_\_\_ equal to the desired fan-in of the circuit.

- a) Base
- b) Collect
- c) Emitter
- d) Gate

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Answer: c

Explanation: In TTL logic, the input transistor has a number of emitters equal to the desired fan-in of the circuit. This is a major advantage.

4. Which of the following is the propagation delay of TTL circuits?

- a) 1 s
- b) 1 ms
- c) 1 ns
- d) 1 ps

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Answer: c

Explanation: The propagation delay of the TTL circuit is 1 ns. It is the main characteristic of the TTL circuit.

5. The standard TTL gates are marketed as \_\_\_\_\_ series.

- a) 80
- b) 82
- c) 74
- d) 08

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Answer: c

Explanation: The standard TTL gates are marketed as 74 series. They can operate up to  $70^{\circ}\text{C}$ .  
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6. Schottky TTL logic family does not have which of the following features?

- a) Good fan-in
- b) Good fan-out
- c) High speed capability
- d) High propagation delay

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Answer: d

Explanation: Schottky TTL circuits have reduced propagation delay than normal TTL circuits. The propagation delay of 10ns is very high for some applications.

7. The logic '0' of ECL is represented as \_\_\_\_\_ V and logic '1' is represented as \_\_\_\_\_ V.

- a) 1, 1.65
- b) 0.9, 1.75
- c) 1.2, 2.35
- d) 1.9, 4.3

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Answer: b

Explanation: The logic '0' of ECL is represented as 0.9 V and logic '1' is represented as 1.75 V. ECL stands for emitter-coupled logic.

8. ECL is a way of achieving a higher speed of gate.

- a) True
- b) False

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Answer: a

Explanation: We can achieve a high speed of gate by sing ECL. ECL stands for emitter-coupled logic.

9. Which of the following is not the advantage of MOS gates?

- a) Low power dissipation
- b) Small size
- c) Good immunity to noise
- d) High switching speeds

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Answer: d

Explanation: MOS gates do not have a high switching speed. They have limited switching capability.  
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10. CMOS gates are commercially available as which of the following series?

- a) 1000
- b) 2000

c) 3000  
d) 4000  
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Answer: d  
Explanation: CMOS gates are commercially available as 4000 series. This technique is most suitable for commercial circuits.

11. The switching of MOS gates can be improved by using CMOS.  
a) True  
b) False  
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Answer: a  
Explanation: The switching of MOS gates can be improved by using CMOS. CMOS stands for complementary MOS. It is an inverter.

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## Genetic Engineering Questions and Answers – Restriction Endonuclease & Phosphatases – 1

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Restriction Endonuclease & Phosphatases – 1”.

1. The term ‘endonuclease’ refers to cutting the DNA sequence from \_\_\_\_\_  
a) only within the polynucleotide chain, not at the ends  
b) the ends of the chain  
c) anywhere in the chain  
d) exactly in the middle of the chain

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Answer: a

Explanation: The cleavage is done within the polynucleotide chain and not at the ends. The enzyme which cuts the sequence at the ends is known as exonuclease.

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2. The restriction endonuclease is having a defence mechanism in the bacterial system against foreign DNA such as viruses. But how it is able to protect its own DNA?

- a) By methylation of bacterial DNA by restriction enzyme
- b) By methylation of foreign DNA by restriction enzyme
- c) By phosphorylation of bacterial DNA by restriction enzyme
- d) By phosphorylation of foreign DNA by restriction enzyme

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Answer: a

Explanation: The bacterial DNA is methylated by restriction enzyme and thus now it is not recognized by the restriction endonuclease. Thus methylation prevents the restriction endonuclease from cutting its own DNA.

3. Even after replication, how the modified DNA remains protected?

- a) It remains protected because of conservative mode of replication
- b) It remains protected because of semi-conservative mode of replication
- c) The mode of replication has no role to play in the protection
- d) It is again modified after replication

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Answer: b

Explanation: Because of the semi-conservative mode of replication, one of the DNA strands remain methylated even after replication. One methylated strand is sufficient for providing protection against cleavage by a restriction endonuclease.

4. How many classes of restriction enzymes are there?

- a) 2
- b) 1
- c) 3
- d) 4

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Answer: c

Explanation: Three classes of restriction enzymes are there, I, II and III. These classes are having different characteristics such as the site of cleavage on the basis of the recognition sequence.

5. Type II cuts the sequence in the following way \_\_\_\_\_

- a) Within the recognition sequence
- b) At 100-1000 nucleotides away from the recognition sequence
- c) At 27-30 nucleotides away from the recognition sequence
- d) It cuts randomly

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Answer: a

Explanation: Recognition sequence is the set of nucleotides which are identified by the enzyme and then it cleaves. In class II, the cleavage is done within the recognition sequence.

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6. After cleaving the sequence, the nature of the ends created by the type II endonuclease is \_\_\_\_\_

- a) The ends created are always single stranded
- b) The ends created are always double stranded
- c) Either the ends are single stranded or they are double stranded
- d) One end is single stranded and one end is double stranded

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Answer: c

Explanation: Either the ends are both double stranded or are both single stranded. The double stranded ends are blunt ends whereas the single stranded ends are sticky ends.

7. A sequence is having two ends, 5' and 3'. Which of the following statements is correct regarding the nature of the ends?

- a) The 5' end is having hydroxyl group
- b) The 5' end is having phosphate group
- c) The 3' end is having phosphate group
- d) Any group can be present at any end

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Answer: b

Explanation: The 5' end is having a phosphate group. As in a DNA sequence, the 5' end is characterized by phosphate group and the 3' end is characterized by a hydroxyl group.

8. Blunt ends created by the restriction endonuclease can be joined.

- a) True

b) False  
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Answer: a

Explanation: The blunt ends created can be joined by the enzyme responsible for ligation such as DNA ligase. It is not necessary to have sticky or single stranded ends.

9. The recognition sequence for BamHI is 5' G|GATCC 3'. The ‘|’ represents the cutting site. What can be inferred about the ends from it?

- a) The ends created are double stranded
- b) The single stranded end is 5' in nature
- c) The single stranded end is 3' in nature
- d) To decide about the nature of the ends more information is needed

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Answer: b

Explanation: The other strand is just complementary to it and can be written in the following way:

5' G|GATCC 3'

3' CCTAG|G 5'

After cleavage, the sequences are represented as:

5' G 3' 5' GATCC 3'

3' CCTAG 5' 3' G 5'

Thus, we can see that the ends generated are single stranded at 5' end.

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10. The recognition sequence of Sau3A is 5' |GATC 3' and that for DpnI is 5' GA|TC 3'. Which of the statements is true?

- a) The ends created by both the enzymes are compatible
- b) The ends created by both the enzymes are not-compatible
- c) The ends created by DpnI are single stranded
- d) The ends created by Sau3A are single stranded

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Answer: b

Explanation: Though the recognition sequence is the same, the ends are not compatible. It is so because both the enzymes leave double stranded ends and thus can't be ligated.

11. The recognition sequence is at times palindromic in nature. Which of the following statements is correct with respect to it?

- a) The molecules which are cut by the same enzyme, anneal only if the sequence is palindromic in nature
- b) When the molecules are cleaved by the same enzyme and the recognition sequence is palindromic in nature, there is no effect on annealing
- c) There are increased chances of annealing if the recognition sequence is palindromic in nature
- d) The term ‘palindromic’ can be used whether the sequence is read from 5' to 3' or 3' to 5'

View Answer

Answer: c

Explanation: The term palindromic can be used only when a sequence is read along the same polarity ie either 5' to 3' or 3' to 5'. When the recognition sequence is palindromic in nature, there are increased chances of annealing because now there are increased orientations. If the sequence is non-palindromic in nature, then also annealing would take place but in fewer orientations.

12. If all the nucleotides are present with equal frequencies and at random, what are the chances of having a particular four nucleotide long motif?

- a) 1/256
- b) 1/64
- c) 1/16
- d) 1/8

View Answer

Answer: a

Explanation: There are four nucleotide bases present in a DNA sequence A, T, C and G. If the bases are present with equal frequency and at random the chances of having a particular 4 nucleotide long motif is  $1/(4 \times 4) = 1/256$ .

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# Genetic Engineering Questions and Answers – Restriction Endonuclease & Phosphatases – 2

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This set of Genetic Engineering Interview Questions and Answers focuses on “Restriction Endonuclease & Phosphatases – 2”.

1. Isoschizomers are defined as \_\_\_\_\_  
a) enzymes having same recognition sequence and always cutting at the same site  
b) enzymes having same recognition sequence and always cutting at different site  
c) enzymes having different recognition site and cutting at the same site  
d) enzymes having same recognition site and they may or may not cut at the same site

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Answer: d

Explanation: Isoschizomers are the enzymes which are having same recognition sequence but they necessarily don't cut at the same site. DraI and AhalIII both recognize and cleave at TTT|AAA, whereas on the other hand, ApaI cuts at GGGCC|C and Bspl20I cuts at G|GGCCC.

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2. Isocaudomers are defined as the enzymes which recognize different sequence but generate same ends. Which of the following pairs of enzymes can be termed as isocaudomers?

- a) DpnI (GA|TC) and Sau3A (|GATC)  
b) BamHI (G|GATCC) and Sau3A (|GATC)  
c) DpnI (GA|TC) and BglII (A|GATCT)  
d) XbaI (T|CTAGA) and BamHI (G|GATCC)

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Answer: b

Explanation: BamHI on cleavage leaves GATC as the single stranded end and the same end is left by Sau3A as double stranded, though their recognition sequences are different. The other options don't satisfy the condition.

3. The specificity of an enzyme is affected by the concentration of buffer used. This phenomenon is termed as:

- a) star activity  
b) specificity elevation  
c) concentration gradient effects  
d) diamond activity

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Answer: a

Explanation: As concentration of buffer is varied, the specificity of an enzyme is lost and this phenomenon is termed as star activity. By loss of specificity we mean that, instead of a particular sequence, a particular set of sequences can be identified.

4. Which of the following statements is correct with respect to a unit of an enzyme?

- a) One unit of enzyme is defined as the amount of enzyme required to digest 1 milligram of standard DNA in a specific time of 1hr and under given temperature conditions  
b) The amount of enzyme required doesn't vary with the number of sites present in the DNA  
c) If more number of sites are there in the DNA more units of enzyme are required in comparison to same amount of DNA with fewer sites

d) The amount of enzyme required for digestion of DNA with less number of sites is more than that of more number of sites in the same amount of DNA

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Answer: c

Explanation: One unit of enzyme is the quantity required for digestion of 1 microgram of DNA in 1hr and under given temperature conditions. The amount of enzyme required is more if more number of sites is there in the same amount of DNA in comparison to less number of sites.

5. Which of the following statement is correct regarding partial digestion?

- a) It is defined as the conditions where all the sites in the DNA sequence are not recognized
- b) The number of fragments created by partial digestion are same as that of complete digestion
- c) It is not useful in representation of genomic library
- d) Exactly half of the sites in the DNA are recognized

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Answer: a

Explanation: Partial digestion is the condition where all the sites aren't recognized and thus the number of fragments created are not same as that of complete digestion. It is very useful in genomic library representation because nearly each and every segment is represented.

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6. Which of the following is the correct nomenclature of a restriction enzyme obtained from the first activity of strain R of Escherichia coli?

- a) EcoRI
- b) EscRI
- c) EcorI
- d) EcoRI

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Answer: d

Explanation: The first letter is the first letter of the genus and the next two letters are the first two letters of the species. They are then followed by the strain and the activity from which they are isolated. The activity is represented in Roman numerals.

7. Why is DNase preferred over restriction endonuclease in some cases?

- a) DNase is preferred over restriction endonuclease in some cases because the latter are not able to recognize some of the restriction sites
- b) DNase is more specific as restriction endonuclease, so the required fragment is obtained
- c) DNase is less specific as compared to restriction endonuclease, hence there are more chances of representation of all the possible fragments
- d) DNase is abundant in comparison the restriction endonuclease

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Answer: c

Explanation: As the DNase is less specific than restriction endonuclease, thus it cuts more randomly. It further leads to the representation of more fragments and hence they can be very useful in genomic library construction.

8. The ends created by use of DNase have unique single stranded sequences.

- a) True
- b) False

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Answer: b

Explanation: The ends created by DNase don't have unique single stranded sequences. It is so because DNase is not specific in nature.

9. Besides enzymatic means, physical stress can also be used for cleaving the DNA. Which of the following statements is true?

- a) Sonication, needles, syringes, etc all come under the category of physical stress
- b) In physical stress, there are no chances of contamination
- c) The ends obtained have unique sequences
- d) They are less effective than DNase treatment

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Answer: a

Explanation: Physical stress methods are used to cleave the DNA randomly and it also generates non-unique ends as the DNase treatment. These include the use of sonication methods, needles and syringes. There are chances of contamination from the metal probes used in the setup used.

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10. Phosphatases refer to \_\_\_\_\_

- a) the enzymes which add phosphate group at the end of the DNA molecule in the place of hydroxyl group
- b) the enzymes which hydrolytically remove phosphate group from the DNA molecules and replace them with hydroxyl group
- c) the enzymes responsible for removal of phosphate group from the DNA molecules and replace them with hydrogen
- d) the enzymes responsible for replacing hydrogen in the DNA molecules with the phosphate group

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Answer: b

Explanation: Phosphatases are the enzymes which remove phosphate group and then replace them with the hydroxyl group. Kinases are the enzymes which are responsible for the addition of the phosphate group in place of hydroxyl group.

11. How is phosphatase related to the ligation reactions?

- a) Phosphate group is not required for the ligation reaction to take place, thus phosphatase is helpful
- b) It is helpful in ceasing the unwanted ligation
- c) Phosphatases are not at all related to ligation reactions

d) They act as a catalyst in case of the ligation reaction

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Answer: b

Explanation: Phosphatases are used to stop unwanted ligation. It is so because if phosphatases are present, phosphate would be removed from the ends and it would further block the ligation. It is so because the phosphate group is necessary for ligation to take place.

12. How can phosphatase activity be terminated prior to a ligation reaction?

- a) By heating
- b) By cooling
- c) By creating vibrations
- d) By alternatively cooling and heating

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Answer: a

Explanation: Heating leads to termination of phosphatase activity prior to a ligation reaction because heating leads to the inactivation of the phosphatase activity.

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## Genetic Engineering Questions and Answers – Polymerases

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Polymerases”.

1. Basic classification of polymerases includes how many types?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: d

Explanation: The types are- DNA dependent DNA polymerase, DNA dependent RNA polymerase, RNA dependent DNA polymerase, template independent polymerase and RNA dependent RNA polymerase. Out of these, RNA dependent RNA polymerases are not focused so much in comparison to other polymerases.

2. Polymerase can be defined as \_\_\_\_\_

- a) an enzyme used to synthesize a new DNA or RNA strand on the basis of pre-existing strand or at times without a pre-existing strand
- b) an enzyme used for removal of nucleotides from the DNA or RNA strand
- c) an enzyme which can synthesize only a new DNA strand, not an RNA strand
- d) an enzyme which can synthesize either a new DNA or an RNA strand but only when a strand is there

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Answer: a

Explanation: The synthesis of a new DNA or RNA strand can be done either on the basis of a pre-existing strand or without it. Those which don't require a pre-existing strand are known as template free or template independent.

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3. Which of the following activity is not possible in the case of DNA polymerase I?

- a) 3'-5' exonuclease
- b) 5'-3' exonuclease
- c) 5'-3' DNA synthesis
- d) 3'-5' DNA synthesis

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Answer: d

Explanation: DNA polymerase is having the ability to synthesize DNA strand in 5'-3' direction but not in 3'-5' direction. Also, it is having exonuclease activity in both the directions, which means that it can remove bases in either of the direction but can synthesize only in 5'-3' direction.

4. The E. coli DNA polymerase enzyme gives different domains with different activities on cleaving with protease subtilisin. Which of the following statements is correct with respect to the fragments generated?

- a) The smaller fragment is having C terminal and the larger fragment is having N terminal
- b) The smaller fragment is named as Klenow fragment and the intact molecule is called as Kornberg fragment
- c) The smaller fragment is having 5'-3' exonuclease activity whereas the larger fragment is having 5'-3' polymerase and 3'-5' exonuclease activity
- d) Both the fragments are having 5'-3' polymerase and 3'-5' exonuclease activity

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Answer: c

Explanation: The two fragments are generated of size 35kDa and 76kDa, with the N terminal in the smaller fragment. The larger fragment, which is of 76kDa is known as Klenow fragment and the intact molecule is called Kornberg fragment. The smaller fragment is having 5'-3' exonuclease activity whereas the larger fragment is having 5'-3' polymerase and 3'-5' exonuclease activity.

5. Removal of single stranded portions produced due to exonucleolytic activity and due to polymerase activity are termed as \_\_\_\_\_

- a) polishing and end filling respectively
- b) end filling and polishing respectively
- c) polishing in both the cases
- d) end filling in both the cases

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Answer: a

Explanation: The single stranded ends generated due to exonucleolytic activity can either be removed by generating their complementary strand or removing the single stranded overhang. In both cases, it is termed as polishing. Whereas removal of single stranded regions generated because of polymerase activity is termed as end-filling.

6. Thermostable DNA polymerases are very important in PCR. How are they obtained?

- a) They are obtained by heating the bacteria manually over high temperatures
- b) They are isolated from extremely stable thermophilic bacteria which are often found growing in oceanic vents
- c) They are found everywhere in nature
- d) They are obtained by genetically modifying the E. coli bacteria with thermal stability property

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Answer: b

Explanation: Thermostable DNA polymerases are found naturally in thermophilic bacteria which can be found growing in oceanic vents. They are having high stability and their DNA polymerases can function effectively even at high temperatures in-vitro.

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7. Which of the following enzyme is said as reverse transcriptase?

- a) DNA dependent DNA polymerase
- b) RNA dependent RNA polymerase
- c) RNA dependent DNA polymerase
- d) DNA dependent RNA polymerase

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Answer: c

Explanation: RNA dependent DNA polymerases are said as reverse transcriptase and the function follows its name. The function is to reverse the phenomenon of general transcription, in which RNA is synthesized from DNA. But here it is reversed and DNA is synthesized by using RNA as a template.

8. Why reverse transcriptase enzymes are having comparatively high error rates than other polymerases?

- a) Because they are not having 3'-5' proofreading exonuclease activity
- b) Because they are not having 5'-3' proofreading exonuclease activity
- c) Because they are having slow rates of exonuclease activity
- d) It is difficult to synthesize DNA from RNA

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Answer: a

Explanation: Reverse transcriptase enzymes are not having proof reading exonuclease activity in 3'-5' direction. Hence, when the synthesis is done in 5'-3' direction it is not checked in the 3'-5' direction and thus the errors inculcated won't be removed.

9. Which polymerase can be used in conjunction with appropriate phage promoters in order to have high levels of specific transcription?

- a) RNA dependent DNA polymerase
- b) DNA dependent RNA polymerase
- c) RNA dependent RNA polymerase
- d) DNA dependent DNA polymerase

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Answer: b

Explanation: DNA dependent RNA polymerases are very specific for phage promoters and thus they are used for carrying out highly specific transcription. They are often isolated from T3, T7 phages.

10. Template independent polymerases are the enzymes which add nucleotide bases without a template. Which of the following statements is correct with respect to these?

- a) They only add a single nucleotide
- b) They only add a string of nucleotides and not a single nucleotide
- c) Terminal transferase adds a series of nucleotides at the 3' end
- d) Taq polymerase adds a single nucleotide at the 5' end of the PCR product

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Answer: c

Explanation: Template independent polymerases can either add a single nucleotide or a series of nucleotides; it is based on the template. Terminal transferase adds a series of nucleotides at the 3' end, which generates a single stranded tail. Whereas, Taq polymerase adds a single A base at 3' end of the PCR product.

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# Genetic Engineering Questions and Answers – Exonucleases

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Exonucleases”.

1. Which of the following statements is correct with respect to exonuclease?
- a) They only act on single stranded DNA molecules
  - b) They only act on double stranded DNA molecules
  - c) They remove a single nucleotide base at a time
  - d) They remove nucleotide bases from the middle of a polynucleotide chain

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Answer: c

Explanation: Exonuclease is responsible for removal of a single nucleotide base at a time, from the end of the polynucleotide sequence. They can act on both single and double stranded DNA molecules.

2. How many approaches are there which can be used for exonucleolytic activity in double stranded DNA molecules?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: There are 2 approaches which can be used to carry out exonucleolytic activity in double stranded DNA. The two approaches which are used as a separation of both the strands together and separation of both the strands separately.

3. What is the mode of action of exonuclease III?

- a) Exonuclease III acts on single stranded DNA in 3'-5' direction
- b) Exonuclease III acts on double stranded DNA in 5'-3' direction
- c) Exonuclease III acts on single stranded DNA in 5'-3' direction
- d) Exonuclease III acts on double stranded DNA in 3'-5' direction

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Answer: d

Explanation: It is an enzyme which is having exonuclease activity in 3'-5' direction and only on double stranded DNA. It doesn't act on single stranded molecules.

4. Which of the following statements is correct regarding S1 nuclease?

- a) It acts on double stranded DNA
- b) It acts on single stranded DNA
- c) It acts on both types of strands
- d) It is obtained from E. coli

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Answer: b

Explanation: S1 nuclease is obtained from Aspergillus oryzae and it acts on single stranded DNA molecules. It is having exonucleolytic activity.

5. What happens if a DNA molecule is treated by first Exonuclease III and then followed by treatment with S1 nuclease?

- a) The molecule is shortened only from 3' end
- b) The molecule is shortened only from 5' end
- c) The molecule is shortened from both the ends
- d) Only Exonuclease acts and S1 doesn't acts

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Answer: c

Explanation: The molecule is shortened from both the ends. It is so because as firstly Exonuclease III acts, single stranded ends are produced on both the sides. These are further acted upon by S1 nuclease and thus the molecule is shortened from both the sides.

6. How can one end be protected from the action of Exonuclease III, so that the molecule is not shortened from both the ends?

- a) By using Phosphorothioate nucleotide analogue
- b) By making both the ends double stranded in nature
- c) By labelling one end with a radioactive compound
- d) By increasing the time of exposure of the DNA molecule to the enzyme

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Answer: a

Explanation: Phosphorothioate nucleotide analogues are used to replace some of the nucleotides at the ends with it. It doesn't allow the action of the enzyme on it and thus the molecule won't be shortened from that end on which replacement is done.

7. Bal31 is also an enzyme which is used. Which of the following statements hold true in its context?

- a) It is having only 3'-5' exonuclease activity and no endonuclease activity
- b) It is having only an endonuclease activity
- c) It is having 5'-3' exonuclease activity
- d) It leads to shortening from both the ends

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Answer: d

Explanation: Bal31 is having an exonuclease activity in 3'-5' direction and also an endonuclease activity. Thus, after having 3'-5' exonuclease activity, the endonuclease activity takes place and the molecule is shortened from both the ends.

8. The extent of deletions can be manipulated by controlling which of them?

- a) Time of incubation only
- b) Amount of nuclease added
- c) They both have a role to play in the extent of the deletion
- d) The amount of deletion which can be carried out for a particular amount of DNA is fixed regardless of the amount of nuclease and incubation time

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Answer: c

Explanation: The extent of deletion can be varied by varying the incubation time and the amount of nuclease added. Thus, they both play a role in controlling the extent of deletion.

9. What is the function of methylase?

- a) Addition of methyl groups to DNA
- b) Removal of methyl groups from DNA
- c) Both in removal and addition of methyl groups from DNA
- d) It is used in production of methane gas

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Answer: a

Explanation: Methylase is used for the addition of methyl groups on DNA. It is done via placing the methyl groups which are taken from S-adenosyl methionine.

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10. Methylase is useful in cloning experiments.

- a) True
- b) False

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Answer: a

Explanation: It is useful in cloning experiments because as it methylates DNA, that DNA is protected from that group of restriction enzyme. It means that if we carry out methylation by EcoRI methylase, the DNA won't be cleaved by the restriction enzyme EcoRI. In cloning experiments, sometimes it is necessary to protect the DNA from cleavage by a particular enzyme.

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## Genetic Engineering Questions and Answers – Categories of Ligation Reaction

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Categories of Ligation Reaction”.

1. Ligation is defined as \_\_\_\_\_  
a) Alignment of only double stranded DNA molecules at the ends and the formation of phosphodiester bonds between both the strands  
b) Alignment of either of the double or single stranded DNA molecules and formation of glycosidic bonds between both the strands  
c) Alignment of either of the double or single stranded DNA molecules and the formation of phosphodiester bonds. The bond can be between either one or both the strands  
d) Alignment of single stranded DNA molecules and formation of glycosidic bonds between these strands

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Answer: c

Explanation: Ligation is basically the formation of bonds between the ends of two DNA strands. The strands can be single or double. The nature of the bond is phosphodiester, which means that bond is formed between sugar and phosphate. The phosphodiester bond can either be formed between one strand or both the strands.

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2. If only one bond is broken in the sugar-phosphate backbone, it is called as \_\_\_\_\_

- a) gap
- b) nick
- c) break
- d) leakage

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Answer: b

Explanation: In the case, if only one bond is broken in the sugar phosphate backbone, it is termed as nick. If a number of nucleotides are missing, it is termed a gap. Nick can be sealed by ligation reactions but gap can't be sealed by a ligation reaction.

3. How many categories of ligation reaction are there on the basis of ends created?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: There are two categories of ligation reaction and are named as blunt-ended and sticky ended reaction. They are named because of the nature of the ends of the molecules to be ligated.

4. In the case of blunt-end ligation, blunt ends can be generated by \_\_\_\_\_

- a) simply the action of restriction endonuclease which gives straight ends
- b) the polishing of staggered ends
- c) both the action of restriction endonuclease which gives straight ends and polishing of staggered ends
- d) by the action of restriction endonuclease which gives staggered ends

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Answer: c

Explanation: Blunt ends are those which don't have single stranded ends as overhangs. The ends are double stranded. And these can be generated by polishing the staggered ends or the action of restriction endonuclease which generate straight ends.

5. The ligation reaction is more efficient in which case?

- a) Blunt end ligation
- b) Sticky end ligation
- c) Both have the same efficiency
- d) Depends on the reaction conditions

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Answer: b

Explanation: Sticky end ligation is generally more efficient than blunt end ligation. It is so because sticky end ligation is carried out because of complementary base pairing.

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6. The sticky ends are held together by which type of bonds?

- a) Hydrogen bond
- b) Covalent bond
- c) Ionic bond
- d) Van-der-waal forces

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Answer: a

Explanation: The sticky ends are held together by the hydrogen bonds. Hydrogen bonds are weak in nature and can easily be broken.

7. Why sticky ended ligations are carried out at temperatures lower than room temperature?

- a) It is so because the vibrational and kinetic energy of the molecules at room temperature is lower than that of the energy required to break the bonds holding the ends
- b) The energy required to break the bonds holding the ends is very less than that of the kinetic and vibrational energy at room temperature
- c) The enzyme carrying out ligation is unstable at low temperature
- d) The sticky ends created, don't just relegate at low temperature

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Answer: a

Explanation: The sticky ends are held together by the hydrogen bonds. These hydrogen bonds are weak in nature and the energy required to break them is very less than the kinetic and vibrational energy of the molecules at room temperature. Hence the reaction is carried at 4 degrees.

8. Ligation reaction can be both intramolecular and intermolecular in nature.

- a) True
- b) False

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Answer: a

Explanation: Ligation reaction can be both intramolecular and intermolecular in nature. The intermolecular reaction is that which ends ligated are of two different molecules. The intramolecular ligation is that which ends ligated belong to the same molecule.

9. If a ligation reaction is being carried out and recircularization is observed, which type of reaction is being carried out?

- a) Intramolecular
- b) Intermolecular
- c) Both observe recircularization equally
- d) Recirculation is not possible in any of the cases

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Answer: a

Explanation: Recircularization is the phenomenon of joining the ends of the same molecule. It happens in the case of intramolecular ligation reaction.

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10. What is the kinetics of the intramolecular and intermolecular ligation reactions?

- a) Second order kinetics for intramolecular and first order for intermolecular
- b) First order kinetics for intramolecular and second order for intermolecular
- c) Both are first order
- d) Both are second order

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Answer: b

Explanation: As the intramolecular reaction requires only the type of reaction species, the reaction is first order. Whereas, on the other hand intermolecular reaction requires collision between two different species and hence it is second order reaction.

11. What are the effects of increasing concentration of reaction components?

- a) It increases chances of ligation in both intramolecular and intermolecular reactions
- b) It increases chances of ligation only in intermolecular and no effect on intramolecular
- c) It decreases chances of ligation in intramolecular and increases in that of intermolecular
- d) It decreases chances of ligation in both types of reaction

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Answer: b

Explanation: As the concentration of reaction components is increased, there are increased chances of ligation in intermolecular reaction because of frequency of collision of two different molecules increases. The intramolecular reaction is unaffected because the probability of meeting the ends of a molecule remains the same.

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# Genetic Engineering Questions and Answers – Enzymes for Ligation

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Enzymes for Ligation”.

1. Enzyme commonly used for carrying out ligation reaction is \_\_\_\_\_  
a) Transferase  
b) Reverse transcriptase  
c) Ligase  
d) DNase  
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Answer: c

Explanation: Ligase is the enzyme which is commonly used for carrying out the ligation reaction. They can either be obtained from E. coli or from cells that have been infected by the virus.

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2. Which of the following statements is correct with respect to T4 DNA ligase?  
a) It can carry out only blunt ended ligations  
b) It doesn't require ATP  
c) It requires a phosphate group at 3' end and a hydroxyl group at 5' end for the molecule to be joined  
d) It is obtained from T4 bacteriophage upon infection by E. coli  
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Answer: d

Explanation: T4 DNA ligase is obtained from T4 bacteriophage upon infection by E. coli. It carries out ligation both in blunt ended and sticky ended molecules and requires ATP. It requires a phosphate group at 5' end and a hydroxyl group at 3' end.

3. If blunt ended ligations are to be carried out. Which of the following enzymes can be used?  
a) E. coli DNA ligase  
b) T4 DNA ligase  
c) Both of these enzymes act equally in carrying out blunt ended ligations  
d) None of them is able to carry out blunt ended ligations  
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Answer: b

Explanation: If blunt ended ligations are to be carried out, T4 DNA ligase should be used. E. coli DNA ligase is unable to carry out blunt ended ligation.

4. E. coli DNA ligase doesn't require a cofactor.

- a) True
- b) False

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Answer: b

Explanation: The E. coli DNA ligase requires a cofactor nicotinamide adenine dinucleotide (NAD), along with 5' phosphate group and 3' hydroxyl group.

5. Mechanism of ligation for both T4 DNA ligase and E. coli DNA ligase makes use of Adenosine Monophosphate (AMP). Which of the steps is involved in the ligation mechanism?

- a) AMP is added to the 5' phosphate of one of the DNA molecule
- b) It leads to the liberation of pyrophosphate from NAD and nicotinamide mononucleotide from ATP
- c) The AMP is further displaced by an electrophilic attack
- d) The AMP is further displaced by nucleophilic attack by 3' hydroxyl of the same DNA molecule

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Answer: a

Explanation: AMP is added to the 5' phosphate of one of the DNA molecule. It leads to the liberation of pyrophosphate from ATP and nicotinamide mononucleotide from NAD. It is further displaced by nucleophilic attack by 3' hydroxyl of the other DNA molecule.

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6. Topoisomerase is also an enzyme which is used for carrying out ligation. The correct statement for topoisomerase is?

- a) They act only on double stranded molecules
- b) They alter the degree of supercoiling of DNA molecules
- c) They are less effective than conventional DNA ligase
- d) There are three types of topoisomerases

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Answer: b

Explanation: Topoisomerases alter the degree of supercoiling of both single and double stranded DNA molecules. There are two types of topoisomerases, I and II. Type I is responsible for altering single stranded molecules and type II for altering double stranded molecules. They are more effective than conventional DNA ligase.

7. Mobile genetic elements can be transferred from one DNA portion to another. The enzyme carrying out this is \_\_\_\_\_

- a) Ligase
- b) Transcriptase
- c) Transposase
- d) Endonuclease

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Answer: c

Explanation: Transposase is used for transferring mobile genetic elements from one portion to another. They are useful in inserting origin of replication or antibiotic resistance genes.

8. Phage based recombination systems are used for \_\_\_\_\_

- a) cleaving the molecules at specific sites
- b) adding the molecules at specific sites
- c) breakage and rejoining the molecules at specific sites
- d) breakage at random sites

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Answer: c

Explanation: Phage based recombination systems are used for breaking and rejoining the molecules at specific sites and not at random sites.

9. Bacteriophage lambda is having a phage recombination system. Following are the characteristics of this system \_\_\_\_\_

- a) It is used for inserting phage genome into the bacterium
- b) It is used for inserting bacterial genome into the phage
- c) The specific site in bacteria is attB and that in phage is attP
- d) The specific sites in both of them are called as attP

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Answer: a

Explanation: The phage genome is inserted into the bacterium. The site for insertion at the phage genome is attP and that in the case of a bacterium is attB.

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10. Ligation enzymes are used for ligating newly synthesized Okazaki fragments. What holds true for Okazaki fragments?

- a) Okazaki fragments are short fragments of DNA formed on the leading strand
- b) Okazaki fragments are large fragments of DNA formed on the lagging strand
- c) Okazaki fragments are short fragments of DNA formed on the lagging strand
- d) Okazaki fragments are large fragments of DNA formed on the leading strand

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Answer: c

Explanation: Okazaki fragments are short DNA fragments on the lagging template strand during replication. They are complementary to the lagging strand.

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# Genetic Engineering Questions and Answers – Transformation

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Transformation”.

1. Introduction of DNA molecules into the recipient organism is termed as \_\_\_\_\_

- a) transformation
- b) translation
- c) transduction
- d) transcription

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Answer: a

Explanation: Introduction of DNA molecules into the recipient organism is termed as transformation. It is done with the help of endonucleases and ligases and the recipient organism is termed as host.

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2. Many bacterial species are having a natural ability to take up the exogenous DNA material. Which of the statement is not correct in regard to it?

- a) This ability is termed as competence
- b) It is not limited to particular growth phases
- c) The bacteria may develop new biochemical abilities under special conditions such as nutrient deprivation
- d) Induction of specific set of bacterial proteins may take place

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Answer: b

Explanation: This ability is termed as competence and it is limited to particular growth phases. It may lead to developing new biochemical abilities under special conditions such as nutrient deprivation. If the bacterial cells are naturally competent, they may take the foreign DNA by simply incubating them with foreign DNA.

3. Which of the statements hold true for conjugation?

- a) Conjugation is the natural process of transferring DNA from one species to another

- b) It is the artificial process in case the cells are not able to take them up naturally
- c) The plasmids are transferred from one cell to another by physical contact
- d) The plasmids are transferred from one cell to another by chemical means

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Answer: b

Explanation: Conjugation is the process used for transferring plasmids from one cell to another in case they are not able to take up naturally. It is done via physical contact and the plasmid being transferred encodes the machinery.

4. F plasmid is often used in conjugation. The correct statement is?
- a) The F plasmid encodes the factor which is transferred from one cell to another
  - b) The factor encoded by the F plasmid is called as Filamentous (F) factor
  - c) It is transferred from one cell to another by filament
  - d) The bacteria must belong to same species to carry out the conjugation

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Answer: a

Explanation: F plasmid encodes the factor called Fertility or F factor. It is transferred from one cell to another by the sex pilus. It is present in E. coli and for the conjugation to take place; bacteria can also belong to different species.

5. Plasmids can be classified into how many types depending on the genes present for their transformation?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: Plasmids can be said as self-mobilizable and mobilizable. They are self mobilizable in the case they contain all the genes necessary to direct its own transfer. Mobilizable are those plasmids which don't carry all the genes necessary for their transfer but they can be transferred if the genes are present somewhere in the host.

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6. Viral infection can also be used to take up the DNA by the cells.

- a) True
- b) False

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Answer: a

Explanation: Viral infection can be used to take up the DNA by the cells. It is all because of the viral coat and the nucleic acid contained within has no role to play.

7. Chemical transformation refers to the methods which use chemicals in order to carry out transformation. Which of the following statements is true with respect to it?

- a) Chemical transformation decreases the efficiency of transformation as compared to natural transformation
- b) Ice cold calcium solution followed by heat shock is responsible for affecting the efficiency of DNA uptake
- c) The mechanism responsible for it named as 'the heat shock model'
- d) Other complex mixtures such as those containing Manganese and hexamine cobalt can't be used to affect the efficiency

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Answer: b

Explanation: Chemical transformation methods increase the DNA uptake efficiency as in comparison to natural methods. The treatment by ice cold calcium solution which is followed by heat shock is responsible for increasing efficiency. But the exact mechanism behind it is not known till now. Other complex mixtures which comprise of cobalt, manganese etc. can be used to increase the efficiency.

8. Electroporation is also used for taking up the DNA by the cells. It constitutes of \_\_\_\_\_

- a) inserting the DNA into the cells via an electric shock
- b) increased efficiency than both natural and chemical methods
- c) causing the least amount of damage in comparison to other methods
- d) decreased efficiency than both natural and chemical methods

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Answer: a

Explanation: Electroporation is the method of DNA uptake via an electric shock. It is provided by varying the potential difference across the electrodes. It is having increased efficiency as compared to other methods. But also if prolonged treatment is given, it can cause destruction. It is so because the electric shock can be at times fatal to the cell wall.

9. Transformation carried out using a particle gun is known as biolistic transformation. It falls under which category of transformation?

- a) Physical
- b) Chemical
- c) Electroporation
- d) Natural

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Answer: a

Explanation: The transformation carried out using a particle gun falls under the physical transformation category. The physical transformation uses some

10. The particle gun method consists of which of the following steps?

- a) The DNA of interest is absorbed onto microprojectile beads
- b) These beads are often made of aluminium
- c) The explosion in a gun propels a macroprojectile forward which in turn propels microprojectile beads
- d) The macroprojectiles and microprojectiles both cross the perforated plate and hit the target tissue behind it

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Answer: c

Explanation: The DNA of interest is adsorbed on the microprojectile beads and these are made of gold and tungsten often. The explosion in the gun propels a macroprojectile forward and in turn propels microprojectile beads. These microprojectile beads cross the perforated plate but macroprojectiles don't. The target tissue is behind the perforated plate and the microprojectiles hit it.

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## Genetic Engineering Questions and Answers – Purification of Plasmid DNA

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Purification of Plasmid DNA”.

1. Isolation of genomic DNA follows the same principles as that of obtaining plasmid from E. coli. Which of the following is not included in it?

- a) Cell lysis
- b) Removal of proteins
- c) Removal of chromosomal DNA
- d) Dissolving plasmid in water

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Answer: d

Explanation: There are some basic steps which are included in obtaining plasmid DNA from E. coli. Firstly, the cell is lysed, further removal of proteins and

chromosomal DNA is done. A plasmid is obtained and collected but not in water. Also, further purification is done if necessary.

2. How many methods are there for obtaining the plasmid DNA from the bacteria?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: There are two methods which are used for obtaining the plasmid DNA from the bacteria. They are named as alkaline lysis method and boiling lysis method. They both are having different working principles.

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3. Cell lysis is carried out by which substance?

- a) Lysozyme and detergents
- b) Water
- c) Sugar solution
- d) Sulfuric Acid

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Answer: a

Explanation: Cell lysis is carried out by adding lysozyme and detergents. The cell wall is made up of N-acetyl glucosamine and N-acetyl muramic acid and they are having cross links. The agents added to break the cross links present between the molecules of the cell wall.

4. Chromosomal or genomic DNA is separated by \_\_\_\_\_

- a) Sedimentation
- b) Dissolution in water
- c) Centrifugation
- d) Distillation

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Answer: c

Explanation: Chromosomal or genomic DNA is comparatively heavier and large in size than that of plasmid DNA. Hence, centrifuging at a high speed leads to settling down of the genomic DNA and thus can be separated easily.

5. Proteins can be removed via treatment by?

- a) Phenol and chloroform treatment
- b) Treatment with sodium hydroxide
- c) Chloroform treatment alone
- d) Centrifuging

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Answer: a

Explanation: Proteins can be removed via treatment with phenol and chloroform treatment. Chloroform is alone not sufficient. The phenol added helps in the destruction of proteins and chloroform helps in its dissolution under acidic conditions.

6. The nucleic acid remaining in the solution can be precipitated by addition of sodium or ammonium acetate and ethanol.

- a) False
- b) True

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Answer: b

Explanation: The nucleic acid is present in the solution and is precipitated by the addition of sodium or ammonium acetate and ethanol. It is because; nucleic acid is polar in nature and thus easily dissolves in water. Hence, to avoid this sodium acetate and ethanol is added. Sodium acetate shields the charge present on the sugar phosphate backbone and further bonds are easily formed between ethanol and phosphate. It leads to separating out of nucleic acids.

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7. Nucleic acid precipitated constitutes of \_\_\_\_\_

- a) plasmid DNA
- b) plasmid DNA, along with RNA and chromosomal DNA
- c) RNA alone
- d) chromosomal DNA only

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Answer: b

Explanation: Nucleic acid precipitated contains the plasmid DNA and along with it RNA and remnants of chromosomal DNA are also present. RNA can be removed via adding RNase.

8. Treatment with exonuclease leads to removal of \_\_\_\_\_

- a) remnants of chromosomal DNA
- b) RNase
- c) plasmid DNA which is circularized
- d) proteins

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Answer: a

Explanation: Exonuclease leads to removal of remnants of chromosomal DNA because they are usually having linear ends. The circularized ends of plasmid are protected from the action of exonuclease because they don't have any free ends for their action.

9. Adsorption onto a solid phase support followed by elution is used as an alternative for separation of which component?

- a) chromosomal DNA
- b) plasmid DNA
- c) RNA alone
- d) other impurities

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Answer: b

Explanation: This method is used for separation of plasmid DNA. It is advantageous because it avoids the use of phenol and also removes RNA at times along with plasmid DNA.

10. Which of the following components bind to the solid column made of silica, under high salt concentration?

- a) Proteins
- b) Polysaccharides
- c) Both proteins and polysaccharides
- d) Plasmid DNA

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Answer: d

Explanation: Plasmid DNA binds to a solid support which is made of silica and under high salt concentrations. A high salt concentration doesn't allow less polar molecules to bind such as polysaccharides and proteins. The bound DNA molecule is further eluted by using a low salt concentration.

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11. Purification of DNA by using silica derivatized groups by DEAE is termed as \_\_\_\_\_

- a) ion exchange resin based method.
- b) silica based purification
- c) atom based resin exchange method
- d) packed bed purification

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Answer: a

Explanation: Silica derivatized groups by DEAE are used for purification of DNA. These groups are positively charged and the DNA gets attached to it, along with other species such as RNA which are negatively charged. Further, DNA can be obtained by varying the ionic concentrations.

12. Which of the following is correct with respect to caesium chloride centrifugation?

- a) Caesium is light in weight
- b) The dissolution of caesium and nucleic acids leads to the formation of gradients
- c) According to the amount of supercoiling and A+T content, the DNA settles
- d) Nicked DNA settles below than supercoiled DNA

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Answer: b

Explanation: Caesium chloride is heavy and when the nucleic acid is dissolved with it, density gradients are formed. According to the extent of supercoiling and G+C content, settling of DNA takes place. The nicked DNA settles above than the nicked DNA.

13. Which of the following components settles at the bottom?

- a) RNA
- b) Proteins
- c) Nicked DNA
- d) Supercoiled DNA

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Answer: a

Explanation: The component settling at the bottom is RNA. And the proteins float on the free surface. The nicked DNA forms a band above the supercoiled form.

14. The location of plasmid DNA can be visualized by addition of:

- a) bromophenol blue
- b) ethidium bromide
- c) ortho xylene
- d) texas red

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Answer: b

Explanation: Ethidium bromide is added before centrifugation. It is an orange-red coloured stain which gives rosy coloured bands when placed under UV light. It acts upon by intercalating between the bases.

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# Genetic Engineering Questions and Answers – Gel electrophoresis, Oligonucleotide & Microarrays – 1

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) on “Gel Electrophoresis, Oligonucleotide & Microarrays – 1”

1. Gel electrophoresis separates nucleic acid molecules based on \_\_\_\_\_

- a) charge on molecules
- b) size of the molecules
- c) nature of the molecules i.e. whether DNA or RNA
- d) chemical properties of the nucleic acids

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Answer: b

Explanation: Gel electrophoresis separates nucleic acid molecules on the basis of their size. The nucleic acid molecules move through the gel because of the force provided by the applied electric field.

2. The charge present on the DNA backbone is negative. The force required to accelerate the molecules towards anode is directly proportional to the number of

- a) sugar molecules
- b) nitrogenous bases
- c) phosphate groups
- d) both phosphate group and sugar molecules

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Answer: c

Explanation: The DNA backbone is negatively charged because of the phosphate groups. Hence, the force required to move the molecules towards anode is directly proportional to the number of phosphate groups present.

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3. Force is defined as mass per unit acceleration. As the number of phosphate molecules increases, the charge also increases which increases the force required. The acceleration is dependent on the size of the molecules.

- a) True

b) False

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Answer: b

Explanation: As the charge increases, which is because of the number of phosphate molecules, the size also increases. As, the size increases, it also results in increase of mass. Thus, now the force and also the acceleration are independent of size until a retarding force is present. But, in the case of gel electrophoresis, the retarding force is provided by gel and thus separation takes place on the basis of size.

4. Which one of the following will travel fastest through the gel if the amount of DNA present is same in all?

- a) Circular
- b) Supercoiled
- c) Nicked
- d) Supercoiled and circular will move at same speed and faster than nicked

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Answer: b

Explanation: The supercoiled form of DNA will travel the fastest. It is so because; the movement through the gel is based on the size. The smaller the molecule is the less retarding force it experiences when it moves. Hence, supercoiled which is having the smallest size will move the fastest.

5. How is the size of molecules under analysis measured?

- a) By measuring the distance moved through a ruler
- b) By measuring the amount of visualising dye used
- c) By running a standard molecule, whose size is known in parallel
- d) There is no exact criterion for doing so

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Answer: c

Explanation: The size of the DNA molecules is measured by a standardized molecule. It is known as DNA ladder. The molecules under analysis are compared with the DNA ladder.

6. Gel matrices are generally of two types Agarose and Polyacrylamide. Which of the statements is correct with respect to agarose gels?

- a) Agarose is a polysaccharide which is obtained from red algae
- b) Agarose is a polysaccharide obtained from fungus
- c) It is composed of glucose residues
- d) It is obtained via dissolving in its water by boiling in water and then cooling it

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Answer: a

Explanation: Agarose is a polysaccharide which is obtained from red algae. It is composed of galactose residues. Agarose gel is obtained via dissolving in it a buffer by boiling it and then cooling it. It leads to the formation of agar in conjunction with other polysaccharides, agropectin.

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7. Polyacrylamide gels are the other types of gels which are commonly used. Which of the following statement is not correct with respect to these types of gels?

- a) They are obtained via polymerization between acrylamide and bis-acrylamide
- b) The components added for initiating polymerization are ammonium persulphate and TEMED
- c) It is casted in horizontal and flat trays
- d) TEMED catalyses the formation of free radicals from persulphate ions which leads to initiation of cross-linking

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Answer: c

Explanation: Polyacrylamide gels are made up by the polymerization of acryl amide and bis acryl amide units. The polymerization takes place because of TEMED and ammonium persulphate, as TEMED catalyses the formation of free radicals from persulphate. These gels are usually casted in vertical trays whereas the agarose gels are casted in horizontal and flat trays.

8. If the amount of agarose added is more, the molecular under analysis should have the following characteristic:

- a) small size
- b) large size
- c) size has no relation with the amount of agarose
- d) the amount of molecules under analysis matters

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Answer: a

Explanation: In the case of agrose gels, the separation takes place because of size. If the amount of agarose is more, smaller size molecules will be able to move easily as in comparison to larger size molecules. It is so because; the movement is through the pores. More the amount of agarose, smaller the size of the pore.

9. In the case of electrophoresis of single stranded DNA or RNA, which type of gels are used?

- a) Renaturing
- b) Denaturing
- c) The routine agarose gel
- d) The routine polyacrylamide gel

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Answer: b

Explanation: In the case of single stranded molecules, denaturing gels are used. It is so because, if denaturing gels are not there, there are chances of formation of secondary structures which hinder the movement of nucleic acids. Thus to avoid this, denaturing agents such as urea, etc. are added.

10. At times, a specific fragment of the molecules of DNA which are analyzed needs to be separated. One of the methods is digesting the gels simply. Which of the following statement is not correct in with respect to it?

- a) The gelling temperature has an important role to play
- b) For higher gelling temperatures, digestion of DNA is done via the addition of agarase or some chaotropic agents
- c) For lower gelling temperatures, simply slicing out of target DNA is done which is followed by melting
- d) The DNA can be extracted via the addition of sodium or any positively charged group

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Answer: d

Explanation: For the method of solubilising DNA, the gelling temperature is very important. For lower gelling temperatures simply the target DNA can be sliced out and further melting is done. But for higher gelling temperatures, either agarase or chaotropic agents are added. After this, the required DNA is obtained via purification which is done by the addition of silica or solvent extraction can also be done.

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# Genetic Engineering Questions and Answers – Gel Electrophoresis, Oligonucleotide & Microarrays – 2

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This set of Genetic Engineering Questions and Answers for Freshers focuses on “Gel electrophoresis, Oligonucleotide & Microarrays – 2”.

1. A piece of DNA that is to be separated is crushed and soaked into the buffer. The majority of DNA diffuses, how can it be separated?
  - a) Filtration and centrifugation
  - b) Filtration or centrifugation
  - c) Allowing to sediment
  - d) By passing through a silica column

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Answer: b

Explanation: As the target DNA is crushed and soaked into the buffer, the majority of it diffuses into the gel. It can be separated via filtration or separation. It is

simply termed as recovering the DNA from the gel by diffusion.

2. Another method of DNA recovery is termed as freeze-squeeze. The correct statement for it is?

- a) The slice containing DNA is cut and frozen into liquid oxygen
- b) Freezing doesn't have any effect on the DNA structure
- c) After freezing centrifugation is carried out through glass wool plug
- d) The substance used for centrifugation allows the gel to pass through but the liquid is retained

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Answer: c

Explanation: It is also a method for obtaining DNA from gels. The slice containing DNA is cut and frozen into liquid nitrogen. Freezing in liquid nitrogen leads to disruption of structure. As the centrifugation by glass wool plug is carried out after freezing out, the gel is retained by it. The liquid which is containing dissolved DNA will be allowed to pass through.

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3. If further electrophoresis is used for recovery of DNA from gels, the method is termed as \_\_\_\_\_

- a) secondary electrophoresis
- b) recovery electrophoresis
- c) denaturing electrophoresis
- d) electro-elution

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Answer: d

Explanation: If electrophoresis is used further for recovery, the method is termed as electro-elution. There are different electro-elution methods which are used such as dialysis tube or membrane is used.

4. The DNA is sliced and is placed into the dialysis tube containing buffer. Further electrophoresis is performed. After it, the DNA moves out of the gel but is retained by buffer.

- a) True
- b) False

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Answer: a

Explanation: As further electrophoresis is carried out, the DNA moves out of the gel but is retained by the buffer. From the buffer, it can be obtained via pipetting.

5. UV shadowing is used at times for visualising the DNA. Which of the statements is correct for it?

- a) In this method, the DNA bands are visualized because they fluoresce under UV
- b) The DNA bands won't fluoresce but will absorb the UV light
- c) It is not suitable for visualizing single stranded molecules
- d) It is less preferred over the use of ethidium bromide

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Answer: b

Explanation: In this method, the DNA bands won't fluoresce but will absorb the UV light. This leads to the formation of a non-fluorescent shadow on the screen. It is suitable for visualising single stranded species because the mode of action is not intercalating as in the case of use of ethidium bromide. It is preferred over it because ethidium bromide is often difficult to remove.

6. The greatest separation is obtained in which portion of the gel?

- a) Lower portion where the anode is
- b) Lower portion where the cathode is
- c) The separation is uniform all over
- d) It varies according to the quantity of the size of the molecules to be separated

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Answer: a

Explanation: The greatest separation is obtained in the lower portion of the gel where the anode is. Thus the smaller molecules are having the greatest separation because they are the one which travels farther in the gel.

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7. Which of the statements is correct for non uniform separation obtained other than the conventional one?

- a) It can be obtained via applying strong field towards the cathode
- b) It can be obtained via applying the same field on both the sides
- c) The separation is greater on the side of stronger field
- d) Its is greater towards the weaker field

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Answer: c

Explanation: Conventionally, separation is greater towards the lower portion i.e. where the anode is. In order to obtain greater separation towards the cathode, the stronger field is applied here. As the field is weaker on the anode side, the molecules retard as they move towards anode and are less separated.

8. How can gradient in the field strength be obtained?

- a) It can be obtained via varying the amount of current, keeping the resistance constant
- b) It can be obtained via varying the amount of resistance, keeping the current constant
- c) Both can be varied, but resistance is having more effect

d) Buffer-gradient gels can be used with decreasing concentration of buffer at the bottom

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Answer: b

Explanation: The gradient field strength can be obtained via varying the resistance because the current flowing throughout the gel needs to remain constant. To vary the resistance, often buffer-gradient gels and wedge gels can be used. Wedge gels are thick and thus are having lower resistance at the bottom. Whereas buffer-gradient gels with increasing concentration at the bottom are used. As the concentration increases at the bottom, resistance decreases.

9. If the molecules to be separated are larger than the size for conventional electrophoresis, which type of gels can be used?

- a) Wedge gels
- b) Buffer-gradient gels
- c) Pulse field gels
- d) Varying the amount of agarose will carry out the separation

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Answer: c

Explanation: In the case, if the molecules to be separated are very large, say the chromosomes are to be separated. In this case, pulse-field gels are used. It is termed as pulse field gel electrophoresis (PFGE).

10. Which of the following statement is correct for the method of separation of large molecules?

- a) The large DNA molecules can pass through the matrix in any direction, not necessarily in the direction parallel to the movement
- b) The separation can be carried out if the fields are at right angles to each other
- c) The time of pulse should be less than that of the reorientation time
- d) Separation is not of the megabase level

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Answer: b

Explanation: For the separation of large DNA molecules, the electric fields are often applied at right angles to each other. Usually, the large molecules pass through the matrix only in the direction of the movement. In rest directions, the movement is blocked by the gel matrix. The time of the pulse is greater than that of the reorientation time. Thus, smaller molecules have greater time for movement. DNA of megabase size can also be separated.

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# Genetic Engineering Questions and Answers – Gel electrophoresis, Oligonucleotide & Microarrays – 3

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This set of Genetic Engineering Interview Questions and Answers for freshers focuses on “Gel electrophoresis, Oligonucleotide & Microarrays – 3”.

1. Often the DNA or RNA needs to be removed from the gel to the solid support. The process can be termed as \_\_\_\_\_

- a) Blotting
- b) Transfer
- c) Chromatography
- d) DNA purification

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Answer: a

Explanation: At times, the DNA or RNA needs to be transferred from the gel to the solid support for various purposes such as analyses. This process is termed as blotting.

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2. Which of the following steps is not included in the transferring of DNA?

- a) The gel containing the DNA is immersed in the buffer in the reservoir
- b) The buffer flows up through the gel via a wick
- c) Membrane is placed over the gel
- d) The nucleic acids are dissolved in the buffer and are obtained from it via pipetting

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Answer: d

Explanation: The gel containing the DNA molecules is immersed in the buffer. The membrane is placed over the gel. The buffer rises from the wick and passes through the gel. It carries along with it, the nucleic acids and they are then trapped by the membrane. The membrane can be washed further in order to obtain the DNA.

3. If the DNA samples are to be analyzed, the membrane should be studied. Which of them is correct for it?

- a) The membrane should not be treated with UV or heat
- b) The membrane is further immersed in the buffer containing labelled nucleic acids which are known as strips
- c) Labelled nucleic acids bind to the sequences which are same as the sequences present on the membrane
- d) The banded sequences can be visualized by autoradiography

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Answer: d

Explanation: The membrane should be treated with UV or heated. It ensures the cross linking of the DNA molecules on the membrane. The labelled nucleic acids in the buffer are called a probe. These sequences bind to the complementary sequences on the membrane and can be visualized via autoradiography.

4. In the case DNA is transferred from gel to the membrane, it is known as \_\_\_\_\_

- a) southern blot
- b) western blot
- c) northern blot
- d) south-western blot

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Answer: a

Explanation: For the DNA to be transferred, it is called a southern blot. If RNA is to be transferred it is called as northern blot. For transferring of proteins it is called a western blot.

5. Oligonucleotides can't be referred to \_\_\_\_\_

- a) undefined sequences
- b) sequences that can be used as PCR primers
- c) sequences that can be used in DNA sequencing
- d) sequences that can be used in identifying complementary DNA molecules

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Answer: a

Explanation: Oligonucleotide is the defined sequences which are having various purposes such as primers in PCR. They are also used in DNA sequencing. Oligonucleotides can be used as probes in complementary base pairing reactions.

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6. Oligonucleotides are synthesized chemically. Which of the following step is involved in oligonucleotide synthesis?

- a) Nucleotide addition is done by adding many nucleotides at a time
- b) The coupling reaction should involve water
- c) Only one type of nucleotides can be added at a time
- d) Unblocking of the reactive groups leads to addition of nucleotides

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Answer: d

Explanation: Oligonucleotide synthesis is done on the basis of blocking the reactive groups so that only one nucleotide is added as the unblocking is done. The coupling reaction should not involve water because than water will do nucleophilic reaction. A mixture of nucleotides can be added at a time.

7. If the known DNA sequences are immobilized onto a solid support, it is called \_\_\_\_\_

- a) Blot
- b) Microarray
- c) DNA plate
- d) Column

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Answer: b

Explanation: In the case known DNA sequences are immobilized on a solid support, the arrangement is called a microarray. If unknown sequences are immobilized, it is called a blot.

8. In the case of microarrays \_\_\_\_\_

- a) Often the whole organism is not sequenced
- b) Changes in transcript level can be studied in response to environmental changes
- c) RNA is synthesized only after the property which is to be studied is inculcated
- d) DNA is synthesized for this RNA by transcriptase

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Answer: b

Explanation: In microarrays, often the whole organism is sequenced on the solid support such as a slide. The change in the transcript level can be studied in response to environmental changes. The RNA is synthesized both for before and after the change is to be studied. DNA is synthesized for both RNAs by reverse transcriptase.

9. The DNA is labelled with fluorescent dyes in order to study the level of transcription.

- a) True
- b) False

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Answer: a

Explanation: The DNA is labelled with fluorescent dyes. The amount of fluorescence they give corresponds to the level of transcription. The dyes which are often used are Cy3 and Cy5.

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10. If undefined sequences are immobilized, the set up is called \_\_\_\_\_

- a) Blot
- b) Microarray
- c) Plate
- d) DNA chip

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Answer: d

Explanation: In the case, undefined sequences are immobilized; the set up is called a DNA chip. They can be used by synthesis of oligonucleotides in situ using photolithography technology from the microelectronics industry.

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## Genetic Engineering Questions and Answers – The Basic Technique

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “The Basic Technique”.

1. The process of amplification of specific DNA sequences by an enzymatic process is termed as \_\_\_\_\_

- a) amplification
- b) polymerase chain reaction (PCR)
- c) translation
- d) microarrays

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Answer: a

Explanation: The process of amplification of specific DNA sequences by an enzymatic process is termed as Polymerase Chain Reaction (PCR). For the PCR to take place there should be small sequences at each end which should be known.

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2. What are primers?

- a) Primers are the short sequences at the end of the nucleotide sequences which are used for amplification
- b) Primers are the short sequences which are complementary to the nucleotides at the end of the sequence which is to be amplified
- c) Primers are the short sequences present anywhere in the nucleotide sequence to be amplified
- d) Primers are the short sequences which are complementary to the nucleotides anywhere in the sequence to be amplified

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Answer: b

Explanation: Primers are short nucleotide sequences which are complementary to the stretches at the ends of the DNA sequence to be amplified.

3. A reaction mixture for PCR consists of \_\_\_\_\_

- a) heat unstable polymerase
- b) primers in a limited amount
- c) deoxynucleoside triphosphate (dNTPs)
- d) a region complementary to the sequence to be amplified

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Answer: c

Explanation: A reaction mixture for PCR consists of the region of the DNA sequence to be amplified, primers in large molar excess, heat stable polymerase and dNTPs. Heat stable polymerase which is used commonly is Taq polymerase.

4. Which of the following is a characteristic of Taq polymerase?

- a) It is an RNA polymerase
- b) It is heat stable
- c) It is obtained from thermophilic bacterium and can be grown in the laboratory below a temperature of 75 degrees
- d) It is used in cellular synthesis processes and the optimum temperature is at least 90 degrees

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Answer: b

Explanation: Taq polymerase is a DNA polymerase obtained from thermophilic bacterium *Thermus aquatics*. It is heat stable and can be grown in the laboratory at a temperature above 75 degrees. It is used in cellular DNA synthesis processes and the optimum temperature is at least 80 degrees. It is not readily denatured by repeated cooling and heating cycles and thus is used in amplification processes.

5. These are steps taken in carrying out the PCR reaction:

- i) Attaching of primers by cooling
- ii) Denaturation of strands
- iii) DNA synthesis
- iv) Heating

Which is the correct order?

(Mentioned from starting to ending the reaction)

- a) i)-ii)-iii)-iv)
- b) ii)-i)-iii)-iv)

- c) iv)-iii)-ii)-i)
- d) iv)-ii)-i)-iii)

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**Answer:** d

**Explanation:** PCR consists of a series of steps. Firstly, the reaction mixture is heated so that the strands are separated i.e. their denaturation takes place. Then it is again cooled so that the primers are able to attach. Once the primers are attached, the synthesis of DNA is allowed. This whole process is repeated.

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**6. Which of the following is not a condition for PCR?**

- a) Initial melting carried out for 5 minutes at 94 degrees
- b) Initial melting followed by 30 cycles each consisting of melting for 1 minute at 94 degrees
- c) Renaturation for 5 minutes at 60 degrees
- d) DNA synthesis at 72 degrees for 1.5 minutes

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**Answer:** c

**Explanation:** The melting temperature is 94 degrees and the initial melting is carried for 5 minutes at this temperature. It is followed by 30 cycles each consisting of melting for 1 minute at 94 degrees. The renaturation is carried for 1 minute at 60 degrees. The DNA synthesis is carried out at 72 degrees for 1.5 minutes. After the 30 cycles, a final round of extension is carried out for 10 minutes.

**7. Primers and polymerases are added again during the reaction because they get consumed as the reaction proceeds.**

- a) True
- b) False

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**Answer:** b

**Explanation:** Primers and polymerases are not added more as the reaction proceeds. It is so because the polymerase is heat stable and is not destroyed during the reaction. Primers on the other hand are added in excess at the beginning of the reaction.

**8. All the molecules generated during PCR will not be full length. Some will also be of intermediate length. Which of the statements is correct?**

- a) After first cycle, majority of the molecules will be full length and only some will be of intermediate length
- b) In the next cycle, each intermediate molecule will generate one intermediate molecule and one target molecule
- c) The number of full length molecules increase as number of cycles proceed
- d) The number of intermediate molecules increase geometrically and the number of target molecules increase arithmetically

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**Answer:** b

**Explanation:** Intermediate molecules are those which would be having primer at one end and the other end won't be defined. After the first cycle, half of the molecules would be full length and half would be of intermediate length. In the next cycle, each intermediate molecule generates one intermediate molecule and one target molecule. Target molecule is that which is defined by primers at both the ends. The number of full length molecules remains constant. But, target molecules increase geometrically and the intermediate molecules increase arithmetically.

**9. Which of the following activity is not present in Taq polymerase?**

- a) 5'-3' polymerase
- b) 5'-3' exonuclease
- c) 3'-5' exonuclease
- d) Both 5'-3' polymerase and 5'-3' exonuclease

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**Answer:** c

**Explanation:** Taq polymerase is not having 3'-5' exonuclease activity. It is a proof reading activity and it is very important to have a check on the mutations if they are encountered in the PCR products.

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**10. Choose the correct statement.**

- a) Taq polymerase is having high processivity
- b) Processivity is defined in this case as a synthesis of DNA by polymerase
- c) It requires a 5' end for the elongation to take place
- d) The maximum size of the molecules which can be synthesized is 10kbp

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**Answer:** b

**Explanation:** Taq polymerase is having low processivity. It means that it falls off from the template before it has synthesized a large piece of DNA. It requires a 3' OH for carrying out the elongation. The maximum size of the molecules which can be synthesized is 2-4 kbp.

**11. What is the half life cycle for Taq polymerase?**

- a) 40 minutes
- b) 80 minutes
- c) 10 minutes
- d) 50 minutes

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**Answer:** a

**Explanation:** The half life cycle for Taq polymerase is 40 minutes at 94 degrees. Thus, at the end of the 30 cycles, a significant loss of activity takes place.

12. Taq polymerase incorporates which residue at 3' end?

- a) G
- b) T
- c) A
- d) C

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Answer: c

Explanation: It incorporates A residue at the 3' end. This overhang is often useful in carrying out the cloning of these PCR products.

13. Polymerases are also available from other Thermus species. Which of the following is correct?

- a) Thermus flavus gives Tfl enzyme
- b) Thermus thermophilus gives Tfl enzyme
- c) They are having proof reading activity
- d) Thermus flavus gives Tth enzyme

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Answer: a

Explanation: Other Thermus species also provide polymerases. Thermus flavus gives Tfl enzyme and Thermus thermophilus gives Tth enzyme. They are also 3'-5' proof-reading activity.

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14. Polymerases are available with proof reading activity. Which of the following are the characteristics of these types of polymerases?

- a) They add A residue at 3' end
- b) They are obtained from Thermococcus litoralis
- c) They can't be obtained from archaeabacteria
- d) The marine bacteria from which they are obtained grow at temperatures lower than that of Thermus aquatics

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Answer: b

Explanation: As these polymerases are having a proof-reading activity, they generally don't add any residue at the end. They are obtained from bacteria such as Thermococcus litoralis and grow at temperatures above than that of Thermus aquatics. They can also be obtained from archaeabacteria.

15. Thermococcus litoralis grows at a temperature upto 98 degrees.

- a) True
- b) False

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Answer: a

Explanation: Thermococcus litoralis grows at a temperature upto 98 degrees. The half life is also high, 90% of its activity is retained after 1 hour of incubation at 95 degrees.

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## Genetic Engineering Questions and Answers – Primers

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Primers”.

1. Primers are generally \_\_\_\_\_

- a) 20-30 nucleotides long
- b) 40-50 nucleotides long
- c) as long as the template is
- d) taken according to the amount available

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Answer: a

Explanation: Primers are generally short in length. They are 20-30 nucleotides long. It is easier to match short primers with the template in comparison to long primers. But in the case of eukaryotic DNA as a template, long primers are preferred.

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2. Which end of the primer should be matched properly in order to carry out the amplification?

- a) 5' end
- b) 3' end
- c) Both of the ends should be matched properly
- d) Anyone of the ends should match

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Answer: b

Explanation: For carrying out the amplification, it is not necessary that the whole primer should match with the template. But it is necessary that 3' end should match because if 3' end is not matched the polymerase won't be able to carry out elongation.

3. Which of the following nucleotides should be there at 3' end?

- a) Any of A, T, G or C will work out
- b) Either A or T
- c) Either G or C
- d) Specifically G

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Answer: c

Explanation: At 3' end, either G or C should be present. It is so because; these form three hydrogen bonds and thus are stronger. Whereas, A and T form only two hydrogen bonds and thus are comparatively less strong than G or C.

4. Melting temperature is given by \_\_\_\_\_

- a)  $4(G+C) + 2(A+T)$
- b)  $2(G+C) + 4(A+T)$
- c)  $2(A+G) + 4(C+T)$
- d)  $4(A+G) + 2(C+T)$

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Answer: a

Explanation: The melting temperature is that temperature at which the primers associate with the template. The melting temperature is decided by the amount of different nucleotides present.

5. Both the primers, the start primer and the end primer should have a nearly same melting temperature.

- a) True
- b) False

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Answer: a

Explanation: Both the primers should have a nearly same melting temperature. It is so because then they would nearly bind at the same time as the temperature is being lowered for their annealing.

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6. Why internal secondary structures are not preferred for primers?

- a) Internal structures are very bulky and thus elongation is not preferred
- b) Because of it, primer may fold back on itself and won't be available for template
- c) Internal secondary structures require more amount of template

d) If internal structures are present, no proof reading would be observed

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Answer: b

Explanation: Internal structures are not preferred because if they are present the primer may fold back on itself. As the primer folds back on it, it is not available for the template. As an intramolecular reaction, self annealing is preferred over intermolecular annealing of primer to the template.

7. Which of the following is favoured for primer design?

- a) The melting temperature should be different for both the primers
- b) Primers should be long in length
- c) Primers should not be complementary to each other
- d) Matching should be of whole primer to the template

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Answer: c

Explanation: Primers should not be complementary to each other. It is so because if they are complementary, primer dimer formation takes place. If primer dimer is formed, proper elongation won't be taking place.

8. What will happen if the amino acid sequence is used directly for primer designing?

- a) There would be certainty because the genetic code is unique for each amino acid
- b) There would be uncertainty as the genetic code is degenerate and none of the amino acid is having a unique code
- c) There would be uncertainty as the genetic code is degenerate but some of the amino acids such as methionine are having a unique codon
- d) The amount of uncertainty or certainty is a matter of chance

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Answer: c

Explanation: If the amino acid sequence is used directly, there would be uncertainty. It is so because the genetic code is degenerate. It means that one codon can correspond to many amino acids. There are some exceptions such as methionine which are having a unique codon.

9. In the case of uncertainty, if more than one nucleotide is included at a position it is called \_\_\_\_\_

- a) mixed site
- b) polynucleotide site
- c) unique site
- d) degenerate site

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Answer: a

Explanation: If uncertainty is there at times, more than one nucleotide can be included in one position. And in this condition it is called a mixed site.

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10. What is the property of inosine?

- a) Having narrow range of pairing capabilities
- b) Having a broad range of pairing capabilities
- c) The pairing capability is the same as the normal nucleotides
- d) It is abbreviated as A

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Answer: b

Explanation: It is having a broad range of pairing capabilities and thus can be used in order to have less amount of uncertainty.

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## Genetic Engineering Questions and Answers – Applications

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Applications”.

1. Which of the following is useful in applications of PCR?

- a) It is manual
- b) Only one sample's analysis can be carried out at a time
- c) It is having a high speed
- d) The amount of DNA required initially is high

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Answer: c

Explanation: PCR is having numerous advantages over normal cloning procedures. It is automated and many samples can be analysed at a time simultaneously. It is having a high speed and the initial amount of DNA required is very less.

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2. What is the correct statement with respect to ddNTPs?

- a) They are dideoxynucleotide triphosphates
- b) They are used in the termination of DNA sequencing
- c) They are used for initiating DNA sequencing
- d) They are used in the case if the starting amounts are large

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Answer: b

Explanation: ddNTPs are dideoxynucleoside triphosphates. It is used in the case for termination of sequencing. It is so because, both the hydroxyl molecules are removed sequencing would be terminated. It is beneficial in the case if the initial amounts are less.

3. Cycle sequencing is the DNA sequencing where very less amounts of template are utilised for carrying out the sequencing.

- a) True
- b) False

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Answer: a

Explanation: Cycle sequencing is that when very less amounts of DNA template is used for carrying out the sequencing. And the whole process is facilitated by the use of ddNTPs.

4. Sickle cell anaemia is a genetic disorder. Which of the following doesn't hold true for it?

- a) It can be analysed by PCR
- b) It destroys a restriction site
- c) The mutation is in alpha globulin gene
- d) The conventional approach took weeks for the whole analyses to be carried out

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Answer: c

Explanation: Sickle cell anaemia is a mutation in the beta globulin gene. It destroys a restriction site and the analyses can be carried out by PCR. PCR is very fast in comparison to conventional methods which took weeks to be completed. And the former method is completed in just one day.

5. PCR products can be analysed in many ways. Which of the following is not possible?

- a) Use of restriction enzymes
- b) Determining whether a particular oligonucleotide probe hybridizes to a PCR product
- c) Electrophoresis
- d) Direct sequencing can't be carried out

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Answer: d

Explanation: Restriction enzymes can be used and analyses can be done via destroying the restriction site. Checking for the hybridization of oligonucleotide probe with a PCR product. Electrophoresis can be used to check the mobility and compare it with a wild type molecule. Direct sequencing can also be carried out in order to analyse the PCR product.

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6. Which of the statements don't hold true for the forensics and the amplification carried out?

- a) In the case of forensics, conventional methods such as southern blotting are used very effectively
- b) In cases of bone fragments which contain less than 300 nucleotides conventional methods can't be applied as they involve southern blotting, restriction digestion etc
- c) The poor condition of DNA also makes the PCR amplification difficult
- d) Microsatellites composed of simply varying repeats of CA sequences are used

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Answer: a

Explanation: In the case of forensics conventional methods are not very useful. If the bone fragments are having less than 300 nucleotides then the conventional methods can't be applied easily.

7. The genetic relatedness between organisms can be identified by studying the band patterns when different PCR products are analysed electrophoretically. This method is called as \_\_\_\_\_

- a) restriction fragment length polymorphism (RFLP)
- b) amplified fragment length polymorphism (AFLP)
- c) random amplification of polymorphic DNA (RAPD)
- d) polymorphism

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Answer: c

Explanation: The genetic relatedness between organisms can be identified by studying the band patterns of different PCR products. This process is termed as random amplification of polymorphic DNA (RAPD).

8. PCR is useful in population genetics because at times it can be used to study genetics of bacteria that can't be cultured axenically.

- a) True
- b) False

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Answer: a

Explanation: If properly designed primers are used then it is possible to amplify DNA from one organism that can't be separated from others. For say a bacterial strain in a mixed population.

9. PCR amplification can be used for which type of samples?

- a) Old samples only
- b) Recent samples only
- c) Equally to both recent and old samples
- d) Recent samples are preferred but can be applied to old samples also

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Answer: c

Explanation: PCR amplification can be used equally to both recent and old samples. DNA from museum samples and archaeological sites is also used for amplification.

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10. What is the problem associated with historical DNA samples?

- a) They are less in amount thus amplification is difficult
- b) Because the samples are very old, there can be contamination
- c) They degrade during repeated cooling and heating cycles
- d) As the samples are old, the standard sequences for comparison is not present

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Answer: b

Explanation: The historical DNA samples though can be analysed but the main problem with them is that the duration for which they can be used. As the samples are very old they are often contaminated by bacteria.

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# Genetic Engineering Questions and Answers – Precautions and Drawbacks

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Precautions and Drawbacks”.

1. Which of the statement holds for long-range PCR and in its relation?
  - a) It is the PCR in which longer templates are used
  - b) DNA polymerases which don't have proof-reading activity give larger products
  - c) DNA polymerases' processivity is not a measure to have larger products
  - d) It is PCR in which a mixture of enzymes is used to have larger products

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Answer: d

Explanation: Long range PCR is the PCR in which a mixture of enzymes is used to have larger products. If DNA polymerases are having proof reading activity then we can obtain larger products because in this case chain terminators are not used. Also, the processivity of the enzymes is also very important.

2. Which of the following conditions don't contribute to wrong annealing to primer?
  - a) Chance complementarity
  - b) Conditions of annealing
  - c) The original sequence of the primers
  - d) Both the conditions of annealing and the original sequence don't play any role

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Answer: d

Explanation: There are cases when wrong annealing of the primer takes place. It can happen because of chance complementarity, conditions of annealing such as ionic concentration and temperature. The original sequence of the primers is very important.

3. How can the specificity of primer annealing be increased?
  - a) Use of short primers
  - b) Raising temperature
  - c) Adjusting the concentration of sodium ions
  - d) Using polymerase with proof reading activity

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Answer: b

Explanation: The specificity of primers annealing can be increased in various ways such as increasing temperature, using long primers. If long primers are used there are increased chances of having correct matching. Also, if the magnesium ion concentration is adjusted, annealing can be done more effectively. It is so because they stabilize primer-template binding.

4. There are basically two types of contamination, laboratory and external. If a PCR product is found to be contaminated by bacteria. It comes under laboratory contamination.

- a) True
- b) False

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Answer: b

Explanation: Laboratory contamination consists of aerosols in pipettes from previously formed PCR products or related DNA sequences. External contamination includes contamination from bacteria, fungi and other human contamination.

5. Which can be used as a precaution in order to minimize contamination?

- a) Careful use and design of pipettes
- b) Placing the pre-PCR and post-PCR stages in the same rooms
- c) Extracting the DNA along with surface layers
- d) Use of primers carefully is not very important

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Answer: a

Explanation: Pipettes are very important in minimizing contamination. Thus they should be designed and used carefully. The pre-PCR and post-PCR stages should be placed in separate rooms. While extraction of DNA surface layers should be removed because they might be containing bacteria. Sometimes the use of species specific primers is also very important, thus they should be used carefully.

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6. During amplification, there are chances of having a product of a mixture of different sequences. There are various ways to detect it. Which of the statement is true in regard to it?

- a) Direct sequencing can't be used in the case if the template DNA is heterozygous at the locus
- b) Direct sequencing can be used if the template DNA is heterozygous at the locus
- c) If cloning is done before sequencing, then it is detected via using only a single clone for sequencing
- d) In the case several recombinants are used, it can't go undetected

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Answer: b

Explanation: If the template DNA is heterozygous at the locus, it can be detected via using direct sequencing. It is so because it would give rise to two different signals at the same nucleotide position at the sequence output. If the cloning is done before sequencing, a single clone won't be helpful to detect heterogeneity. It is because single clones are derived from a single PCR product. Also, if several recombinants are used, there are chances that they go undetected.

7. If the template DNA belongs to several individual rather than single one, this type of heterogeneity is known as \_\_\_\_\_

- a) Heterozygosity
- b) Product heterogeneity
- c) Population heterogeneity
- d) Template heterogeneity

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Answer: c

Explanation: If the template DNA belongs to several individuals then this type of heterogeneity is known as population heterogeneity. It also gives rise to heterogeneity in PCR products.

8. Heterogeneity can also arise if DNA is damaged before amplification. Which of the following doesn't cause DNA damage?

- a) Amination of bases
- b) Chemical cross-linking between the strands
- c) Chemical cross-linking within the strands
- d) Slowing down the polymerase

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Answer: a

Explanation: There are various reasons for DNA damage such as chemical cross-linking both between and within the strands. Deamination of bases is also one of the reasons. If polymerase is slowed down there are chances of incorporation of incorrect bases.

9. If cytosine is deaminated, which of the base is formed?

- a) Thymine
- b) Guanine
- c) Adenine
- d) Uracil

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Answer: d

Explanation: If cytosine is deaminated it leads to the formation of Uracil. This Uracil is further read as Thymine during DNA synthesis.

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10. Which of the statement is correct for misincorporation?

- a) If direct sequencing has carried this misincorporation is a great problem
- b) The erroneous molecules give strong signals than genuine molecules in case of misincorporation
- c) If the misincorporation in cloned PCR products it is a problem
- d) Even if the error is induced at an early stage it is not incorporated in many sequences

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Answer: c

Explanation: If the misincorporation takes place and direct sequencing is carried out, it is not a major problem. It is so because only small portion of molecules have it and thus the signals are weaker than that of genuine molecules. If the misincorporation is in cloned PCR product, it is of great problem. It is so because if it is included at an early stage, they are incorporated in many sequences.

11. Errors can be introduced because of many reasons such as polymerase error or because of heterogeneity. Which of the statement holds true?

- a) The error caused because of polymerase is biased for the first position in the codon
- b) The error caused because of polymerase is evenly distributed on all the positions in the codon
- c) The error caused by sequence heterogeneity is mainly because of first position in the codon
- d) The error caused by sequence heterogeneity is evenly distributed on all the codon positions

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Answer: b

Explanation: The error caused by polymerase whether due to template change or not, it is always distributed evenly over all the codon positions. If the error is caused by sequence heterogeneity is concentrated on the third codon position. It generally doesn't lead to amino acid substitution.

12. Which of the statement is incorrect for jumping PCR?

- a) It is used in the case when the DNA fragment is degraded
- b) In this type of PCR, the molecules are not long enough to span between the two primer sites
- c) At the end of first round of synthesis, the extension of the molecule from the primer site to the end of the fragmented molecule takes place
- d) It doesn't lead to the formation of chimeric product

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Answer: d

Explanation: Jumping PCR is used in the case when the molecule is not long enough to span between the two primer sites. At times, the whole amplification doesn't take place at one go and hence molecule anneals to other fragment having another portion. Thus at times, PCR products longer than the template are designed. But the disadvantage is that it leads to the formation of chimeric products at times.

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# Genetic Engineering Questions and Answers – Modifications in PCR – 1

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Modifications in PCR – 1”.

1. What are the possibilities which can occur until the temperature has reached for primer annealing?

- a) Extension doesn't start until the appropriate temperature is reached
- b) Extension may start even when the temperature is low
- c) At low temperature, there is specific annealing of primer taking place
- d) There are more specific products which are generated

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Answer: b

Explanation: Until the temperature has reached for primer annealing there are chances of extension by polymerase. It is so because at low temperatures primer can anneal in a non specific manner and thus non specific products are generated.

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2. Hot-start PCR is a modification of PCR. Which of the following is not corresponding to it?

- a) The basis is that extension is not started until the first cycle reaches its maximum temperature
- b) The polymerase is added after the first cycle has reached its maximum temperature or melting temperature
- c) It is satisfactory for small number of samples
- d) It leads to generation of non specific products

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Answer: d

Explanation: Hot-start PCR is a modification which is used in order to overcome the problem of the extension before the maximum temperature of first cycle is reached. Hence, polymerase is added only after the maximum temperature for first cycle is reached. Hence, there are more specific products which are generated because proper annealing of primers has taken place. It is suitable for a small number of samples but not for a large number of samples.

3. An alternative to adding polymerase at later stage is \_\_\_\_\_

- a) Make the polymerase inactive by binding it to an antibody
- b) Introduce the polymerase or Magnesium in clay beads
- c) Make the polymerase inactive by attaching groups which cause stearic hindrance
- d) Introduction of polymerase or Magnesium in plastic wires

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Answer: a

Explanation: An alternative to start the extension at higher temperature is to make the polymerase inactive by binding an antibody to it. The antibody detaches itself at a higher temperature and thus polymerase is activated at higher temperature. Also, the polymerase or Magnesium can be introduced into wax beads and these beads melt at higher temperatures. Magnesium is required for the polymerase to function.

4. The primer annealing temperature is often very low from the maximum temperature. This low temperature leads to some mismatches.

- a) True
- b) False

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Answer: a

Explanation: The primer annealing temperature is often very low from the maximum temperature. Though the low temperature is for stable binding of the template and the primer but at times it leads to mismatches.

5. Touch-down PCR is another modification. Its characteristics include:

- a) Lowering the temperature for primer annealing
- b) Primer annealing is done at higher temperatures initially
- c) The temperature is abruptly reduced in the second cycle
- d) In earlier cycles less stringent conditions are there and in later cycles, more stringent conditions are there

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Answer: b

Explanation: It is done in order to overcome the slight mismatch which takes place at lower temperatures. For this, initially the temperature is kept very high and it is reduced in further cycles. As the temperature is reduced, a stage is reached at which correct primer-template binding is possible but not the incorrect one. In this, in the earlier cycles more stringent conditions are there and in later cycles less stringent conditions are there.

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6. If two successive PCR are carried out, it is called as \_\_\_\_\_

- a) Touch-down PCR
- b) Hot-start PCR
- c) Combined PCR
- d) Nested PCR

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Answer: d

Explanation: Nested PCR is that in which two PCRs are carried out. In the first PCR, it uses a conventional template and the second PCR is carried out using the product of first PCR as a template.

7. If two successive PCRs are carried out, in which PCR there are chances of having a non-specific product?

- a) First PCR
- b) Second PCR
- c) Both the PCRs
- d) It depends on the annealing temperature

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Answer: a

Explanation: If two successive PCRs are carried out, there are non-specific products created in the first PCR. But there are least chances that non-specific products also have annealing sites for both the primers in the second PCR. Hence, non specific products are not generated in the second PCR.

8. The process of inserting an amplified PCR product in a vector for cloning is known as \_\_\_\_\_

- a) making library
- b) insertion
- c) making a hard copy
- d) making a PCR based vector

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Answer: c

Explanation: The process of inserting an amplified PCR product in a vector for cloning is termed as making a hard copy. It is further maintained by conventional means.

9. How can PCR product be cloned into a vector?

- a) It can be done only when PCR products are blunt-ended
- b) It can be done only by restriction enzyme digestion
- c) Both the methods can be used
- d) The blunt-ended approach is favoured

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Answer: b

Explanation: PCR product can be cloned into a vector if the DNA molecules are blunt ended or it can also be done by restriction enzyme digestion. In restriction enzyme digestion restriction sites are introduced.

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10. Which of the following statement is incorrect regarding the cloning of PCR products?

- a) In cloning via restriction enzymes, restriction sites are induced before amplification is carried out
- b) The restriction sites are induced in the primers before annealing
- c) The intermediate molecules are having restriction sites at both ends
- d) The amplified molecules can be cut at both the ends by appropriate enzymes

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Answer: c

Explanation: If cloning is done via restriction enzymes, restriction sites are induced before amplification. The restriction sites are induced in the primers before annealing. As the primer binds, the restriction sites are induced at one end of the intermediate molecule. In full length molecules, restriction sites are at both ends. And the amplified molecules can be cut at both the ends by appropriate enzymes.

11. Topoisomerase I is also used for cloning of PCR product at times. Which of the statement holds true for such type of cloning?

- a) The restriction site is induced into the vector and the topoisomerase enzyme is induced into the PCR primers
- b) The topoisomerase I is used for cutting both the strands
- c) The induction of topoisomerase enzyme is done into the vector in the case it is very small in size
- d) The restriction site is induced into the PCR primers and the topoisomerase enzyme is induced into the vector

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Answer: d

Explanation: In the case of this type of cloning, the restriction site is induced into the PCR primers and the enzyme is induced into the vector. The enzyme cuts the PCR product at the restriction site and joins it to the vector. Topoisomerase I is responsible for cutting only one strand and Topoisomerase II cuts both the strands.

12. Generally, amplification is carried out between the PCR primers. But if amplification is carried out outside the primers, it is called as \_\_\_\_\_

- a) Inverse PCR
- b) Circular PCR
- c) Non-conventional PCR
- d) In-situ PCR

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Answer: a

Explanation: Generally, the amplification is carried out of the region which is flanked by the primers. But in inverse primers amplification is carried out of the region which lies outside the primers.

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# Genetic Engineering Questions and Answers – Modifications in PCR – 2

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This set of Genetic Engineering Questions and Answers for Experienced people focuses on “Modifications in PCR – 2”.

1. Which one of the following is not done if amplification of the non flanking region is carried out?
  - a) Firstly, restriction enzyme digestion is done of those sites whose sequence is not known
  - b) Then the self-ligation of molecules is allowed
  - c) Now the molecules are cleaved where the known sequence is
  - d) Again, the molecules are linearized and the known sequence is in the middle

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Answer: d

Explanation: If such amplification has to be carried out, firstly the restriction enzyme digestion is done at those sites whose sequence is not known till now. Then self ligation is carried out i.e. conditions for intramolecular ligation is applied. As the molecules circularize now, cleavage is carried out of known sequence. As the known sequence is cleaved, the molecule is now cleaved with a known sequence at the ends. As it known sequence, primers can be constructed for it and the unknown region is amplified.

2. Reverse transcriptase PCR is also carried out at times. Which of the statement is true?
  - a) Amplification of RNA samples is not required for knowing the abundance of mRNA
  - b) Both the start and the end primers are used
  - c) Only a single cDNA strand is synthesized before the PCR
  - d) The primer used is always specific

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Answer: d

Explanation: Reverse transcriptase PCR is carried out by the use of reverse transcriptase enzyme. RNA amplification is necessary at times to know the abundance of mRNA. In this only one primer is used and one cDNA strand is synthesized before the PCR. The primer can be oligo-dT for general cDNA synthesis or a specific primer is used.

3. Which type of PCR allows the use of permeabilized tissue?

- a) Inverse PCR
- b) In-situ PCR
- c) Quantitative PCR
- d) Hot-start PCR

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Answer: b

Explanation: In-situ PCR allows the use of permeabilized tissue, such as thin sections on a microscopic slide. The PCR product is detected by hybridization and it allows locating the nucleic acid in the target tissue.

4. How many approaches are there for measuring the quantity of PCR products?

- a) 1

b) 2  
c) 3  
d) 4

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Answer: b

Explanation: There are basically two approaches for measuring the amount of PCR products. These are known as end-point approach and real time approach. In end-time approach, the amount is measured once the PCR is done. In real time approach the amount is measured while the PCR reaction is still going on.

5. Which of the statement hold true for Quantitative PCR?

- a) A fluorescent dye is used which binds on single stranded DNA molecules
- b) SYBR green is an example such type of dye
- c) The quantity of DNA is simply measured by measuring the amount of fluorescence
- d) This approach is useful if the products are non-specific in nature

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Answer: c

Explanation: A fluorescent dye is used which binds on double stranded DNA molecules and SYBR green is an example of such type of dye. The quantity of DNA is measured by simply measuring the amount of fluorescence. It is used only in the case if products are created specifically because it simply relies on binding of the dye to double stranded molecules.

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6. In another method of quantitative PCR, reporter-quencher set up is used. Which of the statement holds true for this methodology?

- a) It allows detection of all double stranded molecules
- b) The reporter and quencher are the molecules present on the same probe
- c) The quencher is having a fluorescent group
- d) Fluorescence is observed only when both the groups are present in proximity to each other

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Answer: b

Explanation: This method allows the detection of only specific molecules. It is so because the probes are specific for areas to be amplified. The probe consists of reporter at one end and quencher at the other. The reporter consists of the fluorescent group which fluoresce only when the quencher is released. Quencher is released as a specific binding of the probe is taking place.

7. By using two oligonucleotides, we can measure the amount of quantity of DNA by measuring the amount of fluorescence. The first probe absorbs light and the second emits it at a particular wavelength.

- a) True

- b) False

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Answer: a

Explanation: If two oilgonucleotides are used, which bind nearby to the target DNA help in quantifying the DNA. The first probe is meant for absorbing light and the second probe absorbs the light emitted by the first one and then re-emits it. DNA is quantified by measuring the fluorescence from the second probe and it is possible only when both the probes are close to each other i.e. they have bound to the location near the target DNA.

8. Choose the correct statement with regard to quantitative PCR?

- a) End-point PCR is favourable over real time PCR
- b) In real time PCR, quantification is done as the reaction is going on
- c) If the product measurement is done after the completion then the measurement is done by target sequence and no other factor affects it
- d) If the primers are available in limited amount, then the product obtained is proportional to the target sequence

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Answer: b

Explanation: Real-time PCR is favourable over end-point PCR. It is so because real-time PCR is performed when the PCR is going on and the end-point PCR is performed when the PCR has been completed. In the end-point PCR, it is limited by the amount of reactants such as primers. If fewer amounts of primers are there, the product formed is less and is not proportional to the amount of target sequence only.

9. Mutation is never deliberately induced in PCR products.

- a) True

- b) False

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Answer: b

Explanation: Mutation is deliberately induced in PCR product at times and the process is termed as mutagenesis. In mutagenesis, primers are constructed in such a way that they correspond to the mutated sequence rather than the original one.

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10. If amplification of one of the strand is favoured, the modification of PCR is known as \_\_\_\_\_

- a) single-strand PCR
- b) partial PCR
- c) asymmetric PCR
- d) anchored PCR

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Answer: c

Explanation: If the amplification of one of the strand is preferred, it is called asymmetric PCR. This leads to the formation of single stranded products which are

having uses such as in sequencing.

11. Which of the statement is incorrect for anchored PCR?

- a) Anchored PCR is the modification in which only one piece of the sequence is known and thus one primer
- b) The known sequence is attached to the required region of amplification and then further used as a second priming site
- c) Fragment the sample DNA and ligate it to known sequence
- d) Tails are added enzymatically to the region of known sequence

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Answer: d

Explanation: Anchored PCR is based on the fact that only a piece of the sequence is known and thus only one primer. The known sequence is attached to the required region of amplification and is further used as a second priming site. The sample DNA is fragmented and ligated to known sequence. Also, enzymatically tails are added to the sample DNA or to the molecules formed after first round of synthesis. This tail can be further used as a primer.

12. Emulsion or droplet PCR is another modification of PCR. Which of the statement holds true?

- a) It is possible to incorporate the reagents in a lipid drop
- b) It refers to the PCR carried out at large scale
- c) The temperature variation is not possible easily
- d) If there is a single template molecule at the start then amplification results in the mixture and it because of the extent of extension carried out

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Answer: a

Explanation: It is possible to incorporate the reagents in a lipid drop. In this type, PCR is carried out at a small scale. The temperature of these drops can be varied easily. If there is a single template in the DNA molecule then the amplification results in only one type of molecules.

13. Isothermal amplification is carried out at times. Which of the statement is true?

- a) The repeated heating and cooling required by PCR is not the reason for limiting how quickly the reaction is carried out
- b) It is carried out typically at 65 degrees
- c) Normal Taq polymerase is used
- d) It requires expensive PCR machines to be carried out

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Answer: b

Explanation: Isothermal PCR is that in which the reaction is carried out at typically 65 degrees. The repeated heating and cooling cycles required by the PCR is the reason for limiting how quickly the reaction is carried out. In this case, DNA polymerase with strand displacing activity is used and it avoids heating at high temperatures. It is a rapid process and expensive PCR machines are not used.

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# Genetic Engineering Questions and Answers – Cloning using a Simple Plasmid and Alpha Complementation – 1

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Cloning using a Simple Plasmid and Alpha Complementation – 1”.

1. Plasmids are used for carrying out the cloning procedure. Which of the statement is true for plasmids?

- a) Bacterial plasmids are linear in nature
- b) They are single stranded
- c) Insertion of DNA into plasmid allows it to be propagated in host cells and they are known as vectors because of their this property
- d) They are not capable of replication in bacteria

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Answer: c

Explanation: Plasmids are double stranded and they are circular in nature. They are capable of replication in bacteria. Insertion of DNA into plasmid allows it to be propagated in host cells and the molecules which are used for propagation by this method are called as vectors.

2. Which of the following characteristic is not present in a plasmid on a general basis?

- a) Multiple cloning site (MCS)
- b) Origin of replication (ori)
- c) Antibiotic resistance gene
- d) Beta galactose genes

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Answer: d

Explanation: Plasmid generally consists of characteristics such as multiple cloning site, origin of replication, antibiotic resistant genes and beta galactosidase genes. An origin of replication is necessary for the replication to take place.

3. Bla is a gene, which is incorrect for it?

- a) It is an antibiotic resistance genes
- b) Antibiotic acts by blocking the cross-linking of the bacterial cell wall and thus leading to lysing of cells
- c) It encodes beta lactamase enzyme
- d) The beta lactam ring is activated

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Answer: d

Explanation: Bla is an ampicillin resistant gene. Antibiotic acts by blocking the cross-linking in the bacterial cell wall and thus leading to lysing of the cells. If antibiotic resistant gene is used, which encodes for beta lactamase enzyme it inactivates the beta lactam gene by hydrolysing it.

4. Which of the characteristics is present in lacZ gene?

- a) It encodes for beta galactosidase enzyme
- b) Beta galactosidase enzyme is responsible for cleaving monosaccharides into the constituent elements
- c) It doesn't cleaves a substrate called as X-gal
- d) But if X-gal is cleaved, it liberates pink coloured dye

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Answer: a

Explanation: lacZ gene encodes for beta galactosidase enzyme. This enzyme is responsible for cleaving of disaccharides into monosaccharides. It cleaves a substrate known as X-gal, which then liberates a blue dye.

5. Which of the following orientation is not propagated to later stages?

- a) Circular plasmids having genomic DNA
- b) Intramolecular ligation of plasmids
- c) Linear molecules
- d) Head to head ligation of two DNA plasmids

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Answer: c

Explanation: When a cloning experiment is carried out, there various orientations which are possible. The orientation which is not propagated to the later stages is a linear molecule. Other possible orientations are relegation of plasmid, intramolecular ligation of genomic DNA. Intermolecular ligation of two DNA plasmids and genomic plasmids is also possible.

6. Molecules having new combination of sequences that were not present before are called as \_\_\_\_\_

- a) intermolecular ligants

- b) recombinants
- c) couple
- d) intramolecular ligands

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Answer: b

Explanation: After cloning experiment is carried out, there are various orientations possible. Molecules having combination of new sequences which were not present earlier are called as recombinants.

7. Insertion of DNA into lacZ gene may lead to disruption of the gene function.

- a) True
- b) False

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Answer: a

Explanation: Insertion of DNA into lacZ gene may lead to disruption of the gene function. It always doesn't so but there are minimal chances that function is not disrupted because often it leads to shifting of the reading frame.

8. Transformation efficiency is defined as \_\_\_\_\_

- a) ratio of transformed colonies by microgram of sample DNA that is to be inserted
- b) ratio of transformed colonies by amount of sample DNA that is to be inserted
- c) ratio of transformed colonies by microgram of plasmid DNA
- d) ratio of transformed colonies by amount of plasmid DNA

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Answer: d

Explanation: Transformation efficiency is defined as the ratio of transformed colonies to that of the amount of plasmid DNA which is taken. It is often altered by altering the competence of the cells.

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9. After carrying out the cloning experiment, the cells are plated on agar. Along with agar, it also contains antibiotic resistant genes, X-gal and an inducer of lacZ gene. Which of the following would grow?

- a) Cells that have taken up plasmid DNA
- b) Cells that have taken up genomic DNA
- c) Cells having no insert
- d) Cells either having no insert or having genomic DNA

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Answer: a

Explanation: Only cells that have taken up the plasmid DNA would be able to grow. It is so because the only plasmid is having antibiotic resistant genes and the rest will die after a few generations.

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## Genetic Engineering Questions and Answers – Cloning using a Simple Plasmid and Alpha Complementation – 2

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This set of Genetic Engineering Interview Questions and Answers for Experienced people focuses on “Cloning using a Simple Plasmid and Alpha Complementation – 2”.

1. Which of the following is true regarding taking up of plasmid DNA in the bacterial cells?

- a) There are more chances of having two plasmids in a single cell
- b) There are more chances of having a single plasmid in one cell
- c) Uptake upto two plasmids is possible but not more than that
- d) Both are taken up with the same efficiency

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Answer: b

Explanation: There are more chances of having a single plasmid in one cell. But there are possibilities of having two plasmids in a single cell but the chances are less.

2. If genomic DNA has been inserted instead of the plasmid, what will happen?

- a) It would lead to inactivation of lacZ gene
- b) The X-gal substrate would be broken down
- c) The colonies formed are blue in colour
- d) The lacZ gene would be intact

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Answer: a

Explanation: If genomic DNA is inserted instead of the plasmid the lacZ gene would be inactivated. The X-gal substrate won't be broken down and thus the colonies formed would be white or off-white.

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3. Often PCR can be performed in order to confirm whether an insert is present in the plasmid. Cells are taken directly and PCR is performed, this type of PCR is known as \_\_\_\_\_

- a) direct PCR
- b) colony PCR
- c) quantitative PCR
- d) in-situ PCR

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Answer: b

Explanation: When cells from colonies are taken and directly PCR is performed, it is called as colony PCR. Primers anneal to each side of the cloning site and there is no need of purification in such cases.

4. Generation of recombinants by randomly cloning fragments of total DNA from an organism is called as \_\_\_\_\_

- a) genomic library
- b) screening
- c) recombination
- d) shotgun cloning

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Answer: d

Explanation: Generation of recombinants by randomly cloning the fragments of total DNA from an organism is called as shotgun cloning. Collection of such fragments is known as a library.

5. The phenomenon of alpha complementation is \_\_\_\_\_

- a)  $a + \beta = ?$
- b)  $a = \beta + ?$
- c)  $\beta = a + ?$
- d) It is either  $a + \beta = ?$  or  $\beta = a + ?$

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Answer: a

Explanation: Alpha complementation is the phenomenon of having the alpha and beta subunit combining to give the omega subunit. These are the different genes of the lac operon.

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6. An operon is defined as \_\_\_\_\_

- a) A related set of genes each having different promoters and are present differently
- b) A set of genes which are present together but are controlled by different promoters
- c) A set of genes which are present together and are controlled by the same promoter
- d) A set of genes which are not present together but controlled by the same promoter

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Answer: c

Explanation: An operon is defined as the cluster of genes which are present together and are controlled by the same promoter. An example is lac operon. It consists of three subunits, alpha, beta and omega.

7. Why the whole lacZ gene can't be present in the plasmid at one time?

- a) Because the whole lacZ gene can't be present anywhere
- b) The whole lac Z gene is very large in size and the plasmid size is small
- c) The whole lacZ gene is never functional
- d) Because the plasmid takes is having a restriction site only for taking up a portion of the lacZ gene

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Answer: b

Explanation: The whole lacZ gene is not present in a plasmid because the plasmids are generally small in size and the lacZ gene is large in size. And if the whole gene is present, it makes the overall size very large.

8. Alpha complementation is an indicator of lacZ system. Which of the statement is incorrect for it?

- a) One portion of the lacZ gene known as minigene is present in the plasmid
- b) Another portion is present in the host itself
- c) If they both are allowed to combine in the presence of IPTG, X-gal and ampicillin, blue colonies are observed
- d) If insert is also present along with host and plasmid, it results in the formation of blue colonies

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Answer: d

Explanation: Alpha complementation system is used as a lacZ indicator system. In this, one portion of the lacZ gene is present in the plasmid and is termed as minigene. The other portion is present in the host itself. The combining of two portions is very important to have an intact lacZ gene and in the case, it is intact blue colonies are observed in the presence of IPTG, ampicillin and X-gal. It is so because lacZ breaks down X-gal and it gives blue colour. If the insert is also there, the lacZ gene is interrupted and thus X-gal is not broken down and hence white colonies are obtained.

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## Genetic Engineering Questions and Answers – Vectors

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Vectors”.

1. What will be the consequence of not having an origin of replication (ori) in the vector?
  - a) If an ori is absent, replication of vector would not take place
  - b) As the cells divide after taking up the vector, both the daughter cells would be having the vector
  - c) A colony of transformed colonies is observed
  - d) The vector won't be taken up by the cell

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Answer: a

Explanation: In the case ori is absent, the vector won't be able to replicate. As the replication won't take place, only one of the daughter cells would be having the vector. A colony of transformed colonies won't be obtained. The puc18 ori came from a plasmid in clinical bacterial isolate and was called as pMB1.

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2. It is required to distinguish between the cells that have taken up the vector and that have not. It is done by using \_\_\_\_\_

- a) multiple cloning site
- b) origin of replication
- c) high copy number
- d) selectable marker

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Answer: d

Explanation: Whether the cell has taken up the vector or not is distinguished by using a selectable marker. A selectable marker often used is the ampicillin resistance property. Cells having the plasmid or vector show resistance against ampicillin.

3. Multiple cloning site (MCS) is defined as \_\_\_\_\_

- a) site within the plasmid which contains a site for many restriction enzymes
- b) site within the plasmid which contains a site for many restriction enzymes and they are not present anywhere else in the plasmid
- c) as the site containing many sites for only one restriction enzyme
- d) cloning many inserts together

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Answer: b

Explanation: MCS is defined as a location in the plasmid which is having the site for many restriction enzymes and they are not present anywhere else in the plasmid.

4. Size of the vector is related to having a suitable single restriction site.

- a) True
- b) False

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Answer: a

Explanation: The size of vector is related to having a suitable single restriction site. It is so because; if the vector is large in size there are more chances of having that sequence in the vector.

5. If a restriction site is 6 nucleotides long, what are the chances of finding it in a vector?

- a) Once every 46 base pairs
- b) Once every 64 base pairs
- c) Once every 24 base pairs
- d) Once every 16 base pairs

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Answer: a

Explanation: If a restriction site is 6 nucleotides long, the chances for having it in a vector are once in every 46 base pairs. It is so because there are 4 nucleotides which form the DNA and at six positions, they can form 46 combinations.

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6. Which of the statement is true for pBR322?

- a) It contains only an ampicillin resistance gene
- b) It contains both ampicillin resistant and tetracycline resistant gene
- c) The cloning site is present only in the ampicillin resistant gene

d) It is a natural vector

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Answer: b

Explanation: pBR 322 is the man-made vector. It contains both ampicillin resistant and tetracycline resistant genes. The cloning site is also present in both of the genes.

7. If a plasmid is having two antibiotic resistant genes, say ampicillin resistant and chloramphenicol resistant. If the plasmid grows in ampicillin containing medium but not in chloramphenicol, what can be concluded?

- a) The insert is not present in any of the gene
- b) The insert is present in ampicillin gene but not in chloramphenicol gene
- c) The insert is present in chloramphenicol gene but not in ampicillin gene
- d) The insert is present between both of the genes

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Answer: c

Explanation: The insert is present in the chloramphenicol gene and not in the ampicillin gene. As the insert is present in it, it disrupts its function and hence they are not able to grow in chloramphenicol containing a medium.

8. If high copy number is there, the replication is called as \_\_\_\_\_ and if low copy number is there the replication is called as \_\_\_\_\_

- a) stringent, relaxed
- b) relaxed, stringent
- c) relaxed, relaxed
- d) stringent, stringent

[View Answer](#)

Answer: a

Explanation: If high copy number is there, the replication is known as stringent and if the copy number is low, the replication is known as relaxed.

9. Chloramphenicol amplification is carried out in various plasmids. Which of the statement is incorrect for it?

- a) It is used for increasing copy number in plasmids containing pMB1 origin
- b) Chloramphenicol promotes bacterial protein synthesis
- c) The protein synthesis is responsible for chromosomal DNA replication
- d) Chromosomal DNA replication is related to cell division

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Answer: b

Explanation: Chloramphenicol amplification is used for increasing the copy number in plasmids containing the pMB1 origin. It is responsible for inhibiting bacterial protein synthesis. As the bacterial protein synthesis is inhibited, chromosomal DNA replication is also inhibited. Chromosomal DNA replication is related to cell division and it is also blocked. But the plasmid replication is not inhibited and it replicates.

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10. The phenomenon of not allowing the recombinants to escape into the environment is termed as \_\_\_\_\_

- a) blocking
- b) termination
- c) disablement
- d) inactivation

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Answer: c

Explanation: The phenomenon of not allowing the recombinants to escape into the environment is termed as disablement. It can be achieved by disabling the mob gene, it is responsible for mobilization required for conjugation to take place.

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## Genetic Engineering Questions and Answers – Transformation and Hosts

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Transformation and Hosts”.

1. How will we choose which transformation method is to be used?
  - a) It depends on the available conditions for the reaction to take place
  - b) It depends on the efficiency which is required to be obtained
  - c) All the transformation methods can be used equivalently
  - d) Each reaction has been assigned a particular transformation method

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Answer: b

Explanation: The choice of transformation method to be used is based upon the efficiency which is desired in the reaction which has to take place.  
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2. The cell in which the recombinant molecules are propagated is termed as \_\_\_\_\_
  - a) host
  - b) vector
  - c) plasmid
  - d) carrier

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Answer: a

Explanation: Hosts are the cells which are used for propagation of recombinant molecules. The choice of a correct host is very important.

3. Some mutations are present which assist the uptake of DNA. Which of the statement is incorrect for it?
  - a) deoR is such a mutation which assists the uptake of DNA
  - b) It is a transcriptional regulator
  - c) It is having DNA binding activity
  - d) It controls the expression of a set of genes involved ribonucleoside catabolism

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Answer: d

Explanation: There are various factors which affect the uptake of DNA by the cells. deoR is an example of such a mutation which assists the uptake of DNA. It is a transcriptional regulator and is having DNA binding activity. It controls the expression of a set of genes involved in deoxyribonucleoside catabolism.

4. Endogenous DNA-degrading system is not essential in determining transformation efficiency.
  - a) True
  - b) False

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Answer: b

Explanation: Endogenous DNA-degrading system is essential in determining the transformation efficiency.

5. Which of the following is true for K strain for E. coli?
  - a) It contains restriction-modification system which is encoded by hsDMRS locus
  - b) hsDR encodes for endonuclease which is responsible for cleaving the DNA sequence containing -AACGCNNTGC-
  - c) Cleavage is carried out when the second A is non methylated
  - d) hsDR mutation can be used for cleavage of incoming unprotected DNA

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Answer: a

Explanation: It consists of K restriction-modification system which is encoded by hsDMRS locus. hsDR encodes for endonuclease which is responsible for cleaving the DNA sequencing containing -AACNNNNNGTGC-. Cleavage takes place only in the case when the second A and the A opposite to T in the second strand is methylated. This mutation can be used to avoid cleavage of incoming unprotected DNA.

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6. Methylation dependent restriction system (MDRS) are included in which class of restriction enzymes?

- a) Type I
- b) Type II
- c) Type III
- d) They are the product of mcrA, mcrB or mrr loci

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Answer: d

Explanation: MDRS don't come under the general classification of type I-III. They are the product of mcrA, mcrB and mrr loci. It would degrade DNA containing methylcytosine (mcrA, mcrB) or methyladenine (mrr).

7. Choose the incorrect statement with respect to dam and dcm genes?

- a) Their enzymes are responsible for methylation of DNA
- b) Dam protein methylates cytosine in -GATC-
- c) Dcm methylates cytosine in-CCAGG- and -CCTGG- sequences
- d) The extent of methylation also has effects on the efficiency with which the other restriction enzymes cleave the DNA in vitro

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Answer: b

Explanation: The enzymes of dam and dcm genes are responsible for methylation of DNA. Dam protein methylates adenine in -GATC- and dcm methylates cytosine in -CCAGG- and -CCTGG- sequences. The extent of methylation also has effects on the efficiency with which the other restriction enzymes cleave DNA in vitro.

8. How many recombination systems are present in E. coli?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: c

Explanation: There are mainly three recombination systems in E.coli. They are the products of recBCD, recE and recF genes.

9. Disablement is also done in plasmids. Choose the correct statement.

- a) The strains carrying out the recombinant plasmids should not escape outside
- b) Preferred strains are having mutations which allow their growth in wild
- c) Mutations confer prototrophy
- d) If the recombinants escape outside, there is no such harm

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Answer: a

Explanation: Disablement is also done in plasmids, in order to ensure that the recombinant plasmids don't escape outside. If they escape outside, it causes contamination. Preferred strains are having mutations which don't allow their growth in the wild. Mutations confer autotrophy. Autotrophy is the condition of the introduction of particular metabolites in the medium because they are not synthesized. The opposite of autotrophy is called as prototrophy.

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10. endA mutation is often induced in host molecules. Choose the correct statement.

- a) It activates the gene for DNA-specific endonuclease
- b) It enhances the yield of plasmid DNA preparations only
- c) It enhances the quality of plasmid DNA preparations only
- d) It enhances both the quality and yield of plasmid DNA preparations

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Answer: d

Explanation: endA mutation is often induced in host molecules. It inactivates the gene for DNA-specific endonuclease. It enhances both the yield and quality of plasmid DNA.

11. lacZ?M15 represents \_\_\_\_\_

- a) fully present lacZ gene
- b) it is not required in alpha complementation
- c) it represents the lacZ gene with M15 mutation
- d) it is partially deleted lacZ gene which is needed for alpha complementation

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Answer: d

Explanation: The representation is for a partially deleted lacZ gene and it is very important for alpha complementation.

12. The correct statement with respect to lacIq is \_\_\_\_\_

- a) It is a mutant of lac repressor gene and decreases the level of repressor

- b) It doesn't control the lacZ gene
- c) It is important for the vectors to replicate in a low copy number
- d) It doesn't titrate out the repressor produced by wild type Lac-I gene

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Answer: a

Explanation: It is a mutant of lac repressor gene and decreases the level of repressor. It controls the lacZ gene and it is important for the vectors to replicate with a high copy number. It titrates out the repressor produced by wild-type lac-I gene.

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# Genetic Engineering Questions and Answers – Modifications in Cloning Methods, Linkers, Adaptors and Cassettes

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This set of Genetic Engineering Multiple Questions & Answers (MCQs) focuses on “Modifications in Cloning Methods, Linkers, Adaptors and Cassettes”.

1. There are various methods to distinguish whether a colony contains a recombinant or not. One such method is \_\_\_\_\_  
a) blue white screening  
b) checking whether replication is taking place or not  
c) checking the number of copies  
d) looking for the multiple cloning site

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Answer: a

Explanation: Blue white screening is a method to know whether a colony is having a recombinant or not. It is also known as alpha complementation method. It is based on the lacZ operon. If there is an insert, the colonies are white in colour and if there is no insert, the colonies are blue in colour.

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2. At times it is observed that non-recombinant plasmids are more than that of recombinant plasmids. Choose the correct statement in regard to it.

- a) It makes easier to get the recombinant plasmids from the mixture
- b) The ratio of insert DNA to vector DNA is reduced to get recombinant plasmids
- c) Alkaline phosphatase is used to get recombinant plasmids
- d) Alkaline phosphatase method is less reliable in comparison to the ratio method

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Answer: c

Explanation: Often the recombination plasmids are less in number as compared to non-recombination plasmids. This makes it difficult to get the recombination plasmids from the mixture. In order to overcome this, the ratio of insert DNA to vector DNA is increased. Another more reliable method is to use the alkaline phosphatase method.

3. Alkaline Phosphatase is used at times and the vector is treated with it. Choose the incorrect statement.

- a) It removes 5' terminal phosphate group from nucleic acids
- b) The 5' phosphate group is required for the ligation to take place
- c) Two phosphate bonds should be formed for the complete ligation to take place
- d) The ligation between vector and insert won't take place

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Answer: d

Explanation: Alkaline phosphatase is used at times and the vector is treated with it. It is responsible for the removal of phosphatase group from the 5' end. This group is required for the ligation reaction to take place and at each end two phosphates are required. But as the phosphate groups are removed from the vector, its relication is not possible now. But as the insert is still having a phosphate group, one strand will form the bond and the ligation reaction will take place.

4. What is the correct time for carrying out the alkaline phosphatase treatment?

- a) After the cutting of vector has been done
- b) Before the insert DNA and the vector are mixed
- c) After the cutting of vector has been done but before the insert DNA and vector are mixed
- d) After the mixing of insert DNA and vector

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Answer: c

Explanation: The alkaline phosphatase treatment is carried out after the cutting of DNA has been done but before the mixing of insert DNA and vector has been done. There should be no traces of the enzyme left after the insert DNA has been added.

5. *ccdB* gene is used at times. Choose the correct statement with respect to this gene.

- a) It is a control of cell birth gene
- b) It is activated in complex vectors to increase the fraction of recombinants
- c) If intramolecular ligation takes place this protein is released
- d) It is often regarded as control of cell death and birth gene

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Answer: b

Explanation: It is an approach to increase the fraction of recombinants. There are some genes which are activated on the self ligation of the molecules and are responsible for the death of host molecules. *ccdB* is control of cell death gene and its protein is responsible for killing the host molecules when intramolecular ligation takes place.

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6. When inserting a DNA fragment, it is possible to have two orientations. If the orientation is controlled, this cloning is referred to as \_\_\_\_\_

- a) forced cloning
- b) orientation cloning
- c) correct cloning
- d) restricted cloning

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Answer: a

Explanation: It is possible to insert the DNA fragment into two possible orientations. If somehow it is controlled to insert the fragment in a particular orientation, it is known as forced cloning.

7. What happens if insert DNA is cut with two different restriction enzymes at the ends?

- a) It is difficult to insert the fragment
- b) The insert can be ligated in any orientation
- c) The insert can be ligated in one orientation only
- d) The amount of product increases

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Answer: c

Explanation: If the DNA is cut with two different enzymes at the ends, it is possible to ligate the fragment in only one orientation. It is so because each end would have a unique sequence to ligate.

8. What is the disadvantage of amplification of using PCR over natural cloning?

- a) In PCR, there is no proof reading activity
- b) In PCR, small fragments can't be amplified
- c) There is an A incorporated in PCR products, which makes cloning difficult

d) PCR takes more time as compared to natural cloning

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Answer: a

Explanation: The biggest disadvantage of using PCR amplification over natural cloning is that there is no proof reading activity in the case of PCR. Thus if an error is induced, it is carried forward and is amplified. Also, if large fragments are to be cloned, natural cloning is preferred over PCR. The incorporated A at ends makes the process of cloning of PCR products easier.

9. TA cloning is a method used for cloning of PCR products. Which of the statement is correct with respect to it?

- a) It is based on the fact that a T residue is incorporated at the end of the PCR product
- b) 'A' residue is incorporated into the end of the vector
- c) It gives a low yield
- d) It is preferred over blunt end ligation

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Answer: d

Explanation: TA cloning is a method used for cloning of PCR products. It is based on the fact that A residue is present at the 3' end of the PCR product and thus now T residue is incorporated at the end of the vector. It is preferred over blunt end ligation.

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10. Choose the incorrect statement in respect to topoisomerase I.

- a) It is used to cleave only one DNA strand
- b) It leaves at the recognition sequence -C/TCCTT- and is covalently attached to one end of the cleaved molecule
- c) The supercoiling of the DNA strand is altered and then it is sealed again by the enzyme
- d) It is slower than the normal DNA ligase

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Answer: d

Explanation: Topoisomerase I is an enzyme used for cleaving of one DNA strand. It leaves at the recognition sequence -C/TCCTT- and is covalently attached to one end of the cleaved molecule. The supercoiling of the DNA strand is altered and then it is sealed by the enzyme again. It is usually faster than DNA ligase. Topoisomerase II is used for cleaving both the strands.

11. Linkers are often used in cloning. Choose the incorrect statement for linkers.

- a) These are short chemically synthesized molecules that contain a particular restriction enzyme site within the sequence
- b) They are blunt ended molecules
- c) They are ligated to staggered ended insert molecules by T4 DNA ligase
- d) After treatment with enzyme, both the ends of the linker are staggered

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Answer: c

Explanation: Linkers are often used in cloning. These are short chemically synthesized molecules that contain a particular restriction enzyme site within the sequence. They are blunt ended molecules and are ligated to the blunt ended insert molecules by T4 DNA ligase. After treatment with the enzyme, both the ends of the linker are staggered.

12. There is no effect if the insert itself contains the restriction site.

- a) True
- b) False

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Answer: b

Explanation: If the insert itself is having a restriction site, the insert itself is cleaved when the restriction enzyme is cleaved along with the linker. To avoid this, the methylation of the site in the insert is done.

13. Choose the correct statement for adaptors.

- a) They are blunt ended at both the ends
- b) They are single stranded at both the ends
- c) They may be single stranded at one end and other end may be blunt
- d) They don't have extra restriction sites within their sequence

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Answer: c

Explanation: Adaptors are molecules which are used for cloning. There is no restriction on the type of end they have. Either of the ends can be blunt or staggered. They may also have extra restriction site within the sequence.

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14. If linkers are combined with other features such as a selectable marker, it is called as \_\_\_\_\_

- a) cassette
- b) modified linker
- c) adaptors
- d) induced linker

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Answer: a

Explanation: If linkers are combined with the features such as antibiotic resistance, these are called as cassette or cloning cartridges. They may also contain gene expressing signals.

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# Genetic Engineering Questions and Answers – BAC Vector, M13 and its Derivatives – 1

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “BAC Vector, M13 and its Derivatives – 1”.

1. F (fertility) factor is used in many bacterial systems for different purposes. Choose the incorrect statement with respect to the F factor.
  - a) It was identified in *E. coli* for catalysing genetic exchange between cells
  - b) Cells having F factor are called as female
  - c) The F factor is transferred from one cell to another via factors present outside
  - d) They are not related to BAC systems

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Answer: a

Explanation: BAC vectors are based on the F (fertility) factor. They are known for transferring genetic material between cells and they do it by a proteinaceous filament called sex pilus. The cells having F factor are called as male cells.

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2. F factor integration into the host chromosome is called as \_\_\_\_\_

- a) F' plasmid
- b) F factor and host chromosome recombination
- c) Hfr (High frequency of recombination)
- d) Recombinant host chromosome

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Answer: c

Explanation: F factor integration can be done into the host chromosome and this is called as Hfr (High frequency of recombination) strain.

3. Excision of the F factor can also be done from the host chromosome. Choose the incorrect statement in respect to it.

- a) This excision is possible *in vivo*

- b) Along with the F factor, host chromosome's DNA sequences are also excised
- c) The sequences of host chromosome which can be accommodated in the F plasmid are small in size
- d) These plasmids are termed as F' plasmids

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Answer: c

Explanation: It is possible to carry out the excision of the F factor from the host chromosome. The excision is possible *in vivo*. Along with the F factor, the DNA sequences of host chromosome are also excised. The F plasmid is able to accommodate very large size f host chromosome fragments and these are known as F' plasmids.

4. The low copy number of F plasmid is essential for the stability of these plasmids.

- a) True
- b) False

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Answer: a

Explanation: Usually, the F plasmids are present in a low copy number in cells. These low copy numbers are very essential for the stability because then only a few molecules can act as substrates for recombination mediated deletion.

5. Choose the correct statement for BAC vector system.

- a) BAC vector system stands for bacteria and chromosome
- b) It usually accepts insert of size approximately 1000kbp
- c) The repE and oriS sequences are required for controlling the copy number and par A-C sequences are required for replication
- d) A selectable marker is there for chloramphenicol resistance

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Answer: d

Explanation: BAC vector system stands for Bacterial Artificial Chromosome. It accepts an insert of size 100kbp-300kbp. The repE and oriS sequences are required for controlling the replication and the par A-C sequences are required for controlling the copy number. A selectable marker is there for chloramphenicol resistance. A lacZ gene is also present and recombination of BAC vectors is done into *E. coli* by electroporation.

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6. The bacteriophage M13 vectors belong to a group of phages called as \_\_\_\_\_

- a) skinny or filamentous phage
- b) M phage group
- c) single stranded phage
- d) double stranded phage

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Answer: a

Explanation: Bacteriophage M13 vectors belong to a group of vectors known as skinny or filamentous phage. They have a dimension of 850 nm \* 6 nm \* 6nm. They are very useful as they convert the double stranded DNA into single stranded DNA.

7. Choose the correct statement for the infection process of M13.

- a) The infectious particle is double stranded
- b) It is contained in a protein coat which is made up of products of gene III or gene VIII
- c) The phage infects only female cells
- d) The phage enters the bacterial cells by the filament which is meant for movement

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Answer: b

Explanation: M13 infectious particles are single stranded in nature. It is contained in a protein coat which is made up of products of gene III or gene VIII. The phage infects the bacterial cells by sex pilus and thus it infects only male cells.

8. Once the bacteriophage enters the bacterial cells, some changes are carried out in it. Which of the following is not included?

- a) The single stranded molecule entering the cell is single stranded and is called as a + strand
- b) The single stranded molecule is converted into double stranded molecule which is called as replicative form (RF)
- c) It is carried out in a process similar to normal replication process of *E. coli*
- d) The positive strand is used for the transcription of viral proteins

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Answer: d

Explanation: Once the bacteriophage enters the bacterial cells it is converted into double stranded form from the single stranded form. The double stranded form is known as replicative form (RF). The single strand entering is called as a + strand. It is carried out in a process similar to that the normal replication process. A specific origin of synthesis is used for transcription of the complementary negative strand. The minus strand can be used to synthesize viral proteins.

9. Replication can also be carried out by rolling circle replication. Choose the correct statement for this type of replication?

- a) It can be used for the formation of RF
- b) The product of gene III binds on a specific site of double stranded genome
- c) It creates a nick in the – strand generating a free 3' hydroxyl
- d) This strand is extended by the polymerase and displaces the original – strand

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Answer: a

Explanation: Rolling circle replication is used for the formation of RF. The product of gene II binds on a specific site of double stranded genome. It creates a

nick in the + strand generating a free 3' hydroxyl. This strand is extended by the polymerase and it displaces the original + strand. This strand is removed from the newly synthesized strand because of another nick by gene II. Thus a separate + strand is created and it is circularized by gene II product.

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10. Gene V blocks the production of which gene?

- a) Gene III
- b) Gene II
- c) Gene VIII
- d) Gene IV

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Answer: b

Explanation: Gene V blocks the production of gene II. As the gene V blocks the production of gene II, conversion of single strands into double strands is also blocked.

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## Genetic Engineering Questions and Answers – BAC Vector, M13 and its Derivatives – 2

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This set of Genetic Engineering test focuses on “BAC Vector, M13 and its Derivatives – 2”.

1. What is the size of the DNA molecule which can be packed by the viral protein coat?

- a) 100kbp
- b) 200kbp
- c) 500kbp
- d) No size restriction

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Answer: d

Explanation: There is no size restriction on the DNA molecule which is packaged by the viral coat protein. It is an advantage.

2. The uniform layer of cells is known as lawn and the holes peppered from infected cells are termed as \_\_\_\_\_

- a) plaques
- b) holes
- c) colony
- d) pothole

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Answer: a

Explanation: The infected cells, which are from the infection by bacteriophage create holes and they are termed as plaques.

3. M13 doesn't actually lyse the cells.

- a) True
- b) False

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Answer: a

Explanation: M13 doesn't actually lyse the cells. It infects the cells and retards the growth but doesn't actually lyse the cells.

4. The plaques formed by M13 infection are called as \_\_\_\_\_

- a) retarded plaques
- b) true plaques
- c) pseudoplaques
- d) lysogenized plaques

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Answer: c

Explanation: As the plaques created by M13 are because of slow growth and not because of lysis, these plaques are called as pseudoplaques.

5. M13 vector is tightly packed. Where is the available site to insert DNA?

- a) In the gene II
- b) Between gene II and IV
- c) Between gene III and V
- d) Between gene V and VIII

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Answer: b

Explanation: The production of phage depends upon the insertion of DNA without disrupting any of the phage genes. Hence, M13 vector is tightly packed. One such site for the insertion of DNA is between gene II and gene IV. Here, the lacZ and MCS are also present.

6. Choose the incorrect statement with respect to the collection of single stranded molecules.

- a) An infected culture is set up and after a while the cells are removed by centrifugation
- b) The phage is in the supernatant and is precipitated by addition of glycol and sodium chloride
- c) The phage pellet is resuspended and phenol is used for removal of protein
- d) The single stranded molecules sediment at the bottom

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Answer: d

Explanation: The collection of single stranded molecules is slightly different. An infected culture is set up and after a while cells are removed by centrifugation. The phage is present in the supernatant and is precipitated by addition of glycol and sodium chloride. It is followed by centrifugation. The phage pellet is resuspended and phenol is used for removal of protein. The single stranded molecules remain in the solution and thus can be precipitated further.

7. Choose the correct statement for Sanger's method of sequencing.

- a) They are also called as chain termination methods
- b) Use of M13 vector is made for getting double stranded DNA
- c) Use of dideoxynucleotide phosphate (ddNTP) is made
- d) The use of M13 vectors is more preferred these days

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Answer: a

Explanation: Sanger's method of DNA sequencing is also known as the chain termination method of sequencing. Dideoxynucleoside triphosphate (ddNTP) are used as chain terminating agents. M13 vector is used to obtain the single stranded DNA. Now a days there are technologies available for sequencing on double stranded DNA, thus it reduces the use of M13 vectors these days.

8. Which of the statement doesn't holds for phage display systems?

- a) The filamentous phage is often used as phage display system
- b) Coding sequences are inserted in one of the protein coating genes
- c) The most common protein coding genes are gene II or gene VIII
- d) The inserted is expressed along with other protein coat genes

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Answer: c

Explanation: The filamentous phage is often used as phage display system. The coding sequences are inserted in one of the protein coding genes and the most common protein coding genes are gene III and gene VIII. The insert is expressed along with other protein coat genes.

9. Choose the correct statement for the synthesis of RNA probe?

- a) Double stranded DNA is only used for probe synthesis
- b) Single stranded DNA can be used for probe synthesis
- c) Probes are prepared for RNA transcripts which are specific for only particular strand
- d) Probes are prepared for RNA transcripts which are specific for both the strands

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Answer: b

Explanation: RNA probe can be synthesized by single stranded DNA. This single stranded DNA can be obtained from filamentous phage. Probes are prepared for RNA transcripts which are specific for either of the DNA strands.

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10. M13-plasmid vectors are often used. Which of the following is not a feature for this?

- a) They are known as phagemid, plage or phasmid
- b) Replication takes place through the origin of replication of M13 derivatives only
- c) Replication from M13 requires proteins to be provided by helper phage
- d) Some of the examples of these types of the combination are pUC 118, 119 and 120

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Answer: b

Explanation: M13-plasmid vector hybridization is often used and they are referred to as phagemid, phasmid or plage. Replication can take place either by the origin of replication of the plasmid or by the origin of replication of M13. Replication from M13 requires additional protein to be provided from helper phage. Single-stranded DNA is produced after replication and is packaged in a protein coat. Some of the examples of this type of hybridization are pUC 118, 119 and 120.

11. The main advantage of phagemid is that it can be used for the generation of single or double stranded products without recloning.

- a) True
- b) False

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Answer: a

Explanation: The main advantage of phagemid is that it can be used for the generation of single or double stranded products without recloning. It is so because M13 can be used to produce single stranded products and the double stranded products are obtained by using the origin of replication of plasmid.

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# Genetic Engineering Questions and Answers – Bacteriophage Lambda – 1

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Bacteriophage Lambda – 1”.

1. It is very important to study lambda biology as lambda phages are used for cloning purposes. Which of the statement is true for lambda phage?

- a) It is an example of temperate phage
- b) The fate of the phage is decided before it infects the cell
- c) The lysis fate is that where the phage inserts its genome into the bacterial genome and the replication goes on
- d) The lysogenic fate is that where the phage infects the cell and lysis is carried out

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Answer: a

Explanation: Lambda phage is a temperate phage and its fate is decided as it infects the cell. It can be either be lytic or lysogenic in nature. Lytic phage is that which infects the cell and it is lysed whereas lysogenic phage is that in which phage genome is inserted into the bacterial genome and is replicated along with it.

2. Choose the correct statement for the infectious particle of lambda phage.

- a) It is single stranded genome
- b) It is circular double stranded genome
- c) The ends are blunt with cos (cohesive) sequences
- d) The ends are created by cleavage at cos sites during phage packaging

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Answer: d

Explanation: The infectious particle of lambda phage is linear double stranded genome. The ends are staggered with cos (cohesive) sequences and they are created by cleavage at cos sites during phage packaging.

3. Some changes are encountered in the infectious particle as it infects the cell. Choose the incorrect statement.

- a) The infectious particle circularizes upon causing infection by annealing at cos sites
- b) There are two promoters present, PR and PL
- c) Upon infection only PR is activated
- d) Promoters give rise to immediate early transcripts

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Answer: c

Explanation: As the infectious particle infects the cell it circularizes by annealing at cos sites. Both the promoters PR and PL are activated upon infection. Promoters give rise to immediate early transcripts which terminate at rightward and leftward terminators.

4. The immediate early transcripts direct synthesis of which genes?

- a) N genes
- b) cro genes
- c) Both N and cro genes
- d) PR and PL genes

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Answer: c

Explanation: The immediate early transcripts are transcribed by promoters and they direct the synthesis of gene products of N and cro genes.

5. What is the function of the N gene?

- a) It promotes the function of terminators
- b) It overrides the function of terminators
- c) It promotes the production of the cro gene
- d) It is responsible for making the infectious particle linear

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Answer: b

Explanation: N gene is responsible for overriding the function of terminators. As the terminators are overridden, the transcription is carried in the surrounding regions.

6. Choose the correct statement for cII gene and its related function?

- a) The transcription is extended to the region of cII gene and it is termed as late transcription
- b) They are responsible for deactivating the promoter for repressor establishment
- c) This promoter is responsible to decide whether the life cycle would be lysogenic or lytic
- d) cII gene is responsible for other gene which is gene cIII

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Answer: c

Explanation: The cII gene product is formed when the transcription is extended because of the overriding of terminators by the N gene. It is responsible for activation of a promoter for repressor establishment. This promoter is responsible for deciding whether it would be in lysogenic or lytic mode. The transcripts formed by extension are called as delayed early transcripts and cIII is also produced along with cII.

7. Which gene is required for the lysogenic phage to be adopted?

- a) cI
- b) cII
- c) cIII
- d) All the three genes are interrelated

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Answer: d

Explanation: All three genes are interrelated. The cII gene is protected from proteases by cIII gene and it further promotes the expression of cI gene. cI gene is necessary for silencing of rest of the lambda genome. cII is most important but as it related with other two as well, thus they all are required for lysogenic mode.

8. Choose the incorrect statement for lysogenic mode.

- a) PRE forms cI gene product which is responsible for activation of promoters
- b) The cII protein is responsible for interfering with cro and Q proteins and they are required for lytic life cycle
- c) The cII protein activates the promoter PINT
- d) The Int protein with host protein is responsible for site specific recombination

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Answer: a

Explanation: The cI gene product is responsible for inactivation of promoters and thus silencing rest of the lambda genome. The cII gene product is responsible for interfering with cro and Q proteins and they are required for lytic life cycle. The cII gene also activates promoter PINT and the Int protein produced along with host protein is required for site specific recombination.

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9. Choose the correct statement for the cI gene.

- a) It represses only cII gene
- b) It activates cII gene and represses cIII gene
- c) It represses both cII and cIII gene
- d) It activates both cII and cIII gene

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Answer: c

Explanation: cI gene represses both cII and cIII gene and thus the expression of cIII is also suppressed.

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## Genetic Engineering Questions and Answers – Bacteriophage Lambda – 2

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This set of Genetic Engineering Quiz focuses on “Bacteriophage Lambda – 2”.

1. Which of the promoter requires a low level of cI gene for its activation?

- a) PR
- b) PL
- c) PRE
- d) PRM

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Answer: d

Explanation: The promoter requiring low level of cI gene for its activation is PRM (Promoter for repressor maintenance). It is inactivated by high levels of the cI gene.

2. Choose the correct statement with respect to lysogen and prophage.

- a) The integrated phage is called as lysogen
- b) The infected bacterial cell is called a prophage
- c) If there is only growth of few lysogens, the E. coli lawn would be turbid
- d) If lysogens won't be formed, the plaques won't be clear

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Answer: c

Explanation: The integrated phage is called as a prophage and the infected bacterial cell is known as lysogen. Lysogens are immune to further infection by the same phage. If only growth of few lysogens would take place, the lawn would be turbid. In the case, if lysogens aren't formed, the plaques would be clear.

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3. Choose the incorrect statement for cro and Q proteins.

- a) They are required for the lytic life cycle to continue
- b) Cro protein inactivates the PRM promoter
- c) The Q protein is responsible for the expression of late genes
- d) cII protein is required for the lytic life cycle to continue

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Answer: d

Explanation: The cro and Q proteins are required for the lytic life cycle to continue and cII protein is not required for it. Cro protein inactivates the PRM promoter and the Q protein is responsible for the expression of late genes. These late genes are responsible for producing coat proteins, allowing assembly of functional phage and cell lysis.

4. Induction of lysogen takes place because of \_\_\_\_\_

- a) Low levels of cII gene
- b) Low level of cI gene
- c) Low levels of both cI and cII gene
- d) High levels of both cI and cII gene

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Answer: b

Explanation: Induction of lysogen takes place because of low levels of the cI gene. It is caused by specific proteolysis under the action of host recA protein.

5. Which of the phage genes are responsible for phage excision?

- a) xis gene
- b) int gene
- c) recA protein
- d) both xis and int gene

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Answer: d

Explanation: As the level of cI genes fall, the repression of PR and PL genes is lifted up. Now phage genes are expressed and xis and int genes are expressed. These genes are responsible for causing phage excision.

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6. How many phases are there for replication of lambda DNA to take place?

- a) 1

b) 2  
c) 3  
d) 4

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Answer: b

Explanation: There are two phases for the lambda DNA replication to take place. They include the theta mode and rolling circle mode.

7. The phase generating additional circular DNA molecules in the first phase does it by \_\_\_\_\_

- a) bidirectional theta mode
- b) rolling circle mode
- c) separation of the two strands
- d) copying only one strand

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Answer: a

Explanation: The first phase includes circularization of the molecule by annealing of the cos sites and they replicate in a bidirectional theta mode. This leads to the generation of an additional circular DNA molecule.

8. Choose the incorrect statement with respect to rolling circle replication.

- a) It is for a single replication fork and yields a concatemeric molecule
- b) Staggered cleavage of DNA takes place at the cos sites
- c) The cleavage generates 10 nucleotide long overhangs
- d) Without the cos sites, the packaging won't be possible

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Answer: c

Explanation: The second phase constitutes of rolling circle mode. It is done with a single replication fork and yields concatemeric molecules. They are required for assembly into mature phage particles. The packaging region should be flanked by the cos sites. Phage DNA is inserted into the phage head and the cos sites are brought adjacent to each other. It is followed by cleavage at cos sites and it leaves 12 nucleotide long staggered ends. The cos sites are required for packaging to take place.

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# Genetic Engineering Questions and Answers – Cloning in Lambda – 1

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Cloning in Lambda – 1”.

1. Insertion vectors are a type of vectors. Choose the correct statement for this type of vector.

- a) These are complex vectors
- b) DNA is inserted through many restriction sites
- c) There is an upper limit on the size of the DNA to be packaged
- d) Lambda gt09 is an example of this type of vector

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Answer: c

Explanation: Insertion vectors are the simple vectors and DNA is inserted through a single restriction site. It must be a non-essential gene to maintain phage viability. There is an upper limit on the size of the DNA to be packaged thus only a few kilobases of the extra DNA can be included. Lambda gt10 and gt11 are an example of insertion vectors.

2. Choose the correct statement for lambda gt10.

- a) It is having an EcoRI site
- b) It is having cII gene
- c) It accepts an insert of size greater than that of 8 kbp
- d) This size is less than that the size which is generally accepted by wild type phage

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Answer: a

Explanation: Lambda gt10 is having an EcoRI site which contains the cI repressor gene. It accepts an insert of size upto 7.6 kbp which is generally more than that of the size generally accepted by a wild type phage.

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3. The presence of insert leads to inactivation of which gene?

- a) cII
- b) cI
- c) cIII
- d) both cII and cIII

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Answer: b

Explanation: The presence of insert leads to inactivation of the cI gene and this is the method to detect the presence of an insert.

4. A portion of phage is removed and in place of it, the DNA of interest is inserted. This type of vector is called as \_\_\_\_\_

- a) displacement vector
- b) insertion vector
- c) substitution vector
- d) transposition vector

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Answer: c

Explanation: If a portion of phage is removed and in its place, the DNA of interest is inserted, it is called as substitution or replacement vector.

5. Choose the incorrect statement for the central portion of the lambda genome.

- a) The central portion is not required for lytic growth
- b) The central portion includes repressor gene
- c) The repressor gene is not required for lysogenic growth
- d) It is approximately 10kbp long

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Answer: d

Explanation: The central portion of the lambda genome is approximately 20 kbp and it is not required for lytic growth. The central portion constitutes of repressor gene and thus it has to be removed for the lysogenic growth to take place.

6. The fragment inserted in the place of the central portion of the genome is known as \_\_\_\_\_

- a) insertion fragment
- b) substitution fragment
- c) stuffer fragment
- d) displacement fragment

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Answer: c

Explanation: The fragment inserted in the place of the central portion of the genome is known as the stuffer fragment. It is generated by doing partial digestion an enzyme having a 4bp long recognition site.

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7. Choose incorrect statement for the substitution vector EMBL4.

- a) It is having two single multiple cloning sites
- b) The region to be removed is on one side of the multiple cloning sites
- c) If a digestion within the multiple cloning sites, it generates central portion and right and left arms
- d) The right and left portions are called as arms

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Answer: b

Explanation: The substitution vector EMBL4 contains two multiple cloning sites. The two multiple cloning sites flank the region which is to be removed. If digestion is done within the multiple cloning sites, it generates central portion and the right and left portions. The right and left portions separated are known as arms.

8. Is it necessary to stop the re-ligation of the central portion before the stuffer fragment is ligated.

- a) True
- b) False

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Answer: a

Explanation: The central portion should be stopped from re-ligating before the stuffer fragment should be ligated. There are chances that central portion gets re-ligated to the arms.

9. At times, a second enzyme is used while the central portion is removed and the stuffer fragment is placed there. Choose the statement which doesn't hold for this process.

- a) It is a method which is used for avoiding the re-ligation of central portion before the stuffer fragment is attached over there
- b) In this method, the central portion is cut with another enzyme after being separated from the arms
- c) The arms are also cut with this second enzyme
- d) It is not necessary to remove the fragments generated

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Answer: c

Explanation: A second enzyme is used in order to avoid the re-ligation of the central portion and the arms. In this method, the central portion is cut with a second enzyme after being separated from the arms. These arms are not cut with the second enzymes. Hence the ends created are different now and the arms won't ligate to the central portion again. It is not necessary to remove the fragments generated because the chances of having a multimolecular reaction which are required for the formation of original phage are very less.

10. Physical separation is also used at times. Choose the correct statement with respect to this method.

- a) Physical separation constitutes of gel electrophoresis and or by using centrifugation in sugar density gradient
- b) In sugar density gradient, the molecules are separated on the basis of density
- c) The central portion is recovered from the gel or the gradient
- d) Gel is more efficient than the sugar density gradient

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Answer: a

Explanation: Physical separation is also used at times, it constitutes of using gel electrophoresis or by using centrifugation in the sugar density gradient. In the sugar density gradient, the separation is done on the basis of size. The arms are separated from the gel or gradient. A gradient is more efficient than gel, thus gradient is more preferred over the gel.

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11. Packaging in vitro is also carried out to introduce the lambda DNA into the cells. Choose the incorrect statement in respect to it.

- a) Packaging in phage coat is a more efficient process than the normal transformation process
- b) The lambda DNA is incubated with lysate of lambda infected cells in a concatemeric configuration
- c) Lysate constitutes of lambda proteins needed for phage assembly
- d) The amount of non-recombinant phage in the background is less

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Answer: d

Explanation: Packaging in vitro is used to introduce the lambda. It is more efficient than the normal transformation procedure. Thus, the lambda DNA is incubated with lysate of lambda infected cells in a concatemeric configuration. This lysate constitutes of lambda proteins needed for phage assembly and hence the recombinant DNA is also packed. But there is also a large amount of non-recombinant packaging in the background.

12. Packaging in vitro is basically carried out by two different strategies. Choose the incorrect statement for it.

- a) Separate strains with chain-termination mutations in different genes for coat components are used \_\_\_\_\_
- b) Temperature sensitive cl repressor is used
- c) Due to heat shock packaging proteins are induced
- d) Packaging is carried out in each strain

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Answer: d

Explanation: Packaging in vitro is basically out by two different strategies. In the first strategy, separate strains with chain-termination mutations in different genes (mostly D and E genes) for coat components are used. Temperature sensitive cl repressor is used and due to induction by heat shock, packaging proteins are produced. But packaging is not carried out in any of the strain because none of the strain is having full complement of proteins to carry out packaging.

13. Chain-termination mutations in coat proteins genes are carried out. The coat protein coat genes used are \_\_\_\_\_

- a) A gene
- b) D gene

- c) E and D gene
- d) D and A gene

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Answer: c

Explanation: Chain-termination mutations in coat proteins genes are carried out, these genes are D and E genes.

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## Genetic Engineering Questions and Answers – Cloning in Lambda – 2

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This set of Genetic Engineering Mcqs focuses on “Cloning in Lambda – 2”.

1. What happens if chain-termination mutation is in the S gene?
  - a) Cell lysis is blocked
  - b) Growth of cells containing low levels of packaging proteins is not allowed
  - c) The lysis of cells is not carried artificially
  - d) Packaging is not carried out efficiently

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Answer: a

Explanation: If chain-termination mutation is carried out is in the S gene, cell lysis is blocked. The growth of cells having high levels of packaging proteins is carried out. The lysis is then carried out artificially.

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2. Which of the following is used for blocking the phage-encoded recombination?

- a) Mutation in D gene
- b) Mutation in E gene
- c) Red mutation
- d) Mutation in S gene

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Answer: c

Explanation: Red mutation is used for blocking the phage-encoded recombination. It ensures that no recombination or rearrangement takes place while carrying out packaging in vitro.

3. Which of the following is not a consequence of deletion in the b region?

- a) Excision of the prophage on induction is prevented
- b) It reduces the amount of endogenous phage DNA in the packaging mix
- c) It reduces the amount of exogenous phage DNA in the packaging mix
- d) It reduces the level of background non-recombinant phage

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Answer: c

Explanation: The deletion in the b region is responsible for preventing the excision of the prophage on induction. It reduces the amount of endogenous phage DNA in the packaging mix and thus resultantly it reduces the level of background non-recombinant phage.

4. If a single system is used for packaging, there are increased chances of endogenous material being packed.

- a) True
- b) False

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Answer: a

Explanation: In the case, if a single strain is used for packaging, there are increased chances of endogenous material being packed. It can be avoided by using additional mutations such as xis in the prophage to stop the excision and packaging of the lysogenic phage from the cells producing packaging extract.

5. The cI function can be scanned in order to check whether the recombinants are present or not. Which of the following doesn't hold true?

- a) The cI protein is required for the formation of lysogen
- b) The plaques formed are turbid in the case if the cI gene is active
- c) The plaques formed are clear in the case if the cI gene is inactive
- d) hflA mutant host reduces the amount of cII stability

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Answer: d

Explanation: The cI protein is required for the formation of lysogen to take place. The plaques formed are clear in the case if cI is inactive and turbid in the case if cI is active. hflA (high frequency of lysogenization) mutant hosts is used for enhanced screening. It is so because it increases the amount of cII stability and thus consequently lysogenization is taking place efficiently.

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6. What is the function of red and gam gene products?

- a) It promotes the growth of the phage in the E. coli cells which are lysogenic for bacteriophage P1
- b) It inhibits the growth of the phage in the E. coli cells which are lysogenic for bacteriophage P2
- c) It inhibits the growth of the phage in the E. coli cells which are lytic for bacteriophage P1
- d) It activates the growth of the phage in the E. coli cells which are lytic for bacteriophage P2

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Answer: b

Explanation: The red and gam gene products inhibit the growth of the phage in the E.coli cells which are lysogenic for bacteriophage P2. When red and gam gene products are absent, the growth takes place in the cells which are lysogenic to bacteriophage P2.

7. The red and gam genes are removed in which type of phages?

- a) Substitution phage
- b) Replacement and substitution phages both
- c) Replacement phage
- d) Substitution is preferred over replacement phage

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Answer: c

Explanation: The red and gam genes are removed in replacement vectors. And this can be used as a potent method to select the recombinants by plating them on P2 lysogen.

8. Phages which are designated as spi-are \_\_\_\_\_

- a) red+ gam+
- b) red+ gam-
- c) red- gam+
- d) red- gam-

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Answer: d

Explanation: red- gam- are called as spi- and they are not able to grow on P2 lysogens. The red+ gam+ mutants are called as spi+.

9. Choose the correct statement for RecBCD nuclease.

- a) It promotes rolling circle replication
- b) It is blocked by Gam protein
- c) It blocks theta mode of replication
- d) It is blocked by Red protein

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Answer: b

Explanation: RecBCD nuclease is blocked by Gam protein and it blocks rolling circle replication. As the rolling circle mode is blocked, replication would be carried out by only theta mode of replication.

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10. The essential sites for recombination are known as \_\_\_\_\_

- a) chi sites
- b) rec sites
- c) gam sites
- d) red sites

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Answer: a

Explanation: The sites necessary for recombination are known as chi sites. Host recombination enzymes may not work until and unless the recombination sites are present.

11. The replication rate remains the same for all the phages irrespective of what sequence is there in the phage.

- a) True
- b) False

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Answer: b

Explanation: The replication rate is not the same for all the phages. Some phages having a certain insert may be replicating in a slower rate than that of other phages. Thus, there might be under-representation of some of the sequences.

12. There is a limit on upper size of the DNA to be packed. Choose the correct statement with respect to phages in this context.

- a) There is some phage DNA lost in this process
- b) The phages are known as transformed phages
- c) These type of phages can't be selected and harvested
- d) Lambda is not a special attachment site

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Answer: a

Explanation: There is a limit on the upper size of the DNA to be packed. If the significant amount of sequence is flanked by the phage particles, there are chances of losing some phage DNA. These phages are known as transducing phages and can be easily selected and harvested for the lost DNA. Lambda is having a special site for attachment in E. coli.

13. There are some phages which don't preferentially transduce some special regions of the phage genome. These phages are known as \_\_\_\_\_

- a) transducing phages
- b) specialized transducing phages
- c) generalized transducing phages
- d) transforming phages

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Answer: c

Explanation: Some phages are there which don't preferentially transduce some special regions of the phage genome and they are known as generalized transducing phages.

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## Genetic Engineering Questions and Answers – Lambda ZAP and Cosmids

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Lambda ZAP and Cosmids”.

1. Choose the correct statement for the lambda ZAP vector.
  - a) It is not based on bacteriophage lambda
  - b) It contains a region that can be excised in vivo
  - c) The excision leads to the formation of bluescript plasmids and it contains an initiator region only
  - d) The multiple cloning site is not flanked by the initiator and the terminator region

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Answer: b

Explanation: Lambda ZAP vector is based on the bacteriophage lambda. It contains a region that can be excised in vivo and leads to the formation of bluescript plasmids. This consists of multiple cloning site which is flanked by the initiator and the terminator region.

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2. The initiator is recognized by which gene?

- a) Gene I
- b) Gene I and II
- c) Only gene II
- d) Gene III

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Answer: c

Explanation: The f1 initiator and terminator region flanks the multiple cloning site and the initiator region is recognized by gene II.

3. Choose the incorrect statement for the replication process.

- a) The initiator site is nicked and replication of one strand is started
- b) Replication takes place in both the directions
- c) Replication continues through the bluescript
- d) It is stopped at the terminator and then again a nick is made

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Answer: b

Explanation: The initiator site is nicked and the replication of one strand is initiated. Replication takes place in one direction only and continues through the bluescript. It is stopped at the terminator and then a nick is made again there.

4. Which of the following doesn't take place after replication?

- a) The single stranded sequence is generated
- b) It is circularized to form closed single stranded molecule
- c) It may circularize or remain linear
- d) The double stranded molecule can be synthesized by cellular DNA synthesis

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Answer: c

Explanation: As the replication takes place, a single stranded sequence is generated and it circularizes in vivo in order to form single stranded circular molecule. The double stranded molecule can be synthesized by cellular DNA synthesis.

5. Choose the correct statement for cosmids.

- a) It can be regarded as lambda substitution vector
- b) Less amount of phage DNA is deleted
- c) Only cos packaging sites are left
- d) It doesn't contain a origin of replication

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Answer: c

Explanation: Cosmids can be regarded as lambda replacement vectors. More amount of phage DNA is deleted and only cos packaging sites are left. There are no

coat protein genes left. It also contains an origin of replication.

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6. Once cosmids are inside the E.coli cells, they don't generate phage but are propagated as plasmids.

- a) True
- b) False

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Answer: a

Explanation: Once cosmids are inside the E. coli cells, they don't generate more phage but are propagated as plasmids. It is so because no more coat protein genes are present and thus it can't be packaged. They can't give rise to plaques.

7. Which of the following is the correct method to check whether the DNA has entered into the cell or not in the case of cosmid?

- a) If a transformation has taken place turbid plaques are formed
- b) If a transformation has taken place clear plaques are formed
- c) If a transformation has taken place, it can be confirmed via ampicillin resistance
- d) If a transformation has taken place, it can be confirmed if forms plaques and is ampicillin resistant also

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Answer: c

Explanation: In the case of cosmid, transformation can be confirmed via counting the colonies containing ampicillin. As the plaques are not formed by cosmids, it can't be used as a method to detect transformation.

8. Which size of the insert is accepted by the cosmids?

- a) 10-20 kbp
- b) 35-45 kbp
- c) 50-60 kbp
- d) 100-120 kbp

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Answer: b

Explanation: There is a minimum size limit on the insert which is accepted by the cosmids and it lies in the range of 35-45 kbp. They generally accept large size insert and it is beneficial for the construction of genomic libraries.

9. What happens once the cosmid enters the E. coli cells?

- a) There is strict size selection inside E. coli cells
- b) Partial deletion may take place
- c) The tendency of deletion may be increased by using low copy number
- d) The tendency of deletion can't be altered

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Answer: b

Explanation: There is no size selection once the cosmid enters the E. coli cells. Because of it, partial deletion may take place. The tendency of deletion can be reduced by using a low copy number.

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10. If colEI derived origin of replication is replaced by the origin of replication of F plasmid, it is called as:

- a) phagemid
- b) F cosmid
- c) plasmid
- d) fosmid

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Answer: d

Explanation: If colE1 derived origin of replication is replaced by the origin of replication of F plasmid it is known as fosmid. F plasmids are present in a low copy number.

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## Genetic Engineering Questions and Answers – Bacteriophage-Mu and Bacteriophage-Pi

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Bacteriophage-Mu and Bacteriophage-Pi”.

1. Bacteriophage Mu is also a phage, choose the correct statement for it.

- a) It is an example of temperate phage
- b) It is packaged into heads containing 50 kbp of DNA
- c) When the phage replicates it goes transposition only a few times
- d) Mu can't be used for cloning in vivo

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Answer: a

Explanation: Bacteriophage Mu is also a phage, it is an example of temperate phage. It is packaged into heads containing 39 kbp of DNA. When the phage replicates it goes transposition a few hundred times and inserts itself into many places in the host genome. Mu can be used for cloning in vivo as a ‘mini Mu’ that contains reduced phage genome.

2. Choose the incorrect statement for ‘Mini Mu’?

- a) It is produced by cloning of bacteriophage Mu in vivo
- b) It contains reduced phage genome
- c) It doesn't contain replication of origin of plasmid
- d) A selectable marker is added

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Answer: c

Explanation: Mini Mu is produced by cloning of bacteriophage Mu in vivo. It is having reduced phage genome. A selectable marker and an origin of replication of plasmid are added.

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3. Which of the following is not included as a step for cloning mini Mu in vivo?

- a) A culture of target strain, whose DNA we want to clone is infected with mini Mu
- b) The phage is inserted at multiple sites in the genome
- c) Some of the packaged strain is flanked by two mini Mu genes
- d) The packaged phage is introduced into a second strain and Mu would replicate as a phage

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Answer: d

Explanation: For cloning in mini Mu, a culture of target strain whose DNA we want to clone is infected with mini Mu. The phage is inserted at multiple sites in the genome. Some of the packages strain is flanked by two mini Mu genes. The packaged phage is introduced into a second strain and the Mu won't be able to replicate as a phage.

4. If recombination takes place between elements in the second strain, it would replicate by the origin of replication of mini Mu.

- a) True
- b) False

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Answer: a

Explanation: If recombination takes place between elements in the second strain, it would replicate as a plasmid by the origin of replication of mini Mu. Thus a

plasmid is formed with a piece of DNA from first strain and stably maintained in the second strain.

5. Which of the following is a restriction for cloning in bacteriophage Mu?

- a) It is limited to handling only small number of phage particles
- b) It relies on whether the DNA is flanked by two mini Mu genes or not
- c) Recombination between the elements in the second strain is not a restriction
- d) Fragments of any genomic DNA can be cloned irrespective of the fact whether or not the phage can replicate in it or not

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Answer: b

Explanation: The cloning in bacteriophage Mu is restricted by some factors. These include, it depends whether the DNA is flanked by two mini Mu genes or not. Recombination between the elements in the second strain is also important. Fragments of only those genomic DNA can be cloned, in which Mu can replicate.

6. What is the size of the insert that can be accommodated in the head of bacteriophage PI?

- a) 30-40 kbp
- b) 80-95 kbp
- c) 110-115 kbp
- d) 200-300 kbp

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Answer: c

Explanation: Bacteriophage PI is known to accommodate the larger size of fragments. The size of the fragments that can be accommodated in the head of this phage lies between 110-115 kbp.

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7. What is the function of the pac site in the bacteriophage PI?

- a) It is responsible for the initiation of packaging
- b) It is responsible for the termination of packaging
- c) It is responsible for the initiation of replication
- d) It is responsible for the termination of replication

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Answer: a

Explanation: The pac site in the bacteriophage PI is responsible for initiating the packaging of DNA into the phage heads.

8. What is the function of loxP sites?

- a) It is responsible for linearization of DNA in the host bacterium
- b) It is responsible for circularization of DNA in the host bacterium
- c) It is responsible for conversion of single stranded DNA into double stranded DNA
- d) It is responsible for conversion of double stranded DNA into single stranded DNA

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Answer: b

Explanation: The lox P sites are responsible for the circularization of the linear DNA molecules in the host bacterium.

9. Which of the following is not included as a step in cloning in bacteriophage PI?

- a) The growth of vector is done as a plasmid by using pBR322 origin of replication
- b) Cleaving with BamH1 is done and then products cleaved with Sau3A are ligated
- c) Incubation with mutant lysogen is done which doesn't cleaves the recombinants at pac sites
- d) Incubation is done with mutant lysogen which doesn't contain head and tail proteins

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Answer: c

Explanation: Bacteriophage PI is a complex vector. The growth of vector is done as a plasmid by using pBR322 origin of replication. Cleaving with Bam H1 is done and it is followed by ligation with Sau3A partial digestion products. It is followed by incubation with mutant lysogen which cleaves the recombinants at pac sites but there are no head and tail proteins. It is followed by incubation in lysogen in which cleavage is not carried out at pac sites but there are head and tail proteins. It leads to packaging into heads.

10. What happens after packaging is carried out in the phage head?

- a) A sequence dependent cleavage of DNA is carried out
- b) A sequence independent cleavage of DNA is carried out
- c) They are linearized before they are infected into the bacterial cells
- d) They are circularized before they are infected into the bacterial cells

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Answer: b

Explanation: After the packaging is carried out in the phage head, a sequence independent cleavage of DNA is carried out. Molecules with a very small size insert can't fill into the whole phage head before the next pac site is reached.

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11. Circularization must take place in the bacterial cells before the replication starts.

- a) True
- b) False

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Answer: a

Explanation: Circularization must take place in the bacterial cells before the replication is initiated. The cells are introduced into the bacterial cells after the packaging has been carried out.

12. How many origins of replication are there once the cyclization is carried out by loxP sites?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: There are two origins of replication once the cyclization is carried out by loxP sites. One origin of replication is for low copy number and the other can be activated for carrying out a high copy number replication.

13. Choose the incorrect statement for PAC vectors.

- a) In these vectors, the phage packaging signals are removed but the two P1 origin of replication persist
- b) They resemble BAC vectors
- c) They accept an insert of upto 300 kbp
- d) Instability is observed

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Answer: d

Explanation: PAC vectors are those vectors, in which the phage packaging signals are removed but the two P1 origin of replication persist. These resemble BAC vectors. They accept upto an insert of upto 300 kbp. Maintenance at low copy numbers is helpful in avoiding instability.

14. Choose the correct statement in respect to sacB gene?

- a) The cloning site for PAC lies on the side of sacB gene
- b) It is responsible for producing an enzyme which is responsible for catalysing sucrose into glucose and fructose
- c) Expression of sacB in the presence of sucrose is beneficial
- d) Levan is non-toxic for E. coli

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Answer: b

Explanation: sacB gene along with E. coli promoter flanks the cloning site in PAC vector. It is responsible for producing an enzyme which is responsible for catalysing sucrose into glucose and fructose. The fructose is ploymerized to levan and is toxic to E. coli. Thus expression of sacB in the presence of sucrose is lethal.

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15. Selection of molecules by lack of inserts on the basis of the sacB gene is known as:

- a) positive selection
- b) negative selection
- c) counter selection
- d) sacB selection

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Answer: c

Explanation: The sacB gene is abolished if an insert is there in the cloning site and thus can survive in the presence of sucrose. It is known as a positive selection if it is directly looked for an insert. If instead of insert, absence of sacB gene is looked upon, it is called as the counter selection.

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## Genetic Engineering Questions and Answers – Genomic Libraries

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Genomic Libraries”.

1. Libraries can broadly be classified into how many types?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: Libraries can be classified basically into two types- genomic libraries and cDNA libraries. Genomic libraries are constructed from the whole genome of the organism. cDNA libraries are constructed from the DNA copies of RNA sequences.

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2. Choose the correct statement for genomic libraries.

- a) Genomic libraries include the representation of the whole genome of the organism
- b) Sequences such as telomeres are also represented
- c) Telomeres can be readily cloned
- d) The larger the size of the insert of genomic DNA in recombinants, the more is the number of recombinants required to represent the genome in the library

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Answer: a

Explanation: Genomic libraries include the representation of the whole organism. Sequences such as telomeres can't be represented in the genomic libraries because they can't be readily cloned. The larger size of the insert of genomic DNA in recombinants, less number of recombinants is required to represent the genome in the library.

3. Choose the incorrect statement for the preparation of genomic libraries.

- a) The first step is the isolation of genomic DNA
- b) Physical damage to the DNA should be avoided
- c) If a nuclear DNA library is to be constructed, organelle DNA is to be removed
- d) For the construction of organelle library, organelle DNA is purified from the nuclear DNA

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Answer: c

Explanation: For the preparation of genomic libraries, the first step is the isolation of genomic DNA. Physical damage to the DNA should be avoided and DNA of high molecular weight should be obtained. For the construction of nuclear DNA library, organelle DNA (DNA which is included in mitochondria and chloroplast), is not removed. It is so because they are very less in the amount in comparison to nuclear DNA. For the construction of organelle library, organelle DNA is purified from the nuclear DNA.

4. The various steps for construction of libraries are \_\_\_\_\_

- i) Fragmentation of DNA
- ii) Isolation of genomic DNA
- iii) Amplification
- iv) Ligation and introduction to the host
- v) Vector preparation

The correct order of construction of libraries is (In the order of starting to ending).

- a) i)-ii)-iii)-iv)-v)
- b) ii)-i)-v)-iv)-iii)
- c) ii)-v)-i)-iv)-iii)
- d) v)-ii)-i)-iii)-iv)

[View Answer](#)

Answer: b

Explanation: Firstly, the isolation of genomic DNA is carried out. It is followed by the fragmentation of DNA. Then the vector preparation is done, which is

followed by the ligation and introduction to the host. The final step is the amplification of the recombinants.

5. Complete digestion is preferred over partial digestion for the fragmentation of DNA.

- a) True
- b) False

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Answer: b

Explanation: Partial digestion is preferred over complete digestion. It is so because if complete digestion is carried out, it is not necessary that all the fragments are represented. Thus partial digestion is preferred over complete digestion.

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6. To avoid ligation of separate DNA fragments, which of the enzyme is used?

- a) phosphatase
- b) kinase
- c) ligase
- d) endonuclease

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Answer: a

Explanation: To avoid ligation of separate DNA fragments, phosphatase is used. By the use of phosphatase, terminal phosphate groups are removed and thus ligation is not done. Joining of separate fragments is avoided because it would lead to the formation of non-contiguous DNA.

7. Vector and insert are mixed, ligated and packaged and introduced into the host by \_\_\_\_\_

- a) transformation
- b) transduction
- c) infection
- d) transformation and infection

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Answer: d

Explanation: Vector and insert are mixed, ligated and packaged into the host by transformation and infection both.

8. Libraries using phage cloning vectors are often kept as \_\_\_\_\_

- a) unpackaged phage
- b) packaged phage
- c) both packaged and unpackaged phage
- d) both packaged and unpackaged phage are used but packaged is favoured

[View Answer](#)

Answer: b

Explanation: Libraries using phage cloning vectors are often kept as packaged phage. This can be plated out on appropriate hosts when needed.

9. Libraries constructed in plasmid vectors can be kept as \_\_\_\_\_

- a) plasmid containing cells
- b) naked DNA
- c) both plasmid containing cells and naked DNA
- d) naked DNA is preferred over plasmid containing cells

[View Answer](#)

Answer: c

Explanation: Libraries constructed in plasmid vectors can be kept as both plasmid containing cells and naked DNA. The naked DNA can be transformed into the host as required.

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10. During storage, there are chances of degradation of DNA. Larger fragments are having more chances of being lost.

- a) True
- b) False

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Answer: a

Explanation: During storage, there are chances of degradation of DNA and the larger fragments are at greater risk of being lost. And thus average insert size will gradually fall.

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## Genetic Engineering Questions and Answers – cDNA Libraries, Polyadenylated RNA and cDNA Synthesis – 1

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “cDNA Libraries, Polyadenylated RNA and cDNA Synthesis – 1”.

1. Choose the incorrect statement for cDNA libraries.
  - a) They constitute of DNA copies produced from the RNA sequences and usually mRNA
  - b) They represent expressed sequences
  - c) Introns are not represented
  - d) Comparison of cDNA sequences with genomic sequences leads to the determination of polyadenylation sites

[View Answer](#)**Answer: c**

Explanation: cDNA libraries constitute of DNA copies produced from RNA sequences and usually mRNA. They are not only the collection of expressed sequences but post transcriptional changes are also recorded. Introns can also be represented. Comparison of cDNA sequences with genomic sequences can lead to the determination of positions of introns, polyadenylation sites etc.

2. A times partial sequencing of cloned cDNAs is carried out. These cDNA are known as \_\_\_\_\_
  - a) expressed RNA sequences
  - b) expressed sequence tags (ESTs)
  - c) expressed cDNA sequences
  - d) library

[View Answer](#)**Answer: b**

Explanation: The partial sequencing of cloned cDNA is the first step of genome characterization project. These cloned cDNA sequences are known as expressed sequence tags (ESTs).

3. Polyadenylation of RNA species is an important criterion for the production of cDNA species. Which of the following holds true?
  - a) Polyadenylation should be at 3' end
  - b) Eukaryotic mRNAs are mostly non-polyadenylated
  - c) Bacterial mRNAs and organelle mRNAs are polyadenylated
  - d) It is carried out by the addition of T residues after synthesis

[View Answer](#)**Answer: a**

Explanation: Polyadenylation of RNA species is an important criterion for the production of cDNA species and polyadenylation should be at the 3' end. Mostly eukaryotic mRNAs are polyadenylated. It is carried out by the addition of A residues after synthesis. Usually, bacterial mRNAs and organelle mRNAs are non-polyadenylated residues.

4. Choose the incorrect statement for oligo-dT cellulose.

- a) It is used for separation of polyadenylated mRNA from another mRNA
- b) oligo-dT are covalently attached to the solid support via OH bonds
- c) A solution containing RNA is passed through the column
- d) Poly A tail attaches to the oligo-dT by ionic bonds

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Answer: d

Explanation: oligo-dT cellulose is used for separation of polyadenylated mRNA from another mRNA. These are covalently attached on a solid support via OH bonds. For separation, a solution containing RNA is passed through the column and the molecules having poly A tails are attached to the column via hydrogen bonds.

5. Poly A tail from the column is eluted by using high salt concentration.

- a) True
- b) False

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Answer: b

Explanation: All non-specific mRNA are firstly eluted from the column. The poly A tail is eluted from using low salt concentration, it is so because low salt concentration destabilizes nucleic acids.

6. At times streptavidin is used in place of cellulose. Choose the correct statement for this alternative.

- a) oligo-dT streptavidin conjugate can be extracted by magnetic beads
- b) The magnetic beads are attached with activin
- c) Recovery is not based on the magnetic properties of the beads
- d) The interaction between polyA tail and the oligo-dT is reduced

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Answer: a

Explanation: If streptavidin is used in the place of cellulose, oligo-dT streptavidin conjugate can be extracted by magnetic beads. These magnetic beads are having biotin attached to them. Recovery is based on the magnetic properties of the beads. The interaction between the polyA tail and the oilgo-dT still remains the basic principle and it is not affected.

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7. Choose the correct with respect to RNA molecules.

- a) They are less labile than DNA molecules
- b) The 2' hydroxyl group of ribose group decreases the activity
- c) There is no loss of activity while boiling
- d) Baking of glassware, treatment with UV can be used for protection against degradation

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Answer: d

Explanation: RNA molecules are more labile as compared to the DNA molecules and they are more reactive because of the 2' hydroxyl group of ribose group. Baking of glassware, treatment with UV can be used as methods for protection against degradation. If precautions are not taken, there is subsequent loss of activity while boiling.

8. What is the basis of RNaseH method?

- a) It is based on RNA synthesis by DNA strand
- b) It is based on complementary DNA synthesis by RNA strand through reverse transcriptase
- c) It is based on complementary DNA synthesis by RNA strand through RNaseH enzyme
- d) It is based on getting double strand RNA from a single strand

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Answer: b

Explanation: RNase H method is based on the synthesis of the complementary DNA synthesis by RNA strand through reverse transcriptase enzyme and it leads to the formation of the duplex of RNA and DNA.

9. The first step for RNaseH method is to anneal a chemically synthesized oligo-dT primer to the 3' polyA tail of RNA.

- a) True
- b) False

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Answer: a

Explanation: A chemically synthesized oligo-dT primer is annealed to the 3' polyA tail of RNA. After this primer is attached the RNA DNA duplex is formed with the help of reverse transcriptase.

10. For the synthesis of the second DNA strand, incorporated oligo-dT is of no use. Why?

- a) It is so because it is unstable
- b) It is so because it is at the 3' end of the template molecule
- c) It is so because it would be unable to initiate replication
- d) It is so because it detaches itself after first strand synthesis

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Answer: c

Explanation: For the second DNA strand synthesis, oligo-dT is of no use. It is so because it is present at 5' end of the template and replication could not start

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## Genetic Engineering Questions and Answers – cDNA Libraries, Polyadenylated RNA and cDNA Synthesis – 2

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This set of Genetic Engineering Multiple Choice Questions & Answers focuses on “cDNA Libraries, Polyadenylated RNA and cDNA Synthesis – 2”.

1. Choose the incorrect statement for second DNA strand synthesis.
  - a) The RNA: DNA complex is treated with the enzyme RNaseH and DNA pol
  - b) The enzyme RNaseH is responsible for nicking the RNA strand and leaving free 3' hydroxyl ends
  - c) These RNA fragments can be used as primers
  - d) There is no portion of RNA left attached to the DNA strand

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Answer: d

Explanation: For second strand DNA synthesis, the RNA: DNA complex is treated with RNaseH enzyme along with DNA pol. The enzyme is responsible for nicking the RNA strand and leaving 3' hydroxyl ends. These free ends are used for second strand synthesis. These RNA fragments can be used as primers. After DNA: DNA duplex formation, only a small portion of RNA is left at the 5' end.

2. What is the final product of the RNaseH method?
  - a) blunt ended dsDNA
  - b) staggered dsDNA at both ends
  - c) staggered dsDNA at 3' end
  - d) staggered dsDNA at 5' end

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Answer: a

Explanation: The final product of the RNaseH method is blunt ended dsDNA. The RNA piece left at the 5' end is removed by RNase and thus blunt ended dsDNA is left.

3. What would not happen if the RNA strand is completely removed from RNA: DNA hybrid?

- a) There are no chances of the synthesis of the second DNA strand
- b) Chance complementarity would take place
- c) Hairpin structure would be formed
- d) Hairpin structure is formed is not the final structure

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Answer: a

Explanation: If the RNA strand is completely removed from RNA: DNA hybrid, the single stranded DNA remains. Then chance complementarity takes place and the 3' end complements with any other portion in the single stranded DNA. It leads to the formation of a hairpin structure and the 3' end extends in the presence of DNA pol and nucleotides.

4. The loop region is single stranded. It can be cleaved by using which enzyme?

- a) Exonuclease
- b) S1 nuclease
- c) RNaseH
- d) DNase

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Answer: b

Explanation: The loop region in the hairpin structure is single stranded in nature. The single stranded portion can be cleaved by S1 nuclease.

5. Choose the correct statement with respect to the self priming method of cDNA synthesis.

- a) It is less preferred than RNaseH method
- b) A hairpin structure is formed with guarantee
- c) The sequence corresponding to the 5' end is lost
- d) Reverse transcriptase is not used

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Answer: c

Explanation: The self priming method is based on the formation of a hairpin structure. But there are only chances and no guarantee of formation of hairpin structure. In the first strand synthesis, reverse transcriptase is used. The sequence corresponding to the 5' end is lost and in cDNA large deletions are observed. This method is less preferred than RNaseH method.

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6. Choose the incorrect statement for the method homopolymer tailing.

- a) The first step is the RNA: DNA hybrid synthesis
- b) Terminal transferase is used for the addition of nucleotides on 3' end
- c) Terminal transferase adds only at DNA strands
- d) The DNA strand is now having known sequence at 3' end

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Answer: c

Explanation: Homopolymer tailing is also used for cDNA synthesis. The first step remains same as the other methods, which is the synthesis of RNA: DNA hybrid. It is then treated by terminal transferase, the enzyme is responsible for adding nucleotides on 3' end of both DNA and RNA. The 3' end is now having a known DNA sequence and it is used as a tail in the reaction.

7. Choose the correct statement for RACE.

- a) It stands for Random Amplification of cDNA ends
- b) It is for cloning particular cDNA ends
- c) It is only of one type, which is 5' RACE
- d) Sequence data is not available in any case

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Answer: b

Explanation: RACE stands for Rapid Amplification of cDNA ends. Sometimes, we wish to clone specific cDNA portion and are having some sequence data. It is meant for cloning specific cDNA ends and is classified into two types, 5' RACE and 3'RACE.

8. The first primer in the case of 3' RACE is \_\_\_\_\_

- a) internal sequence
- b) oligo-dT adaptor molecule
- c) oligo-dA adaptor molecule
- d) adaptor oligo-dT primer

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Answer: b

Explanation: The first primer in the case of 3' RACE is oligo-dT adaptor molecule. The second primer is an internal sequence.

9. The first cDNA strand in 5' RACE is tailed with oligo-dA tail.

- a) True

b) False  
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Answer: a

Explanation: The first cDNA strand in the case of 5' RACE is tailed with an oligo-dA tail. The synthesis of the first cDNA strand is by an internal primer.  
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10. What is the second primer in the case of 5' RACE?

- a) Internal primer
- b) Oligo-dA sequence
- c) Adaptor-oligo-dT primer
- d) Oligo-dT adaptor molecule

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Answer: c

Explanation: The second primer ie the primer used for the synthesis of the second cDNA strand is adaptor-oligo-dT primer. Subsequent PCR is carried out by using internal primer for coding sequence.

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# Genetic Engineering Questions and Answers – Cloning the cDNA and Specialized Libraries – 1

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Cloning the cDNA and Specialized Libraries – 1”.

1. RNaseH method and homopolymer tailing method generates blunt ended cDNA molecules. Which of the following can be used for attaching them to vector?

- a) Blunt ended ligation
- b) Addition of linkers
- c) Using appropriate restriction enzymes
- d) All the methods can be used equivalently

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Answer: d

Explanation: As the products of RNaseH method and homopolymer tailing method generates dsDNA and blunt ended molecules, there are many methods to attach them to vector. Blunt ended ligation, the addition of linkers and restriction enzymes all can be used.

2. Choose the correct statement for modification of homopolymer tailing method.
- a) It includes modification of primers
  - b) Primers are varied by simply altering their size by randomly adding or removing bases
  - c) The 5' end of the first cDNA strand is tailed with C residues
  - d) A single stranded oligonucleotide is then used for second strand synthesis

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Answer: a

Explanation: The modification of homopolymer tailing method includes modification of primers. Primers can be modified by the introduction of restriction sites in them. The 3' end of the first cDNA strand is tailed with C residues. Another oligo-dG primer precedes the introduced restriction site and is contained with the double stranded oligonucleotide region. It is used for second strand synthesis.

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3. By synthesizing two strands separately then annealing them leads to formation of double stranded oligonucleotide.

- a) True
- b) False

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Answer: a

Explanation: Double stranded oligonucleotides are required for the synthesis of second cDNA strand. This double stranded oligonucleotide is synthesized by separately synthesizing two strands and then annealing them.

4. Choose the incorrect statement for the homopolymer tailing of cDNA strands.

- a) The blunt ended double stranded cDNA molecules are treated with terminal transferase and dCTPs
- b) Vector is also treated with terminal transferase and dGTPs
- c) The vector and cDNA can now anneal with the help of DNA ligase
- d) If gaps are created they can be repaired by physiological processes

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Answer: c

Explanation: For homopolymer tailing of cDNA strands, the blunt ended double stranded molecules are treated with terminal transferase and dCTPs. This leads to the addition of C residues at 3' end. Vector is also treated with terminal transferase and dGTPs. This leads to annealing of vector and cDNA molecules and DNA ligase is not required. The gaps created can be repaired by physiological processes once the recombinant molecules enter the host.

5. Choose the correct statement if the RNA is non polyadenylated.

- a) A collection of chemically synthesized oligonucleotides is used as primers
- b) They are usually tetramer
- c) Unequal quantities of A, G, T and C are used
- d) The primers attach at only specific sequences for first strand synthesis

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Answer: a

Explanation: As the RNA is non polyadenylated, oligo-dT primer can't be used and in place of it a collection of chemically synthesized oligonucleotides is used as primers. They are usually hexamers and are made by equal quantities of A, G, C and T. And thus all hexameric sequences can be synthesized. The primers can attach to the RNA sequences throughout.

6. In case if molecules smaller than the fragments required for making a full genomic library are used for making a collection. This collection is called as

- 
- a) library
  - b) shelf
  - c) small library
  - d) mini library

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Answer: b

Explanation: If the molecules smaller than the fragments required for making a full genomic library are used for collection, this collection is called a shelf. It is a subsection of the library.

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7. Choose the correct statement for construction of a library subsection.

- a) The size of a particular restriction fragment on which the gene is located is not known
- b) The size of the restriction fragment can be known by carrying out southern blotting
- c) Another digest of the genomic DNA is carried out by a different enzyme
- d) DNA fragments of different size are recovered after carrying out gel electrophoresis

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Answer: b

Explanation: For the construction of a subsection of the library, some steps are followed. The size of a particular restriction fragment on which gene is located is known at times. The size of the fragment can be known by carrying out southern blotting. After the size is known, another digest of the genomic DNA is carried out and is done by the same enzyme. DNA fragments of the approximately same size are recovered from the gel after carrying out gel electrophoresis. They can be further cloned into a vector.

8. Any cDNA library would represent a fraction of RNA species of an organism.

- a) True
- b) False

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Answer: a

Explanation: Any cDNA library would represent a fraction of RNA species of an organism, the whole organism can't be represented in a library. It depends on the developmental stage, physiological state and the tissue from which RNA was isolated.

9. What do we mean by housekeeping genes?

- a) Housekeeping genes are those genes which are specific to an organism
- b) Housekeeping genes are those genes which are present in all the organisms
- c) Housekeeping genes are those genes which are meant for repair and maintenance in a species of organism
- d) Housekeeping genes are those genes which required for the replication process

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Answer: b

Explanation: Housekeeping genes are those genes which are present in all the organisms. cDNA libraries may therefore contain housekeeping genes and genes specific to that organism.

10. Choose the correct statement for RNA fractionation.

- a) The RNA is fractionated by size but before separating on oligo-dT cellulose
- b) A sucrose density gradient is used
- c) The RNA is applied to the top of a pre-poured gradient and during centrifugation smaller molecules move down the tube faster
- d) Different bands are formed according to the density in the sucrose density gradient

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Answer: b

Explanation: RNA fractionation is carried out and the basis is the size. It is fractionated by size after carrying out separation on oligo-dT cellulose. A sucrose density is used for size based separation. The RNA is applied to the top of a pre-poured gradient and during centrifugation larger molecules move down the tube faster. There are different bands formed on the basis of size in the sucrose density gradient.

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11. What is done after RNA fractionation is carried out?

- a) Each band is translated in vivo
- b) Translation is carried out in wheat gram or lysate of rabbit reticulocyte cells
- c) Translation is carried out with a high background
- d) Amino acid is not radioactively labelled

[View Answer](#)

Answer: b

Explanation: RNA fractionation is carried out and it is followed by a translation of each band in vitro. It is carried out in wheat gram or lysate of rabbit reticulocyte cells. Ribosomes, tRNAs are added in order to carry out the translation with low background. An amino acid is radioactively labelled and thus the polypeptide sequence synthesized is labelled.

12. The polypeptides produced after addition of mRNA are analysed with antibodies. Choose the incorrect statement for this analysis.

- a) Antibodies are added to each reaction tube and precipitation is simply based on antigen-antibody reaction
- b) Along with simple antigen-antibody complex, a substrate is added for easy precipitation
- c) Protein A-Sepharose is added
- d) Protein A-Sepharose binds to IgG antibodies

[View Answer](#)

Answer: a

Explanation: The analysis of polypeptides after addition of mRNA can be carried out by the addition of antibodies. But it is not simply based on antigen-antibody reaction. A substrate for easy precipitation is also added. For this, protein A-Sepharose is added. Protein A-sepharose binds to IgG antibodies. After carrying out centrifugation, it can be pelleted easily.

13. What is done after the recovery of pellets has been carried out in order to know the amount of polypeptides?

- a) Denaturing and gel electrophoresis in SDS- Polyacryamide gel
- b) Gel electrophoresis in agarose gel
- c) Quantitative PCR
- d) Weighing pellets

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Answer: a

Explanation: After the recovery of pellets has been carried out by the use of antigen-antibody reaction, denaturation and gel electrophoresis in SDS-Polyacrylamide gel. The amount of radioactivity gives the amount and location of polypeptides.

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# Genetic Engineering Questions and Answers – Cloning the cDNA and Specialized Libraries – 2

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This set of Genetic Engineering online test focuses on “Cloning the cDNA and Specialized Libraries – 2”.

1. Sometimes the required mRNA is present in less number. So the process of increasing the representation of rare mRNAs is called as \_\_\_\_\_  
a) amplification  
b) normalization  
c) selection  
d) narrowing  
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Answer: b

Explanation: If the required mRNA is present in less number, its representation can be increased by a process called normalization. It reduces the number of times the library has to be screened for required cDNA.

2. Choose the correct statement in order to enrich rare species.  
a) The most basic principle relies on the kinetics of hybridization  
b) A collection of single stranded molecules is allowed to reanneal under given conditions  
c) The strands which are less abundant are able to find their complement easily  
d) The left over molecules are more abundant in nature  
[View Answer](#)

Answer: a

Explanation: In order to enrich the rare species, the basic principle relies on the kinetics of hybridisation. A collection of double stranded cDNA molecules is allowed to melt. As the strands melt away, they are then allowed to reanneal under suitable conditions. The more abundant the species is, the more easily they anneal. The rare species are obtained in single stranded form because it is difficult to reanneal them.

3. Which statement holds true for hydroxyapatite?  
a) It binds to single stranded molecules more tightly than double stranded molecules  
b) It binds to linear molecules more tightly than circular molecules  
c) It binds to circular molecules more tightly than linear molecules

d) It binds to double stranded molecules more tightly than single stranded molecules

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Answer: d

Explanation: Hydroxyapatite is the molecule which binds more tightly to the double stranded molecules than the single stranded molecules. This property is very useful in the process of enrichment of rare species.

4. Libraries in which a particular sequence is present in one organism but are absent from another organism, are called as \_\_\_\_\_

- a) normalized libraries
- b) subtractive libraries
- c) selective libraries
- d) partial libraries

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Answer: b

Explanation: Sometimes it happens that a particular sequence is present in one organism but is absent from another organism, such libraries are known as subtractive libraries.

5. The nucleic acid from the cell type that contains the sequence we are interested in is called \_\_\_\_\_

- a) driver
- b) subtractive sequence
- c) tracer
- d) wanted sequence

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Answer: c

Explanation: The nucleic acid from the cell type containing the sequence we are interested in is called a tracer. The driver is the molecule which lacks the sequence.

6. Choose the correct statement for libraries constructed by mixing cell types differing in the sequences they are having.

- a) The driver and tracer are mixed in double stranded form
- b) Tracer is in stoichiometric excess in comparison to driver
- c) Tracer and driver are in the same amount
- d) The sequences are allowed to hybridize

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Answer: d

Explanation: It is about subtractive libraries. The driver and tracer are mixed in single stranded form and driver is in stoichiometric excess in comparison to the driver. It is about tenfold excess. The sequences are mixed and allowed to hybridize.

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7. Which of the following is desirable?

- a) Driver- driver hybrid
- b) Driver- tracer hybrid
- c) Tracer- tracer hybrid
- d) Driver alone

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Answer: c

Explanation: Our sequence of interest is present in the tracer. So if it hybridizes with a driver, it means that the sequence is present in it also and thus it is not required by us. Hence, either tracer-tracer hybrids or single stranded tracers are required.

8. Which of the statement holds true?

- a) The tracer is treated with an enzyme which generates compatible ends
- b) The driver is treated with an enzyme which generates compatible ends
- c) Both driver and tracer are treated with an enzyme to generate compatible ends
- d) Both driver and tracer are treated with an enzyme to generate incompatible ends

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Answer: a

Explanation: The tracer is treated with an enzyme which generates compatible ends and the driver is treated to generate incompatible ends. It is done so because then driver-driver or driver-tracer hybrids won't form. Only tracer-tracer hybrids would form.

9. If physical methods are used, tracer is amplified and is labelled with biotin.

- a) True
- b) False

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Answer: b

Explanation: In the case of physical removal methods, the driver is amplified and is labelled with biotin. After hybridization between tracer and driver, streptavidin is added and it attaches to biotin. Methods such as phenol extraction are used in order to remove streptavidin and sequences attached to it. Thus, tracer sequences which are not attached to driver remain in the aqueous phase only.

10. Sometimes a gene which we want to clone is present on a particular chromosome. For this purpose, the chromosome should be in which phase?

- a) Prophase
- b) Telophase

- c) Metaphase
- d) Anaphase

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Answer: c

Explanation: The chromosomes should be in metaphase state because then they will be in a condensed form and it would be easy to handle them.

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11. For cloning purposes, the intact chromosomes should be separated by \_\_\_\_\_

- a) agarose gel electrophoresis
- b) fluorescence- activated sorter
- c) polyacrylamide gel electrophoresis
- d) chromatography

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Answer: b

Explanation: For cloning purposes, the intact chromosomes should be separated by using fluorescence-activated sorter. The amount of fluorescence obtained is based on the amount of dye and thus depends on the size of the chromosome.

12. The process of examining stained chromosomes in a light microscope and removing appropriate regions with a micro-manipulator is called as \_\_\_\_\_

- a) microdissection
- b) chromosome sorting
- c) chromosome walking
- d) chromosome jumping

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Answer: a

Explanation: The process of separating the region of interest from a chromosome is termed as microdissection. It is carried out by firstly staining the chromosome and then observing it under a light microscope.

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# Genetic Engineering Questions and Answers – Database Screening and Screening by Nucleic Acid Hybridisation – 1

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Database Screening and Nucleic Acid Hybridisation – 1”.

1. The process of finding a particular member of the library which is having some defined properties is called as \_\_\_\_\_

- a) searching
- b) screening
- c) locating
- d) narrowing

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Answer: b

Explanation: The process of finding a particular member of the library which is having some defined properties is called as screening. Mostly screening is carried out for a particular coding sequence.

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2. If for a particular organism sequence data is available and we have to simply search in the data through a computer, then this method is called as \_\_\_\_\_

- a) annotation
- b) database search
- c) in silico
- d) electronic search

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Answer: c

Explanation: The easiest way to find for a particular sequence is to exploit the genomic analyses. If the database is available for a particular sequence and the task is to simply search the data through the computer then the procedure is called in silico.

3. If we are having sequence data for a particular organism, but screening is carried out for homologues the program used is BLAST.

- a) True
- b) False

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Answer: a

Explanation: Homologues are a group of organisms which contain similar sequences. Screening for such organisms can be carried out by using programs such as BLAST (Basic Local Alignment Search Tool). Search can be carried out within or for nucleotide and protein sequences.

4. If screening is carried out on the basis of sequences which are related to the desired sequence, then the process is called \_\_\_\_\_

- a) in-silico
- b) homologue search
- c) annotation
- d) partial search

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Answer: c

Explanation: If the search is carried out on the basis of the related sequence rather than looking for the actual sequence then the process is termed as an annotation.

5. How many techniques are there for carrying out the screening of sequences encoding for RNAs?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: There are basically two techniques used for carrying out the screening of sequences encoding for RNAs. The first technique is based on nucleic acid hybridization and the second is based on coding function in vivo.

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6. Choose the incorrect statement for colony or plaque lift.

- a) It is the base for screening based on nucleic acid hybridization
- b) It is also known as Grunstein-Hogness technique
- c) It is based on the fact that which members of the library have the same sequence as the DNA probe
- d) The library may be plaques on a bacterial lawn and in that case it is known as plaque lift

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Answer: c

Explanation: Colony lift or plaque lift is the basis for nucleic acid hybridization. It is also known as Grunstein-Hogness technique named after the discoverer. It is based on the fact that which members of the library are complementary to the sequence of DNA probe can be known. The library may be plaques on a bacterial lawn and in that case it is known as plaque lift. There may be colonies on a plate and in that case, it is known as colony lift.

7. The screening of libraries us carried out by nucleic acid hybridisation and constitutes of following steps:

- i) Peeling of membranes carrying away bacterial cells with it
- ii) Cells are lysed and denaturing of DNA is being carried out
- iii) Hybridization with labelled DNA
- iv) Placing the membrane onto plate containing recombinant cells

Choose the correct sequence in which the steps are carried out (starting to ending).

- a) iv)-i)-ii)-iii)
- b) iv)-ii)-i)-iii)
- c) i)-ii)-iii)-iv)
- d) iii)-ii)-i)-iv)

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Answer: a

Explanation: Firstly, the membrane is placed onto the plate containing recombinant cells. Then the membrane is peeled off and the bacterial cells are carried away with it. After this, cells are lysed and denaturing of DNA is done. It is followed by hybridization with labelled DNA and then visualization is done.

8. Choose the incorrect statement with respect to the membranes used for adhering of bacterial cells onto them.

- a) Nitrocellulose membranes were preferred earlier
- b) They bind DNA very efficiently
- c) They can be handled easily without breakage
- d) They are inflammable

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Answer: c

Explanation: Nitrocellulose membranes were preferred earlier. They bind DNA very efficiently and are brittle thus can't be handled efficiently without breaking. They are inflammable.

9. Nitrocellulose membranes are less sensitive than nylon membranes.

- a) True
- b) False

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Answer: b

Explanation: Nylon membranes are less sensitive than nitrocellulose membranes. Though nylon membranes are used more often today but nitrocellulose membranes are more sensitive. To make nylon membranes more sensitive, they are derivatized.

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10. What is used for lysing of bacterial cells and denaturation of DNA?

- a) Exonuclease
- b) Sulphuric Acid
- c) Sodium Hydroxide
- d) Heat

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Answer: c

Explanation: The bacterial cells are lysed by the use of sodium hydroxide. The phage proteins and DNA are also denatured by the use of sodium hydroxide.

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## Genetic Engineering Questions and Answers – Database Screening and Screening by Nucleic Acid Hybridisation – 2

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This set of Genetic Engineering online quiz focuses on “Database Screening and Screening by Nucleic Acid Hybridisation – 2”.

1. The process of baking or cross-linking of the membrane is carried out by \_\_\_\_\_

- a) By heating at 80 degrees
- b) By irradiating with UV
- c) Both irradiation and heating method are used
- d) By addition of agarose

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Answer: c

Explanation: The cross-linking or baking of membrane is carried out by either heating it at 80 degrees or irradiating with UV. It is important to carry out this step because it binds the DNA irreversibly to the membrane.

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2. Choose the incorrect statement for prehybridization mixture.

- a) The function of it is to carry out specific binding
- b) It constitutes of non-labelled DNA of non-specific sequence which is obtained from salmon or herring testes or sperm
- c) It is added in a small amount
- d) It is carried out before the hybridization is carried out

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Answer: a

Explanation: Prehybridization mixture is meant for blocking sites which are meant for non-specific binding. It constitutes of non-labelled DNA of non-specific sequence which is obtained from salmon or herring testes or sperm. They are added in a small amount and it is added before the hybridization is carried out. So that when hybridization is carried out, only specific binding takes place.

3. After hybridization how the position of the labelled DNA probe is determined?

- a) By staining
- b) By UV irradiation
- c) By using chemiluminescence
- d) By electronic microscope

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Answer: c

Explanation: After the hybridization has been carried out and the membrane has been washed, the position of the labelled DNA probe is determined by using chemiluminescence. Commonly the probe is labelled by incorporation of fluorescein conjugated molecules.

4. The important parameters for precise annealing of the probe and the subsequent washing don't include \_\_\_\_\_

- a) Size of the probe
- b) Proportion of only A
- c) Ionic concentration of hybridization buffer
- d) Other agents which alter the base pairing

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Answer: b

Explanation: The probe should anneal precisely and the parameters which decide these are size of the probe, proportion of all A, G, T and C. Ionic concentration of hybridization buffer and other agents such as formamide which alter base pairing. These parameters define the maximum temperature at which probe and target DNA bind fully.

5. If hybridization is carried out with a clone having a sequence similar to that of the vector from which library has been constructed, then it is of no use. Choose the correct statement in respect to it.

- a) PCR amplification of the probe can be carried out
- b) Excision of the probe should be carried out which should be followed polyacrylamide gel electrophoresis
- c) If the vector sequence and the DNA probe are having similarities, some of the vector would be hybridized

d) Probe should be in a vector that is having some sequence similarity with the library to be screened

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Answer: a

Explanation: If hybridization is carried out with a clone having a sequence similar to that of the vector from which the library has been constructed then all the vector would hybridize. To make the sequence different, PCR amplification of the probe can be carried out. Also, excision of the probe can be carried out by using suitable restriction enzymes and it is followed by agarose gel electrophoresis. Or probe in a vector should not have any sequence similarity with the library to be screened.

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6. At what temperatures the hybridization and washing of the DNA probes should be carried out?

- a) At melting temperature
- b) At a temperature lower than the melting temperature
- c) At a temperature higher than the melting temperature
- d) At 100 degrees

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Answer: b

Explanation: The hybridization and washing of the DNA probes should be carried out at a temperature below than the melting temperature. It is so because if it is carried out a temperature lower than the melting temperature, some amount of mismatch is allowed. Melting temperature depends on the composition of the probes.

7. Which library should be used, genomic or cDNA when the screening is carried out by oligonucleotide probes?

- a) Genomic
- b) cDNA
- c) Both genomic and cDNA library can be used equivalently
- d) None of the libraries are preferred if oligonucleotide probes are used

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Answer: b

Explanation: If oligonucleotide probes are used, then cDNA libraries should be used. It is so because cDNA libraries are enriched for coding sequences and thus fewer sequences have to be screened.

8. Sometimes successive rounds of screening of a genomic library are carried out and an ordered collection of clones is done in a linear fashion, then the process is called as \_\_\_\_\_

- a) chromosome jumping
- b) chromosome sorting
- c) chromosome walking
- d) transposon tagging

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Answer: c

Explanation: Chromosome walking is the process of successive rounds of screening of a genomic library and it leads to the collection of clones in a linear order.

9. If the clone for a gene is obtained on the basis of its position in the gene map, then it is called as \_\_\_\_\_

- a) locational cloning
- b) positional cloning
- c) chromosome walking
- d) transposon tagging

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Answer: b

Explanation: If the clone for a gene is obtained on the basis of its position in the gene map then it is called positional cloning.  
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10. Mobile portions of a chromosome which can be transferred from one portion to another are termed as \_\_\_\_\_

- a) mobile part
- b) transposons
- c) walking elements
- d) transferable genetic element

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Answer: b

Explanation: Transposons are the mobile portions of the chromosomes which can be transferred from one portion of the chromosome to another either on the same chromosome or different chromosome.

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# Genetic Engineering Questions and Answers – Screening by Expression In Vivo

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Screening by Expression In Vivo”.

1. At times screening is done for the protein product of DNA of interest rather than the sequence itself. How many methods are there to carry out this?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: The two methods for this procedure are the direct selection for insert function and the second is ligand binding by the expressed protein.

2. Choose the correct statement if the screening is carried out by screening by expression in vivo.

- a) The proportion of recombinants carrying gene of interest is small
- b) The recombinants carrying gene of interest don't complement the host mutation
- c) Mutation should be affecting many genes
- d) Most of the products selected would be result of complementation

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Answer: a

Explanation: The proportion of recombinants carrying the gene of interest is small. The host is mutant towards the gene of interest and thus the recombinants complement the host mutation. Mutation used should affect only one gene. The most of the products selected would be a result of reversion of only mutation and not complementation.

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3. Choose the incorrect statement with respect to host used.

- a) The host must carry mutation for the gene of interest
- b) The host should not contain restriction enzymes
- c) The host if having restriction enzymes, then the incoming DNA should not be methylated
- d) The host should be deficient in recombination

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Answer: c

Explanation: The host used must carry the mutation for the gene of interest. The host must not contain restriction enzymes. If the host is having restriction

enzymes then the incoming DNA must be methylated. If the incoming DNA is not methylated, then it would be cleaved by restriction enzymes. The host should also be deficient in recombination otherwise it would be difficult to get it.

4. If the gene to be screened belongs to prokaryotic species then there are chances that it is not expressed.

- a) True
- b) False

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Answer: a

Explanation: In the case, if gene which is to be screened belongs to prokaryotic species than there are chances that it is not expressed. There are chances that promoter is not present in the insert region.

5. If the library to be screened and the host belongs to different species, then it is called as \_\_\_\_\_

- a) homologous selection
- b) heterologous selection
- c) intraspecies selection
- d) mixed selection

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Answer: b

Explanation: If the library to be screened and the host belong to different species, then it is called as heterologous selection. In this case, there are chances that protein is expressed but it is non functional.

6. The direct selection allows \_\_\_\_\_ number of recombinants to be screened and \_\_\_\_\_

- a) less, slowly
- b) less, quickly
- c) more, quickly
- d) more, slowly

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Answer: c

Explanation: If the direct selection is carried out on a plate, then the process results in the screening of more recombinants and it is done quickly and easily.

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7. Xenopus oocyte cells are also used at the time to carry out screening. Choose the incorrect statement for this procedure.

- a) DNA from collections is transcribed within in vitro and the transcription products are microinjected into oocytes
- b) The RNA is translated within oocytes
- c) Screening is carried out on the basis of DNA
- d) The screening is helpful for the proteins whose function can be easily screened such as transport of ions

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Answer: c

Explanation: DNA from collections is transcribed within in vitro and the transcription products are microinjected into the oocytes. The RNA is translated within the oocytes and screening is carried out on the basis of RNA. The screening is helpful for those proteins whose functions can be easily screened such as transport of ions.

8. In the case of ligand binding by the expressed protein, the library can be screened by \_\_\_\_\_

- a) immunochemically, by the use of antibodies
- b) ligands if the sequence we are looking for encodes a protein specific to a ligand
- c) using a specific DNA sequence which can bind to the protein encoded by the sequence of interest
- d) all of the mentioned

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Answer: d

Explanation: There are various ways to screen such a library. It can be done immunochemically i.e. by the use of antibodies. Ligands can also be used which bind to the specific proteins encoded by the sequence. There are also cases in which specific DNA sequences bind to the protein encoded by the sequence of interest.

9. In the case of immunochemical screening, the position of \_\_\_\_\_ antibody is detected by \_\_\_\_\_ antibody.

- a) secondary, primary
- b) primary, secondary
- c) primary, tertiary
- d) secondary, tertiary

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Answer: b

Explanation: In the case of immunochemical screening, the position of the primary antibody is detected with a secondary antibody. Secondary antibody is common for all the primary antibodies and thus detection becomes easier.

10. The ligand should bind to a single protein only for the screening process.

- a) True
- b) False

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Answer: a

Explanation: The ligand should bind to a single protein only for the screening process, because if binds to a heterodimer than both the proteins should be present

and then it would become difficult.

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11. Choose the incorrect statement for panning.

- a) It is a variant of ligand binding approach
- b) The ligand is immobilized on the solid support and the cells are passed over it
- c) If the ligand-binding domain is exposed on surface of the any recombinant molecules then they will bind to ligand
- d) They are not useful for scanning libraries in cultured mammalian cells

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Answer: d

Explanation: Panning is a variant of ligand binding approach. In this, the ligand is immobilized on the solid support and the cells are passed over. If the ligand binding domain is exposed on the cells they would bind to the ligand and would be recovered afterward. They are useful in screening libraries in cultured mammalian cells because the cell wall is not there and thus access is easy.

12. If screening is carried out by using a combination of nascent peptide and mRNA, then it is called as \_\_\_\_\_

- a) nascent peptide display
- b) mRNA display
- c) ribosome display
- d) ribozyme display

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Answer: c

Explanation: In the case of ribosome display, a pool of translating ribosomes is used. In this, nascent peptide and mRNA is there. It is passed over solid support which is having ligand attached to it. Ribosomes which encode a protein that binds to the ligand are attached.

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## Genetic Engineering Questions and Answers – Expression of Coding Section in-Vitro

This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Expression of Coding Section In-Vitro”.

1. If an expression of the coding sequence is to be carried in the vitro, then which of the statement holds true?

- a) The extract in which the host DNA constructs are incubated is capable of translation only
- b) The extract in which the host DNA constructs are incubated is capable of transcription only
- c) The extract is made up of lysate of E. coli cells, containing RNA polymerase, ribosomes, tRNAs etc
- d) Non radiolabelled amino acids are used

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Answer: c

Explanation: If an expression of the coding sequence is to be carried in vitro, then the extract in which host DNA constructs are incubated is capable of both transcription and translation. The extract is made up of lysate of E. coli cells, containing RNA polymerase, ribosomes, tRNAs etc. Radiolabelled amino acids are used and thus detection becomes easier.

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2. If translation and transcription are taking place together, the reaction is called as \_\_\_\_\_ and if they are carried out separately, it is called as \_\_\_\_\_

- a) coupled, linked
- b) linked, coupled
- c) grouped, separate
- d) grouped, individual

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Answer: a

Explanation: If translation and transcription are carried out together, it is known as a coupled reaction. If they are carried out separately then they are known as linked reactions.

3. If translation and transcription are carried out separately, then what is added to carry out translation?

- a) DNA polymerase
- b) RNA polymerase
- c) Taq polymerase
- d) Tfl polymerase

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Answer: b

Explanation: The added RNA polymerase carries out the translation in a separate reaction by the use of lysate of wheat gram cells.

4. If the screening of the DNA constructs is carried out in pooled batches then it takes less time.

- a) True
- b) False

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Answer: a

Explanation: If the screening of DNA constructs is carried out in pooled batches then less time is taken. Once the pooled batch is identified with recombinants then each member is screened.

5. Choose the incorrect statement for the open reading frame.

- a) It is helpful in deciding whether the clone is correct or not
- b) It consists of an initiation codon
- c) It consists of a termination codon
- d) The presence of introns doesn't affect the open reading frame

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Answer: d

Explanation: Open reading frame is very important in deciding whether the clone is correct or not. It consists of an initiation codon, followed by a stretch of DNA and termination codon. The presence of introns the open reading would be affected and makes detection difficult.

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6. Introns are \_\_\_\_\_ in nature and the sequence is \_\_\_\_\_ than exons.

- a) coding, less random
- b) non-coding, less random
- c) non-coding, more random
- d) coding, more random

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Answer: c

Explanation: Introns are non-coding in nature and thus the sequence is having a more random base composition than exons. Exons are coding sequences.

7. If the genome size is small, then sequencing of the entire genome is \_\_\_\_\_

- a) easy
- b) difficult
- c) independent of the size of genome
- d) not possible

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Answer: a

Explanation: If the genome size is small, then the sequencing of entire genome is carried out easily. Hence, direct sequencing is carried out if the genome size is small.

8. Choose the correct statement with respect to the bacterial genome.

- a) They are easy to sequence
- b) They are difficult to sequence
- c) Methods such as transcription and translation are satisfactory
- d) Only transcription can be carried out

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Answer: b

Explanation: Bacterial genome is of large size and thus it is difficult to carry out sequencing. Methods such as transcription and translation are unsatisfactory.

9. For identification of genes that are expressed under special conditions, \_\_\_\_\_ libraries are used.

- a) cDNA
- b) genomic
- c) subtractive
- d) shelf

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Answer: c

Explanation: If genes are expressed under special conditions then specialized libraries should be used. These specialized libraries are subtractive. In this, driver and tracers are used.

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10. In \_\_\_\_\_ organisms, firstly the gene is looked into model organisms.

- a) eukaryotic
- b) prokaryotic
- c) both eukaryotic and prokaryotic
- d) large sized

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Answer: a

Explanation: In eukaryotic organisms, firstly the gene is looked into the model organism. In the model organism, the genome size is small. Eukaryotic organisms generally have a varying size of the genome.

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# Genetic Engineering Questions and Answers – Reporter Genes

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Reporter Genes”.

1. Promoter-probe vectors are used often. Choose the correct statement for these vectors.

- a) They are used for identifying sequences that can function as promoter in vivo
- b) It contains a reporter gene which contains its promoter along
- c) The reporter gene is having a cloning site
- d) After insertion of DNA into the cloning site, selection of plasmids is carried out by blue white screening

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Answer: a

Explanation: Promoter- probe vectors are used for identification of sequences that can function as a promoter in vivo. It consists of a reporter gene which is not having its promoter along but other genes such as those for chloramphenicol resistance are present. The reporter gene is preceded by the cloning site and after the insertion of DNA has been done, selection of plasmids is carried out by using chloramphenicol resistance.

2. GFP is one of a marker which is used for screening libraries in hosts other than E. coli. Choose the incorrect statement for GFP.

- a) It stands for Green Fluorescent Protein
- b) It is obtained from a bio-luminescent jellyfish and produces protein aequorin which emits blue light
- c) The blue light is produced because of binding of sodium ions
- d) The absorbed blue light produces green light which can be detected further

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Answer: c

Explanation: It stands for green fluorescent protein and is obtained from a bio-luminescent jellyfish. The jellyfish produces protein aequorin which produces blue light. This blue light is produced because of binding Calcium ions. The absorbed blue light emits green light which is detected further.

3. Luciferase genes are also used at times for detection. Choose the correct statement for them.

- a) They are obtained from fire flies only
- b) The detection requires provision of substrate which produces light
- c) Enzymes such as beta-galactosidase requires substrate X-gluc to produce light
- d) Luciferase genes are preferred over fluorescent proteins

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Answer: b

Explanation: Luciferase genes are not obtained only from fire flies but also from bio-luminescent bacteria and a sea pansy. The section requires a substrate which produces light. Enzymes such as beta-galactosidase requires X-gal for the production of blue light. Fluorescent proteins are more preferable over these because they don't require substrates like luciferase genes.

4. In case of promoter-probe vectors, the same or related species should be as a vector whose DNA is to be screened.

- a) True
- b) False

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Answer: a

Explanation: For promoter-probe vectors, the same species should be used as a host for the vector whose DNA is to be screened. It is so because a gene which is a promoter in one species may not be a promoter in other gene and thus it becomes difficult to detect.

5. Sequences that can function as origins of replication are called as \_\_\_\_\_

- a) partial replicating sequences
- b) self replicating sequences
- c) autonomously replicating sequences
- d) modified replicating sequences

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Answer: c

Explanation: There are some sequences which can function as origins of replication and they are known as autonomously replicating sequences (ARS). At times, the selection is carried out for these sequences.

6. Screening is often carried out for a sequence that interacts with a protein for which already a clone is present. It is carried out in which host?

- a) Bacterial host
- b) Fungal host
- c) Parasitic host
- d) Yeast host

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Answer: d

Explanation: Screening is often carried out for a sequence that interacts with a protein for which already a clone is present. This type of screening is often carried out in a yeast host.

7. In two hybrid screening system, the activator binds through \_\_\_\_\_ domain to a sequence upstream of the gene under its control, and \_\_\_\_\_ domain stimulates transcription.

- a) DNA binding, activation
- b) Activation, DNA binding
- c) Activation, transcription
- d) DNA binding, transcription

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Answer: a

Explanation: The two hybrid-screening system is based on the fact that many transcriptional activators consist of two domains, the DNA binding domain and activation domain. The activator binds through the DNA binding domain to a sequence upstream of the gene under its control. The activation domain stimulates transcription.

8. For two hybrid systems, activation domains can be present in different proteins also rather than being on a single protein. A sequence encodes \_\_\_\_\_ protein for which we want to find an interacting protein.

- a) prey
- b) bait
- c) binding
- d) activation

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Answer: b

Explanation: Bait protein is the name given to the protein for whom we are looking for an interacting protein. Bait protein is cloned adjacent to the DNA binding protein. The protein interacting with bait protein is called as prey protein and leading to activation of domains.

9. The transcription domain is \_\_\_\_\_ if some of the bait and prey proteins are non-specific in nature?

- a) deactivated
- b) activated
- c) destroyed
- d) may be activated or not

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Answer: d

Explanation: If the bait and prey proteins are non-specific in nature, some of them might lead to activation of the transcription domain without the presence of another domain.

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10. \_\_\_\_\_ should enter the cell in the case of activation of the reporter gene for two hybrid system.

- a) Bait protein
- b) Prey protein
- c) Both bait and prey protein
- d) Either one of them

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Answer: c

Explanation: Both prey and bait proteins should enter inside the cell for activation of the reporter gene for two hybrid system. It is so because activation is based on the interaction of these two proteins.

11. Protein-protein interactions such as in electron transport lead to activation of the reporter gene.

- a) True
- b) False

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Answer: b

Explanation: Protein-protein interactions are weak interactions and thus they are not sufficient for the activation of the reporter gene.

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# Genetic Engineering Questions and Answers – Removal and Introduction of Restriction Sites and Generation of Insertions and Deletions

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This set of Genetic Engineering Question Bank focuses on “Removal and Introduction of Restriction Sites and Generation of Insertions and Deletions”.

1. Direct alteration of particular parts of protein as a way of probing the relationship between structure and function is termed as:
- a) genetic engineering
  - b) protein engineering
  - c) alteration of protein function
  - d) structure engineering

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Answer: b

Explanation: Protein engineering is the direct alteration of parts of protein as a way of probing the relationship between its structure and function. The function of protein is altered in a controlled way.

2. At times, the gene which is cloned is not well known for the protein encoded by it. To access the function, the endogenous gene for the mutant strain is inactivated. This technique is called as \_\_\_\_\_
- a) reverse genetics
  - b) protein engineering
  - c) mutation
  - d) location of function

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Answer: a

Explanation: Reverse genetics is the technique by which the exact function of the gene cloned is known. It is done by inactivating the mutant strain in the host.

3. Approaches for creating mutations can be divided into how many types?
- a) 1
  - b) 2
  - c) 3
  - d) 4

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Answer: b

Explanation: There are basically two approaches to creating mutations. They are relying on restriction enzymes and oligonucleotide-directed DNA synthesis.

4. In the case of deletion of a restriction site, it should be cleaved with the same restriction enzyme.
- a) True
  - b) False

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Answer: a

Explanation: For the deletion of a restriction site, it should be cleaved with the same restriction enzyme. As it is cleaved, the restriction site is destroyed and further the staggered ends created are either filled or degraded. After this religation is carried out but the restriction site is destroyed.

5. If there are multiple restriction sites for an enzyme in a given molecule, digestion is carried out in many steps. The initial digestion should be?

- a) complete
- b) partial
- c) carried out by a different enzyme than that the restriction site
- d) carried out by a mixture of restriction enzymes

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Answer: b

Explanation: If there are multiple restriction sites for an enzyme in a given molecule, the initial digestion would be partial. It is so because molecules cut on one site at an average.

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6. If a functional gene is disrupted while disrupting a restriction site \_\_\_\_\_ is created.

- a) frameshift mutation
- b) point mutation
- c) either of the mutations
- d) any other kind of mutation

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Answer: a

Explanation: If a functional gene is disrupted while disrupting a restriction site, a frameshift mutation would be created. As it is created, the gene might become dysfunctional.

7. Additional restriction sites can be introduced near the existing restriction site by mutagenesis.

- a) True

- b) False

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Answer: a

Explanation: Additional restriction sites can be introduced near the existing restriction site by mutagenesis. It is done by inserting chemically synthesized oligonucleotide carrying the appropriate sequence.

8. Restriction site can also be introduced by oligonucleotide directed mutagenesis of a region that is \_\_\_\_\_ and \_\_\_\_\_ to the original restriction site.

- a) not only similar, also exactly same
- b) similar, not same
- c) not similar, is entirely different
- d) different, near

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Answer: b

Explanation: Restriction site can also be introduced by oligonucleotide directed mutagenesis of a region that is similar and is not the same to the original restriction site.

9. Small deletions at a restriction site can be generated by cutting and degrading the \_\_\_\_\_ with an exonuclease.

- a) double stranded ended
- b) circular molecules
- c) single stranded ends
- d) supercoiled molecules

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Answer: c

Explanation: Small deletions at a restriction site can be generated by cutting and degrading the single stranded ends with an exonuclease.

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10. When a series of deleted regions are replaced by some other DNA fragment of equal length, then it is known as:

- a) linker scanning
- b) generation of deletions
- c) mutation
- d) replacement

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Answer: a

Explanation: Sometimes, a series of deleted regions are replaced by a fragment of DNA of equal length, then it is called as linker scanning. It is done in order to not disrupt the spacing between control regions.

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## Genetic Engineering Questions and Answers – Mutagenesis without PCR

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Mutagenesis without PCR”.

1. Bisulphite ions are used to deaminate \_\_\_\_\_ residues in \_\_\_\_\_ DNA.

- a) C, double stranded
- b) C, single stranded
- c) U, double stranded
- d) U, single stranded

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Answer: b

Explanation: Bisulphite ions are used to deaminate C residues in single stranded DNA. These C residues on deamination give U residues.

2. For mutagenesis without PCR, which of the following can be used as a template?

- a) Single stranded DNA
- b) Double stranded DNA
- c) Circular DNA
- d) Both single and double stranded DNA

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Answer: d

Explanation: If mutagenesis is carried without PCR, both single and double stranded DNA can be used as a template. The single stranded DNA is obtained from filamentous phages and double stranded DNA is obtained from conventional vectors.

3. An oligonucleotide is synthesized which contains the mutation and the rest is \_\_\_\_\_ to the template DNA.

- a) complementary
- b) non-complementary
- c) can either be complementary or non-complementary
- d) not related

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Answer: a

Explanation: The oligonucleotide is synthesized which contains the mutation and the rest of the sequence is complementary to the template DNA. And the oligonucleotide is allowed to anneal to the template DNA.

4. If the template is double stranded, they need to be separated before annealing of oligonucleotide.

- a) True
- b) False

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Answer: a

Explanation: If the template is double stranded, then the two strands are separated before annealing of the oligonucleotide. This separation is done by heating or alkali denaturation.

5. Which of the following statement is incorrect for the synthesis of the second strand?

- a) The oligonucleotide is acting as a primer for the synthesis of the second strand
- b) DNA polymerase and dNTPs are added for synthesis
- c) The polymerase should have 5'-3' exonuclease activity
- d) A polymerase having 5'-3' exonuclease activity would degrade the primer that carries the mutant sequence

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Answer: c

Explanation: The oligonucleotide is acting as a primer for synthesis of the second strand. DNA polymerase and dNTPs are added for synthesis and the polymerase should not have 5'-3' exonuclease activity. If the polymerase is having exonuclease activity it would degrade the primer that carries the mutant sequence and the mutated portion is replaced by template DNA.

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6. Once the double stranded molecule with the mutation is introduced into E. coli for replication, how many types of molecules are produced?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: Once the double stranded molecule with the mutation is introduced into E. coli for replication, there are basically two types of molecules produced after replication. One is the wild type molecule and the other is having mutated sequence.

7. How many sites can be mutated at a time?

- a) 1
- b) 2
- c) 3
- d) Many

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Answer: d

Explanation: Many sites can be mutated at a time. For inducing more than one mutation, more than one mismatch are there in oligonucleotide to the target sequence.

8. Several different mutations can be induced at one site.

- a) True
- b) False

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Answer: a

Explanation: Several mutations can be induced at one site. This is done by using a mixture of oligonucleotides which are having different nucleotides at the same position.

9. If mixed oligonucleotides are used, it is regarded as \_\_\_\_\_

- a) mixed mutagenesis
- b) multiple mutagenesis
- c) cassette mutagenesis
- d) polymutagenesis

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Answer: c

Explanation: Mixed oligonucleotides is the collection of those oligonucleotides which are having different nucleotides at the same position. This type of mutagenesis is called as cassette mutagenesis. It is a fast method for inducing multiple mutations.

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10. It is easier to subclone a restriction fragment if it belongs to?

- a) small gene
- b) large gene
- c) prokaryotic organism
- d) eukaryotic organism

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Answer: b

Explanation: If the target sequence belongs to a large gene, it is easier to sub-clone a restriction fragment from it and mutate the fragment. Chances of having unwanted mutations are also reduced.

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# Genetic Engineering Questions and Answers – Mutagenesis using PCR and Recovery of Mutated Sequences

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Mutagenesis using PCR and Recovery of Mutated Sequences”.

1. A megaprimer method is a \_\_\_\_ stage approach and uses \_\_\_\_ oligonucleotide primers.

- a) two, two
- b) two, three
- c) one, two
- d) one, three

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Answer: b

Explanation: A megaprimer method is an approach of carrying out mutagenesis by using PCR. It is a two stage approach and uses three oligonucleotide primers.

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2. Choose the correct statement.

- a) There are two flanking primers and they are having mutations
- b) There is one primer which anneals the target sequence and is having mutation
- c) Either of the flanking primers or the primer is annealing to the target sequence is having mutation
- d) One of the flanking primer and the primer annealing to the target sequence is having mutation

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Answer: b

Explanation: In the megaprimer approach three primers are used. There are two primers which flank the target sequence and a third primer anneal to the target sequence. The mutation is there in the third primer.

3. PCR using the mutagenic primer and one of the flanking primers is used to carry out amplification and generates a product corresponding to the part of the gene. It is called as megaprimer.

- a) True

b) False  
View Answer

Answer: a

Explanation: Megaprimer is produced when amplification is carried out by using mutagenic primer and one of the flanking primers. It corresponds to the part of the gene.

4. Sometimes mutagenesis is carried out with the help of primers. Choose the correct statement with respect to it.

- a) Double stranded circular molecule is used as a template
- b) Mutation is introduced into one of flanking primers
- c) Single stranded circular molecule is used as a template
- d) After amplification, mutation is introduced into one strand

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Answer: a

Explanation: Double stranded circular molecules are used as a template. Mutation is introduced into both of the primers and then amplification is carried out. After amplification is carried out, mutation can be introduced either in one strand or both the strands.

5. If PCR is used to introduce random mutations rather than specific mutations, it is called as \_\_\_\_\_

- a) mutagenic PCR
- b) error-prone PCR
- c) random PCR
- d) general PCR

View Answer

Answer: b

Explanation: At times, PCR is used to introduce random mutations, rather than specific mutations and this type of PCR is called as error-prone PCR. There can be either one or many mutations.

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6. For the selection of the molecules having mutated sequence, which of the statement is true?

- a) It is suitable for methods which are PCR based
- b) It is suitable for methods which are not PCR based
- c) It is suitable for both PCR and not PCR based
- d) Selection of molecules with the mutant sequence is not possible

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Answer: b

Explanation: Selection is done either of molecules having a mutant sequence or degradation of wild type molecules is carried out. For selection of molecules having a mutant sequence, it can be used for methods which are not PCR based.

7. Choose the incorrect statement for the methodology of selection of molecules with mutant sequences.

- a) A vector is used which is having antibiotic resistance gene
- b) Apart from antibiotic resistance gene, a second antibiotic resistance gene is also present
- c) There are two mutagenic primers which are used
- d) The second strand synthesis is carried out by only one primer

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Answer: d

Explanation: A vector is used which is having conventional antibiotic resistance and along with a second antibiotic resistance gene. The second gene is inactivated because of point mutation. Also, there are two mutagenic primers used. The first primer is used for directing the incorporation of mutation. The second primer makes the inactive gene inactive. Both the primers are used for second strand synthesis.

8. Once second strand synthesis is carried out, it is introduced into the host. Host is having which mutation?

- a) mutS mutation
- b) mutD mutation
- c) mutE mutation
- d) mutG mutation

View Answer

Answer: a

Explanation: The host is having a mutS mutation. And because of this mutation, no mismatch repair takes place.

9. Replication by first strand leads to the formation of mutated molecules and functional antibiotic resistant gene.

- a) True
- b) False

View Answer

Answer: b

Explanation: Replication can be either by first strand or second strand. First strand replication leads to generation of wild type molecules and the antibiotic resistance is inactive. If the replication is carried out by second strand, mutated sequence is formed and the antibiotic resistance gene becomes active.

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10. In a phosphothiorate nucleotide, oxygen atom is replaced by with atom?

- a) Magnesium
- b) Calcium
- c) Sodium

d) Sulphur  
View Answer

Answer: d

Explanation: In a phosphothiorate nucleotide, oxygen atom is replaced by a sulphur atom. Because of this replacement the DNA molecule becomes resistant to attack by nucleases.

11. What is the function of ung gene?
- a) It is responsible for deamination of cytosine
  - b) It is responsible for deamination of uracil
  - c) It is responsible for removal of uracil
  - d) It is responsible for removal of cytosine

View Answer

Answer: c

Explanation: Ung gene is responsible for the removal of uracil. It does it by the enzyme Uracil-N-glycosylase and apyrimidinic site is created.

12. DpnI cuts \_\_\_\_\_ strands.

- a) methylated
- b) non-methylated
- c) phosphorylated
- d) non-phosphorylated

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Answer: a

Explanation: DpnI is the restriction enzyme which is meant for cutting the DNA strands which are methylated.

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# Genetic Engineering Questions and Answers – Choosing the Right Mutations, Database of Mutant Lines and Gene Disruption

« Prev This set of Genetic Engineering Questions and Answers for Entrance exams focuses on “Choosing the Right Mutations, Database of Mutant Lines and Gene Disruption”.

1. The minor change in amino acid sequence can lead to \_\_\_\_\_ effect on three dimensional structure and there \_\_\_\_\_ in the primary sequence.

- a) huge, may be no change
- b) no, may be huge change
- c) very less, is very less change
- d) huge, would be huge change

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Answer: a

Explanation: The minor change in the amino acid sequence can lead to a huge effect on the three dimensional structure and might also abolish its function. In the primary sequence, there might be no change.

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2. It is often useful to inactivate endogenous genes in an organism. It might be helpful in finding out \_\_\_\_\_ role of the wild type gene.

- a) biological
- b) chemical
- c) physiological
- d) anatomical

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Answer: c

Explanation: Inactivation of endogenous genes in an organism is very important at times. It is helpful in finding out the physiological role of the wild type gene.

3. The inactivation of endogenous genes may also be helpful in directing the expression of the mutated gene in the absence of background expression of wild type gene.

- a) True
- b) False

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Answer: a

Explanation: Inactivation of endogenous genes is very useful. It can be used to direct the expression of the mutated gene in the absence of background expression of wild type gene.

4. How can mutant strains be produced?

- a) In systematic mutagenesis programmes
- b) In individual organisms
- c) Both by individual organisms and systematic mutagenesis programmes
- d) Apart from these two, other methods are also used

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Answer: c

Explanation: For popular model organisms, there are databases for mutant strains. These mutant strains can either be produced by systematic mutagenesis programmes or by individual organisms.

5. The principle of gene disruption is \_\_\_\_\_ to replace the endogenous chromosomal copy of a gene with \_\_\_\_\_.

- a) homologous recombination, inactivated gene
- b) reciprocal translocation, inactivated gene
- c) homologous recombination, activated gene
- d) reciprocal translocation, activated gene

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Answer: a

Explanation: For gene disruption, the basic principle is homologous recombination to replace the endogenous chromosomal copy of a gene with the inactivated gene.

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6. The gene to be disrupted is cloned and a selectable marker is inserted. What should be the effect of selectable marker?

- a) It should have no effect on target gene
- b) It should make the target gene non-functional
- c) There is no restriction; it can be either functional or non-functional
- d) It should improvise the chances of survival of the target gene

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Answer: b

Explanation: In the target gene, a selectable marker should be inserted. It can be either in the form of ampicillin resistance or a nutritional marker. The selectable marker should render the target gene non-functional.

7. The disrupted gene is excised from the vector and is inserted into the target organism. The excised gene should be in which form?

- a) Circular
- b) Supercoiled
- c) Either supercoiled or circular

d) Linear  
View Answer

Answer: d

Explanation: The disrupted gene is excised from the vector and is inserted into the target organism. The excised gene should be linear in form.

8. Stable acquisition of the marker can take place only if a double crossover over the flanking sequence and their chromosomal counterparts causes the marker's integration into the chromosome.

- a) True
- b) False

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Answer: a

Explanation: The incoming molecule having the marker will not replicate stably because it is linear. For the stable replication, double crossover of the flanking sequence should take place, replacing the endogenous gene with the disrupted gene.

9. If \_\_\_\_\_ gene is there, the double crossover may leave \_\_\_\_\_ in the chromosome.

- a) linear, functional copy
- b) circular, functional copy
- c) linear, a non-functional copy
- d) circular, a non-functional copy

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Answer: b

Explanation: If the disrupted gene is in a circular form, there is a possibility that the double crossover may still leave a functional copy in the chromosome.  
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10. If the target organism contains more than one copy of the gene, what is the effect on these copies?

- a) Only copy is disrupted
- b) All the copies are disrupted
- c) It is difficult to ensure that all the copies are disrupted
- d) Only a specified number of copies are disrupted

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Answer: c

Explanation: If more than one copy of the gene is there in the target organism, it is difficult to ensure that all the copies are disrupted. Multiple copies of the gene can be present, if the organism is not haploid.

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# Genetic Engineering Questions and Answers – Post-transcriptional Gene Silencing

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Post-transcriptional Gene Silencing”.

1. If methods are based on cellular processes that lead to inactivation of gene expression by affecting the RNA, then it is called as \_\_\_\_\_

- a) transcriptional
- b) pre-transcriptional
- c) post-transcriptional
- d) translational

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Answer: c

Explanation: If inactivation of gene expression is carried out by affecting the RNA then these methods are referred to as post-transcriptional. As transcription is the process of obtaining RNA from DNA.

2. Choose the incorrect statement for the method based on antisense RNA.

- a) RNA is synthesized complementary to the sequence of the gene which is to be inactivated
- b) It is achieved by placing a DNA sequence which encodes RNA complementary to the RNA to be inactivated
- c) Expression of the endogenous gene is diminished
- d) This method is preferred over gene disruption has gene inactivation can be achieved completely

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Answer: d

Explanation: Antisense RNA is the RNA which is complementary to the RNA sequence which is to be inactivated. It is done with the help of a DNA sequence. Expression of the endogenous gene is diminished. This method doesn't lead to complete inactivation, which is not the case with gene disruption.

3. The method of post transcriptional gene silencing is particularly useful in \_\_\_\_\_

- a) plants
- b) animals
- c) insects
- d) microorganisms

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Answer: a

Explanation: The method of post transcriptional gene silencing is particularly useful in plants.

4. Down regulation of expression of endogenous genes by transformation with constructs that would generate sense RNA, rather than anti-sense RNA is known as \_\_\_\_\_

- a) suppression
- b) co-suppression
- c) multisuppression
- d) anti-suppression

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Answer: b

Explanation: When anti-sense RNA is used in plants, a phenomenon observed is co-suppression. It is the down regulation of expression of endogenous genes by transformation with constructs that would generate sense RNA, rather than anti-sense RNA.

5. In some organisms, presence of double stranded RNAs leads to breakdown of corresponding single stranded mRNA.

- a) True
- b) False

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Answer: a

Explanation: In some organisms, presence of double stranded RNAs leads to the breakdown of corresponding single stranded endogenous mRNA. The double stranded RNA is having one strand same as that of endogenous RNA.

6. Double stranded RNA is cleaved by a nuclease called as Dicer and small fragments are generated known as \_\_\_\_\_

- a) short interfering RNAs
- b) long interfering RNAs
- c) short interspersed RNAs
- d) long interspersed RNAs

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Answer: a

Explanation: Double stranded RNA is cleaved by a nuclease called as Dicer and small fragments are generated, they are about 22 nucleotides long and are known as short interfering RNAs (siRNA).

7. The process of RNA inactivation by siRNAs is termed as \_\_\_\_\_

- a) RNA silencing
- b) RNA interference
- c) Short RNA inactivation
- d) RNA dysfunction

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Answer: b

Explanation: siRNAs are short interfering RNAs. The process of RNA inactivation by use of these is called as RNA interference (RNAi).

8. DNA \_\_\_\_\_ is also a method for gene silencing through short RNAs.

- a) acetylation
- b) phosphorylation
- c) methylation
- d) acylation

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Answer: c

Explanation: Short RNAs can also lead to gene silencing via DNA methylation.

9. siRNAs can either be introduced directly or by microinjection.

- a) True
- b) False

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Answer: a

Explanation: siRNAs can either be introduced directly or by microinjection. It can also be induced by feeding as in the case of C. elegans.  
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10. Introduction into host organism can also be done by using a DNA construct, which when transcribed, generates an RNA which is \_\_\_\_\_

- a) circular
- b) linear
- c) double stranded
- d) self-complementary

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Answer: d

Explanation: Introduction into the host organism can also be done by using a DNA construct, which when transcribed, generates a RNA which is self-complementary. It leads to the formation of double stranded RNA and is capable of activating RNAi effect.

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## Genetic Engineering Questions and Answers – Cre Lox Excision

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Cre Lox Excision”.

1. The \_\_\_\_\_ protein of bacteriophage P1 mediates site-specific recombination at a 34 bp sequence, loxP.

- a) cre recombinase
- b) gene II
- c) gene IV
- d) gene VIII

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Answer: a

Explanation: The Cre recombinase protein of bacteriophage P1 mediates site-specific recombination at a 34 bp sequence, loxP.

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2. Choose the incorrect statement for cre-lox excision.

- a) The chromosomal copy of the target gene replaces the target gene flanked by loxP sites
- b) The second step is supply of Cre recombinase
- c) Integration of cre takes place under a controllable promoter followed by induction of the promoter
- d) Induction results in expression of cre, recombination along loxP sites and excision of the sequence between

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Answer: a

Explanation: For cre-lox excision, the chromosomal copy of the target gene is replaced by target gene flanked by loxP sites. The second step is supply of cre recombinase. Integration of cre is done by a controllable promoter which is followed by the induction of promoter. This induction results in expression of cre and recombination along loxP sites, leading to excision.

3. Cre can be introduced by crossing it with a strain containing the gene or by infection with virus containing it.

- a) True
- b) False

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Answer: a

Explanation: Generally cre is introduced with the help of a promoter. But it can also be introduced by crossing it with a strain containing the gene or by infection with virus containing it.

4. How much effect is there on the surrounding genes by the loxP sequence which is left after recombination has taken place?

- a) Little effect
- b) No effect
- c) Huge effect
- d) It depends on the nature of the surrounding gene

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Answer: b

Explanation: As the recombination has taken place, the loxP sequence remains there. The remaining loxP sequence has no effect on the surrounding genes.

5. The ability to control the expression of cre allows controlling what?

- a) recombination
- b) replication
- c) excision
- d) packaging

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Answer: c

Explanation: The ability to control the expression of cre allows when and where excision takes place. Specific excision of the target takes place if an expression is tissue or time specific.

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6. Excision of DNA flanked by loxP sequences is also known as \_\_\_\_\_

- a) subtle excision
- b) croxing
- c) floxing

d) sequence specific excision

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Answer: c

Explanation: Excision of DNA flanked by loxP sequences is called as floxing at times. Other site specific recombination systems are also used.

7. RNA molecule with catalytic activity is termed as \_\_\_\_\_

- a) ribosomes
- b) catalytic RNA
- c) reactive RNA
- d) ribozyme

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Answer: d

Explanation: Any RNA molecule with catalytic activity is termed as a ribozyme. Some of the catalytic activity can be removal of introns by self-splicing.

8. Hepatitis delta virus capable of self cleavage.

- a) True
- b) False

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Answer: a

Explanation: Hepatitis delta virus, which is associated with hepatitis B is capable of self cleavage. Ribozymes mainly comprise of RNA molecules which are capable of self cleavage.

9. Choose the correct statement for self cleavage reaction.

- a) It is nucleophilic attack reaction by 2' hydroxyl of RNA
- b) It is nucleophilic attack reaction by 3' hydroxyl of RNA
- c) It is nucleophilic attack reaction by 2' hydroxyl of DNA
- d) It is nucleophilic attack reaction by 3' hydroxyl of DNA

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Answer: a

Explanation: In the self cleavage reaction, it is an internal nucleophilic attack reaction by 2' hydroxyl of RNA. The attack is done on the phosphate group in the sugar phosphate group.

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10. Self cleavage reaction can take place in?

- a) DNA
- b) RNA
- c) Both DNA and RNA
- d) Can take place in both but is preferred in DNA

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Answer: b

Explanation: The self cleavage reaction takes place in RNA. It is because it involves a nucleophilic attack by 2' hydroxyl, which is found in RNA and not in DNA.

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## Genetic Engineering Questions and Answers – Synthesis of RNA

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Synthesis of RNA”.

1. Cloning vectors designed for the purpose of synthesis of RNA and proteins are known as \_\_\_\_\_

- a) Cloning vectors
- b) RNA vectors
- c) Bacteriophage vectors
- d) Expression vectors

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Answer: d

Explanation: Expression vectors are those vectors which are used for the synthesis of RNA and protein i.e. cloned DNA sequences are used for expression.

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2. For studying processes such as splicing and cleavage, RNA is required. Choose the correct statement for this.

- a) A mixture of different types of RNA is required
- b) Two types of RNA are required
- c) A few contaminating proteins are required
- d) Sodium hydroxide is required

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Answer: c

Explanation: For studying RNA processing events such as splicing and cleavage, RNA is required. Here, a single type of RNA is required and along with it, a few contaminating proteins are also used.

3. RNA can be synthesized by using vector. A vector with \_\_\_\_\_ is used and further through \_\_\_\_\_ RNA is isolated.

- a) origin of replication, translation
- b) promoter, transcription
- c) promoter, translation
- d) origin of replication, transcription

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Answer: b

Explanation: Vectors can be used at times for synthesis of RNA. A vector with the promoter is used and transcription is carried out in a bacterial cell and afterward RNA is isolated.

4. Isolation of RNA can be carried out easily from bacterial cells.

- a) True
- b) False

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Answer: b

Explanation: Isolation of RNA can't be carried out easily from bacterial cells. Hence, the production of RNA is carried out by the transcription of cloned DNA.

5. Promoters are generally used after isolation from \_\_\_\_\_

- a) bacteriophage T7
- b) bacteriophage SP6
- c) bacteriophage Mu
- d) both bacteriophage T7 and SP6

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Answer: d

Explanation: Promoters used for the synthesis of RNA are generally obtained from bacteriophage T7 and SP6. They can also be obtained rarely from bacteriophage T3.

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6. By selecting the appropriate polymerase to activate the promoter \_\_\_\_\_ can be carried out \_\_\_\_\_

- a) transcription, regardless of orientation
- b) transcription, only in one orientation
- c) translation, regardless of orientation
- d) translation, only in one orientation

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Answer: a

Explanation: By selecting the appropriate polymerase to activate the promoter, transcription can be carried out but it is regardless of the orientation.

7. Guanylyl transferase and GTP are used for?

- a) Transcription
- b) Translation
- c) Capping of the message
- d) Packaging

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Answer: c

Explanation: At times, capping of the message is very necessary. Capping can be achieved by incubating the transcripts with enzymes such as guanylyl transferase and GTP.

8. Capping can be introduced by the use of cap analogue. Which of the statement is true?

- a) Cap analogue can be introduced at the end of the transcript
- b) Cap analogue can be introduced at the start of the transcript
- c) Cap analogue can be introduced anywhere in the transcript
- d) Cap analogue can be introduced both at the end and starting of the transcript

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Answer: b

Explanation: For achieving capping, cap analogue should be introduced. Cap analogue should be introduced at the starting of the transcript. It is so because it requires 5' end.

9. If transcription should not be carried out beyond the insert in the vector, then it should be linearized.

- a) True
- b) False

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Answer: a

Explanation: If the transcription should not be carried out beyond the insert in the vector, then it should be linearized. It can be done by digesting with a restriction enzyme.

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10. If the cells containing plasmids are infected with helper phage, which type of DNA can be produced, packaged and secreted into the medium?

- a) Single stranded DNA
- b) Double stranded DNA
- c) Both single and double stranded DNA
- d) Circular DNA

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Answer: c

Explanation: If the cells containing plasmids are infected with helper phage, then single stranded DNA can be produced, packaged and secreted into the medium.

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## Genetic Engineering Questions and Answers – Synthesis of Proteins and Translation In Vitro

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This set of Genetic Engineering Questions and Answers for Campus interviews focuses on “Synthesis of Proteins and Translation In Vitro”.

1. Little quantities of radiolabelled proteins are required for which of the following?
  - a) co or post translational targeting
  - b) modification of proteins
  - c) both co or post translational targeting and modification of proteins
  - d) crystallization for structural studies

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Answer: c

Explanation: Protein synthesis is very important and they are having varied functions. Small quantities of radiolabelled proteins are required for co or post translational targeting and modification of proteins.

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2. \_\_\_\_\_ quantities of \_\_\_\_\_ protein are required for determination of properties in biochemical and biological assays.
  - a) Small, non-radiolabelled
  - b) Small, radiolabelled
  - c) Large, radiolabelled
  - d) Large, non-radiolabelled

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Answer: d

Explanation: At times, large and non-radiolabelled proteins are required for determination of properties in biochemical and biological assays. It is also required for carrying out the crystallization for structural studies.

3. Small quantities of radiolabelled RNA can be produced by translation in vitro which is done by transcription in vitro.
  - a) True
  - b) False

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Answer: a

Explanation: If small quantities of radiolabelled RNA are required, it can be produced by translation in vitro which is accomplished by transcription in vitro.

4. For the production of unlabelled and huge amount of proteins, which of the following is true?
  - a) Transcription is carried out in vivo and translation in vitro
  - b) Transcription and translation both are carried out in vivo
  - c) Transcription and translation both are carried out in vitro
  - d) Transcription is carried out in vitro and translation in vivo

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Answer: b

Explanation: For having, large and unlabelled proteins, transcription and translation both should be carried out in vivo.

5. How many methods are there, which are used for protein synthesis in vitro?
  - a) 1
  - b) 2
  - c) 3
  - d) 4

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Answer: c

Explanation: There are basically three methods which are used for protein synthesis in vitro. They are based on a lysate of reticulocytes.  
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6. Reticulocytes are immature red cells, which are obtained from \_\_\_\_\_

- a) rabbit
- b) pig
- c) human
- d) cow

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Answer: a

Explanation: Reticulocytes are immature red blood cells which are obtained from rabbits. The lysate of this is used for transcription in vitro.

7. What is the use of adding micrococcal nuclease in the reticulocyte cells?

- a) It degrades DNA
- b) It degrades mRNA
- c) It degrades proteins
- d) It degrades RNA and untranslated DNA

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Answer: b

Explanation: The micrococcal nuclease is added in the reticulocyte cells in order to degrade the mRNA. This mRNA produces a high amount of background in translational products.

8. Treatment of reticulocyte cells is done with EGTA. It chelates the calcium ions which are required for functioning of micrococcal nuclease.

- a) True
- b) False

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Answer: a

Explanation: The treatment of reticulocyte cells is done with EGTA. It chelates the calcium ions and they are required for the functioning of micrococcal nuclease. It is required for cleavage of mRNA.

9. In \_\_\_\_\_ transcription and translation is coupled.

- a) prokaryotes
- b) eukaryotes
- c) both prokaryotes and eukaryotes
- d) both prokaryotes and eukaryotes, but favourable in eukaryotes

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Answer: a

Explanation: In prokaryotes, transcription and translation are coupled. It means that as the transcription is initiated, translation also starts.  
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10. In which of the following systems, transcription and translation are carried out together?

- a) Reticulocyte lysate
- b) Wheat gram extract
- c) Both in reticulocyte lysate and wheat gram extract
- d) S-30 extract

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Answer: d

Explanation: S-30 extract is the one in which transcription and translation are carried out together. In wheat gram extract and reticulocyte lysate, they are carried out separately.

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## Genetic Engineering Questions and Answers – Expression in Vivo

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Expression in Vivo”.

1. If overexpression of proteins takes place, they become toxic at times. In such a case \_\_\_\_\_ colonies are recovered after \_\_\_\_\_ with the recombinant plasmid.  
a) few, translation  
b) few, transformation  
c) no, transformation  
d) no, translation

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Answer: c

Explanation: At times, overexpression of proteins takes place. It leads to toxicity. In such a case, no colonies are recovered after transformation with the recombinant plasmid. It is so because no colonies survive because of overexpression of the protein.

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2. Ribosome binding site in E.coli is composed of which sequence primarily?

- a) -GAGG-
- b) -CTCC-
- c) -ATGG-
- d) -CGTT-

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Answer: a

Explanation: Ribosome binding site is responsible for initiating translation. It is composed of –GAGG- sequence primarily.

3. Translation starts at first \_\_\_\_\_ codon in the mRNA downstream from the ribosome binding site.

- a) ACG
- b) AUG
- c) UAC
- d) CAG

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Answer: b

Explanation: Translation starts at first AUG codon in the mRNA downstream from the ribosome binding site. It is the start codon.

4. Expression of cloned sequences in E.coli requires a promoter, a ribosome binding site and an initiation codon.

- a) True
- b) False

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Answer: a

Explanation: Expression of cloned sequences in E. coli requires a promoter, a ribosome binding site and an initiation codon. Initiation codon is the start codon AUG.

5. If an expression vector contains all three, viz. a controllable promoter, a ribosome binding site and an initiation codon, then a hybrid protein is produced. The \_\_\_\_\_ region of hybrid protein is encoded by vector and the rest is expressed by the sequence inserted.

- a) N terminal
- b) C terminal

c) Both N & C terminal  
d) Middle

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Answer: a

Explanation: If all three elements are present, then a hybrid protein is formed. The N terminal region of the hybrid protein is encoded by the vector and the rest is expressed by the sequence inserted.

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6. Proteins synthesized by carrying out a translation of the vector region and continuing it in the insert region is called as \_\_\_\_\_

- a) hybrid protein
- b) fusion protein
- c) combination protein
- d) insert protein

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Answer: b

Explanation: At times, translation of vector is carried out and is continued in the insert. Proteins produced by this method are known as fusion proteins.

7. It is also possible to generate a fusion protein in which \_\_\_\_\_ is encoded by the vector.

- a) N terminal
- b) C terminal
- c) Both N and C terminal
- d) Middle region

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Answer: b

Explanation: Generally, N terminal is encoded by the vector. But at times it is also possible to generate a fusion protein by encoding C terminal.

8. Which of the following is present in E. coli rrnB operon for rRNA?

- a) Initiation codon
- b) Termination codon
- c) Both initiation and termination codon
- d) Both are absent

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Answer: c

Explanation: Initiation codon is present in all expression vectors, but few are also having termination codons. It is necessary to stop high levels of transcription.

9. Termination codon is required for stopping high levels of transcription of other regions such as \_\_\_\_\_ which might interfere with \_\_\_\_\_ of the vector.

- a) origin, replication
- b) end, replication
- c) end, stability
- d) origin, stability

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Answer: d

Explanation: Termination codon is required for stopping high levels of transcription of other regions such as origin. Other regions might interfere with the stability of the vector.

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10. In fusion proteins, the reading frame in a vector is out of phase with the insert.

- a) True
- b) False

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Answer: b

Explanation: Fusion proteins are the proteins produced by carrying the translation in vector region and then continuing it in insert region. Hence, to carry out this, the reading frame should be in phase.

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# Genetic Engineering Questions and Answers – Promoters

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Promoters”.

1. Some vectors carry a mutant form of promoter known as lacUV5 promoter. It carries \_\_\_\_\_ in the promoter region and \_\_\_\_\_ the efficiency.  
a) point mutations, decreases  
b) point mutations, increases  
c) frameshift mutations, increases  
d) frameshift mutations, increases

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Answer: b

Explanation: In some vectors, lacUV5 promoter is present. It is a mutant form and carries point mutations which increase the efficiency.

2. Lambda PL promoter is used in which vectors?

- a) Cloning vectors
- b) Expression vectors
- c) Both cloning and expression vectors
- d) Bacteriophage Mu

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Answer: b

Explanation: Lambda PL promoters are the promoters for the left region in bacteriophage lambda. It is widely used in expression vectors.

3. The promoter can be controlled by a repressor which is temperature sensitive.

- a) True
- b) False

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Answer: a

Explanation: The promoter is activated at a temperature higher than 30 degrees because at this temperature repressor is inactivated.

4. Choose the correct statement for rifampicin.

- a) It inactivates both E. coli polymerase and T7 polymerase
- b) It activates both E. coli polymerase and T7 polymerase
- c) It inhibits T7 polymerase but doesn't inhibit E. coli polymerase
- d) It inhibits E. coli polymerase but doesn't inhibit T7 polymerase

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Answer: d

Explanation: Rifampicin is added in order to reduce the transcription of other genes. It inhibits the E. coli RNA polymerase but doesn't inhibit the T7 polymerase.

5. The \_\_\_\_\_ operon encodes proteins involved in arabinose metabolism.

- a) araBCD
- b) araABD
- c) araBAD
- d) araDBA

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Answer: c

Explanation: The araBAD operon encodes proteins involved in arabinose metabolism. It is controlled by AraC transcriptional regulator.

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6. tac promoter is an example of which type of promoter?

- a) hybrid promoter
- b) fusion promoter
- c) lacZ promoter
- d) araBAD promoter

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Answer: a

Explanation: Hybrid promoters are those promoters which are produced by two promoters from different sources. Tac promoter is a hybrid promoter produced from trp promoter and lacUV5 promoter.

7. The tac promoter is made by \_\_\_\_\_ region of trp promoter and \_\_\_\_\_ region of the lacUV5 promoter.

- a) 10, 35
- b) 35, 10
- c) 10, 10
- d) 35, 35

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Answer: b

Explanation: It is a hybrid promoter made by 35 regions of trp promoter and 10 regions of the lacUV5 promoter.

8. The tac promoter includes the lac operator and is regulated by a repressor.

- a) True
- b) False

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Answer: a

Explanation: The tac promoter includes the lac operator and is regulated by the repressor. The repressor is to be supplied by the host.

9. Expression of T7 promoter- lac operator hybrid requires \_\_\_\_\_

- a) T7 RNA polymerase
- b) An inducer such as IPTG
- c) Both T7 RNA polymerase and inducer such as IPTG
- d) T7 DNA polymerase

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Answer: c

Explanation: Expression of T7 promoter- lac operator hybrid requires both T7 RNA polymerase and inducer such as IPTG. If inducer is absent levels of expression are very low.

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10. When lacUV5 control system is used, addition of IPTG \_\_\_\_\_ the expression of \_\_\_\_\_

- a) activates, T7 RNA polymerase
- b) inactivates, T7 RNA polymerase
- c) activates, T7 DNA polymerase
- d) inactivates, T7 DNA polymerase

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Answer: a

Explanation: When a lacUV5 control system is used, the addition of IPTG activates the expression of T7 RNA polymerase. Thus transcription of sequences under the control of T7 promoter is controlled.

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## Genetic Engineering Questions and Answers – Fusion Proteins

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Fusion Proteins”.

1. There are some advantages of expressing protein as a fusion protein. It may enhance stability, folding \_\_\_\_\_ and \_\_\_\_\_ formation.  
a) solubility, phosphodiester bond formation  
b) insolubility, phosphodiester bond formation  
c) solubility, disulphide bond formation  
d) insolubility, disulphide bond formation

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Answer: c

Explanation: Expressing a protein as a fusion protein is advantageous. It may enhance stability, folding, solubility and disulphide bond formation.

2. A short peptide region fused to a protein of interest is known as \_\_\_\_\_  
a) tag  
b) oligonucleotide  
c) fragment  
d) dimer

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Answer: a

Explanation: A short peptide region (generally, a few nucleotides long) is fused to a protein of interest and is known as tag.

3. Glutathione-S-Transferase (GST) enzyme is used for the conjunction of Glutathione molecules and is having a protective function in many organisms.  
a) True  
b) False

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Answer: a

Explanation: GST enzyme is used for the conjunction of Glutathione molecules and is also having a protective function in many organisms. It is widely used as a basis for fusion proteins.

4. Maltose binding protein is the product of \_\_\_\_\_ gene in E.coli and located in \_\_\_\_\_  
a) malE, nucleus  
b) malD, nucleus  
c) malE, periplasmic space  
d) malD, periplasmic space

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Answer: c

Explanation: Maltose binding protein is the product malE gene in E.coli and is located in the periplasmic space. It is responsible for uptake of maltose and other sugars.

5. Thioredoxin protein contains two \_\_\_\_\_ residues.

- a) cysteine
- b) cystine
- c) adenine
- d) guanine

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Answer: a

Explanation: This protein contains two cysteine residues and they are reversibly oxidized to cysteine residues.

6. Often, protein to be expressed is fused with histidine and it is called as histidine tags. For their purification, matrix containing \_\_\_\_\_ is used.

- a) calcium ions
- b) nickel ions
- c) iron ions
- d) fluorine ions

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Answer: b

Explanation: Histidine tags are used in place of naturally occurring protein at times for fusion proteins. For purification, matrix containing nickel ions is used and is based on affinity purification.

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7. Pel B protein is produced in plants and helps in the degradation of \_\_\_\_\_

- a) vacuole
- b) plasma membrane
- c) cell wall
- d) mitochondria

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Answer: c

Explanation: Pectate lyase or pelB protein is produced in plants and helps in the degradation of plant cell wall.

8. His tagged proteins can be eluted using EDTA or a pH gradient from the matrix.

- a) True
- b) False

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Answer: a

Explanation: His tagged proteins can be eluted using EDTA or a pH gradient from the matrix. They disrupt the chelation.

9. Enterokinase is an intestinal enzyme that converts \_\_\_\_\_ to \_\_\_\_\_

- a) pepsinogen, pepsin
- b) pepsin, pepsinogen
- c) trypsinogen, trypsin
- d) trypsin, trypsinogen

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Answer: c

Explanation: Enterokinase is an intestinal enzyme which is used to convert inactive trypsinogen to trypsin. It forms the basis for the extraction of fusion proteins from the matrix.

10. Cyanogen bromide is used for cleavage of junctions. It cleaves after \_\_\_\_\_ residues.

- a) methionine
- b) tryptophan
- c) cysteine
- d) phenolic acid

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Answer: a

Explanation: Cyanogen bromide is used for cleavage of junctions and it cleaves after methionine residues. But this method is not widely used.

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# Genetic Engineering Questions and Answers – Co-expression of Proteins and Optimization

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This set of Genetic Engineering Questions and Answers for Aptitude test focuses on “Co-expression of Proteins and Optimization”.

1. If it is desirable to express two or more proteins simultaneously, then it is known as \_\_\_\_\_  
a) hybrid of proteins  
b) fusion of proteins  
c) co-expression of proteins  
d) combination of proteins

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Answer: c

Explanation: If it is desirable to express two or more proteins simultaneously, then it is called as co-expression of proteins. There are varied uses of such proteins.

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2. For co-expression of proteins, it is possible to have several independent sets of promoters and other signals in a single vector.

- a) True
- b) False

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Answer: a

Explanation: For co-expression of proteins, there are two strategies which are used. The first is to use several different expression vectors at a single time. The second method is to use several independent sets of promoters and signals in a single vector.

3. A considerable amount of modification can take place in the \_\_\_\_\_ region of RNA in \_\_\_\_\_ before translation. It affects the yield of proteins.

- a) coding, prokaryotes
- b) coding, eukaryotes
- c) non-coding, prokaryotes
- d) non-coding, eukaryotes

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Answer: b

Explanation: A considerable amount of modification in the coding region of the RNA can take place in eukaryotes before translation. This can have an effect on the yield of the protein.

4. Strong secondary structure in a message may affect \_\_\_\_\_

- a) translation
- b) transcription
- c) both translation and transcription
- d) none of translation and transcription

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Answer: a

Explanation: It is not necessary that if transcription and translation initiate well, they continue well. Factors such as secondary structure, affect translation. There are other factors such as codon usage and codon meaning which affect translation.

5. What is the function of T7 lysozyme?

- a) Attacking the peptidoglycan in bacterial cell walls
- b) Inhibitor of T7 polymerase
- c) Activator of T7 polymerase
- d) Both attacking the peptidoglycan in bacterial cell walls and inhibitor of T7 polymerase

[View Answer](#)

Answer: d

Explanation: T7 lysozyme is used for reducing the level of expression from T7 promoters. It is phage encoded and serves a dual purpose. It attacks the peptidoglycan in bacterial cell walls and is an inhibitor of T7 polymerase.

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6. As the activity of T7 polymerase is reduced by lysosome, what is an effect on the rate of synthesis after induction?

- a) Increase
- b) Decrease
- c) May increase or decrease
- d) No effect

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Answer: b

Explanation: As the activity of T7 polymerase is reduced by the lysosome, resultantly the rate of synthesis after induction is also reduced.

7. Proteins at times are not soluble in the cell and form aggregates known as \_\_\_\_\_

- a) coagulation
- b) aggregated mass
- c) inclusion bodies
- d) insoluble mass

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Answer: c

Explanation: Proteins are not always soluble and at times they form insoluble aggregates. These are called as inclusion bodies. It is to separate them out by centrifugation.

8. It is not possible to solubilise proteins from aggregated mass of proteins.

- a) True
- b) False

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Answer: b

Explanation: At times, it is possible to solubilise proteins from the aggregated mass of proteins. And this further helps in correct folding.

9. Lon protease is used for degradation of foreign proteins in E.coli cells. It is active against which type of proteins?

- a) Partially denatured proteins
- b) Completely denatured proteins
- c) Both partially and completely denatured proteins
- d) Intact proteins

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Answer: c

Explanation: Lon protease is used for degradation of foreign proteins. It is active against both partially and completely denatured proteins.

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10. Lon mutation can lead to \_\_\_\_\_ and \_\_\_\_\_

- a) mucoidy, UV sensitivity
- b) mucoidy, UV insensitivity
- c) overproduction of fats, UV sensitivity
- d) overproduction of fats, UV insensitivity

[View Answer](#)

Answer: a

Explanation: Lon mutation can lead to problems such as mucoidy and UV sensitivity. Mucoidy is the phenomenon overproduction of polysaccharide capsules in the cell and thus manipulation becomes difficult.

11. Mutation in gale gene or cpsA-E gene cluster is used for \_\_\_\_\_

- a) suppression of mucoidy
- b) activation of mucoidy

- c) suppression of UV sensitivity
- d) both suppression of mucoidy and UV sensitivity

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Answer: a

Explanation: Mucoidy is undesirable for physical manipulation. It can be suppressed by a mutation in gale gene or cspA-E gene cluster.

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# Genetic Engineering Questions and Answers – Gene Function and Gene Trapping

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Gene Function and Gene Trapping”.

1. How many types of reporter gene constructs are there?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: There are mainly two constructs for the reporter gene. In the first construct, reporter gene completely replaces the target gene. In the second construct, there is a fusion between the target gene and the reporter gene.

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2. Desired changes are made in the structure of the promoter and is ligated onto reporter gene. The alteration can be known by measuring the activity.

- a) True

b) False  
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Answer: a  
Explanation: Desired changes are made in the structure of the promoter in order to know about the region of expression.

3. \_\_\_\_\_ fluorescent protein should be used for determination of \_\_\_\_\_ of subcellular components.

- a) One, age
- b) One, location
- c) More than one, location
- d) More than one, age

[View Answer](#)

Answer: c

Explanation: Fluorescent protein is used for location of subcellular components. More than one fluorescent protein should be used for exact determination of the location of the subcellular components.

4. Sequences can be cloned flanking the reporter genes using the transposon tagging approach. The use of reporter genes to identify sequences expressed in this way is called as \_\_\_\_\_

- a) trapping
- b) tagging
- c) identification
- d) blotting

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Answer: a

Explanation: Sequences can be cloned flanking the reporter genes using the transposon tagging approach and if sequences are identified in this way, then it is called as trapping.

5. If detection of enhancers is done it is called as \_\_\_\_\_ and for detection of transcribed sequences, it is called as \_\_\_\_\_

- a) enhancer trapping, promoter trapping
- b) enhancer trapping, gene trapping
- c) promoter trapping, gene trapping
- d) promoter trapping, enhancer trapping

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Answer: b

Explanation: Trapping can be classified into different types by using different types of constructs. If enhancer is detected it is called as enhancer trapping. For promoter, it is called as promoter trapping and for transcribed sequences it is called as gene trapping.

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6. The enhancer trap system will \_\_\_\_\_ in the \_\_\_\_\_

- a) not replicate independently, host
- b) replicate independently, host
- c) not replicate independently, vector
- d) replicate independently, vector

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Answer: a

Explanation: The enhancer trap system will not replicate independently in the host. But the detection can be done by using a selectable marker.

7. For gene trap vector system, reporter gene and \_\_\_\_\_ are present. Reporter gene is \_\_\_\_\_

- a) selectable marker, having promoter
- b) selectable marker, promoterless
- c) helper phage, promoterless
- d) helper phage, having promoter

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Answer: b

Explanation: For gene trap vector system, reporter gene and a selectable marker are present. The reporter gene is promoterless.

8. The reporter gene in enhancer trap system is preceded by \_\_\_\_\_

- a) intron
- b) exon
- c) promoter
- d) origin of replication

[View Answer](#)

Answer: a

Explanation: The reporter gene in the enhancer trap system is promoterless and it is preceded by introns.

9. Insertion of vector into intron gives rise to \_\_\_\_\_ it contains a part coming from intron and a part from \_\_\_\_\_

- a) hybrid intron, exon
- b) hybrid vector, exon
- c) hybrid intron, target DNA sequence

d) hybrid vector, target DNA sequence

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Answer: c

Explanation: Insertion of vector into intron gives rise to hybrid intron. It contains a part coming from intron and a part from the target DNA sequence.

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10. The hybrid intron is spliced from the transcript using the splice acceptor site in the vector.

- a) True
- b) False

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Answer: a

Explanation: The hybrid intron is spiced from the transcript using the splice acceptor site in the vector and then the reporter sequence is fused next to the target exon.

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## Genetic Engineering Questions and Answers – Bacteria

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Bacteria”.

1. An organism containing a gene which doesn't belong to it and is derived from somewhere else then the organism is said to be \_\_\_\_\_  
a) transformed  
b) transgenic  
c) mutant  
d) modified
- [View Answer](#)

Answer: b

Explanation: An organism which contains a gene which doesn't belong to it and is derived from somewhere else, it is said to be transgenic.

2. E.coli is a gram negative bacterium.

- a) True
- b) False

[View Answer](#)

Answer: a

Explanation: There are basically two types of bacteria, gram negative and gram positive. E.coli is a gram negative bacterium. These two groups are having properties which make them different.

3. If a host other than E.coli is to be used, what property of DNA to be inserted is disadvantageous?

- a) Circular DNA
- b) Linear DNA
- c) Replicating DNA
- d) Non-replicating DNA

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Answer: c

Explanation: If the DNA is to be inserted in a host other than E.coli than the DNA can be circular or linear and it should be non-replicating. As it is non-replicating, it can be stably maintained in the host only by integration into replicon.

4. If plasmids direct their own transfer from one bacterium cell to another, then they are called as \_\_\_\_\_

- a) self-transmissible
- b) auto-transmissible
- c) autonomously replicating
- d) auto-transfer

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Answer: a

Explanation: It is important to transfer the plasmids from one bacterium to another. If, plasmids are able to direct their own transfer, then it is called as self-transmissible. There are some plasmids which do it with the help of other plasmids.

5. If a plasmid can't be transferred from one cell to another, then it is called as \_\_\_\_\_

- a) non-transmissible
- b) non-mobilizable
- c) untransferrable
- d) immobilized

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Answer: b

Explanation: Some plasmids can't be transferred from one cell to another even with the help of other plasmids. Such plasmids are said to be non-mobilizable.

6. Choose the incorrect statement for shuttle vectors.

- a) These are vector hybrids constructed from E.coli and other plasmids
- b) They are having a varied use
- c) They can replicate and selected in both the species
- d) They are the plasmids which are having naturally broad host range

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Answer: d

Explanation: Shuttle vectors are those vector hybrids which are constructed artificially with the help of E.coli and other plasmids. They are able to replicate and selected in both the species and thus they are having a varied use. These are the plasmids which are having artificially broad host range because of the introduction of an extra origin of replication.

7. Which of the bacteria are used as hosts?

- a) Gram-positive
- b) Gram-negative
- c) Both gram positive and negative are preferred equally
- d) Both can be used but gram positive is preferred

[View Answer](#)

Answer: d

Explanation: Gram positive bacteria are particularly used as hosts. It is so because they secrete the expressed proteins in the growth medium at a much higher rate.

8. Basically, there are how many methods for introduction of DNA into the bacterial cells?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: c

Explanation: There are basically three methods for introduction of DNA into the bacterial cells. These are the introduction of naked DNA, transformation of protoplasts and conjugation.

9. Gram-positive Bacillus, Streptococcus and Streptomyces include species that don't exhibit natural competence.

- a) True
- b) False

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Answer: b

Explanation: These include species which exhibit natural competence. It means that they take up DNA without any physiological treatment.  
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10. Competence is determined by the excretion into growth medium of \_\_\_\_\_ & \_\_\_\_\_ proteins called as competence proteins.

- a) cellular & high molecular weight
- b) cellular & low molecular weight
- c) extracellular & low molecular weight
- d) extracellular & high molecular weight

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Answer: c

Explanation: Competence proteins are the proteins which are extracellular and low molecular weight and they help in determination of competence. Competence further develops as cell density.

11. Natural transformation can be relieved by the use of protoplasts, in the presence of osmotic buffer and polyethylene glycol. What are protoplasts?

- a) Protoplasts are the cells from which cell membrane has been removed
- b) Protoplasts are the cells from which cell wall has been removed
- c) Protoplasts are the cells from which vacuole has been removed
- d) Protoplasts are the cells from which golgi bodies are removed

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Answer: b

Explanation: Protoplasts are the cells from which the cell wall has been removed. They help in relieving natural transformation in the presence of osmotic buffer and polyethylene glycol.

12. Transfer of plasmids from one cell to another can also be done conjugation. The plasmid to be transferred known as \_\_\_\_\_ is often unable to do so by itself and thus it relies on other plasmids known as \_\_\_\_\_

- a) cargo, conjugal
- b) conjugal, cargo
- c) cargo, helper
- d) conjugal, helper

[View Answer](#)

Answer: a

Explanation: Plasmids can also be transferred from one cell to another through conjugation. Plasmids which are unable to transfer themselves are referred as cargo plasmids and they often rely on other plasmids which are called as conjugal plasmids. At times, helper plasmids are used in order to protect cargo plasmids from degradation.

13. The transfer of plasmid from one bacterial cell to another when cargo and conjugal plasmids are used, it is usually carried out by \_\_\_\_\_ mating.

- a) diparental
- b) uniparental
- c) triparental
- d) multiparental

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Answer: c

Explanation: The transfer is carried out by triparental mating. Three conjugants are used, E.coli carrying the conjugal plasmid, E.coli containing cargo and helper plasmid and the recipient bacterial species to be manipulated.

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## Genetic Engineering Questions and Answers – Markers

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Markers”.

1. One of the commonly used markers is the URA3 gene. It encodes for \_\_\_\_\_ biosynthesis.  
a) adenine  
b) uracil  
c) guanine  
d) cytosine  
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Answer: b

Explanation: URA3 gene is a commonly used selectable marker. It encodes an enzyme for uracil biosynthesis. The enzyme encoded is orotidine-5'-phosphate decarboxylase.

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2. CAN1 gene encodes a permease that causes uptake of \_\_\_\_\_ analogue.  
a) toxic guanidine  
b) toxic arginine  
c) non-toxic guanidine  
d) non-toxic arginine  
[View Answer](#)

Answer: b

Explanation: CAN1 gene encodes a permease that causes uptake of toxic arginine analogue. It causes consequent cell death.

3. Loss of SUP4 abolishes canavanine uptake, it is arginine analogue.  
a) True  
b) False  
[View Answer](#)

Answer: a

Explanation: Loss of SUP4 abolishes canavanine uptake. It is an arginine analogue. It causes canavanine resistance and cells can be readily selected.

4. Phosphoribosyl amino-imidazole carboxylase is a component of \_\_\_\_\_ biosynthesis pathway.  
a) pyrimidine  
b) purine  
c) both purine and pyrimidine  
d) only adenine  
[View Answer](#)

Answer: b

Explanation: Phosphoribosyl amino-imidazole carboxylase is a component of the purine biosynthesis pathway. The mutation for this enzyme is used in the selection of SUP4 gene.

5. Cells that have lost SUP4 gene acquire \_\_\_\_\_ pigment and are visibly distinguishable from others.  
a) red  
b) blue  
c) green

d) pink  
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Answer: a

Explanation: Cells that have lost SUP4 gene acquire red colour and this makes them visibly distinguishable from others. This is the basis for selection.  
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6. Cells mutant in \_\_\_\_\_ gene can be selected by using 5-fluoro orotic acid, which is turned into \_\_\_\_\_ products by wild type protein.

- a) SUP4, toxic
- b) SUP4, non-toxic
- c) URA3, toxic
- d) URA3, non-toxic

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Answer: c

Explanation: Cells mutant in URA3 gene can be selected by using 5-fluoro orotic acid, which is turned into toxic products by wild type protein. URA3 gene is responsible for uracil biosynthesis.

7. The replicating plasmid vectors in yeast can be divided broadly into how many categories?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: The replicating plasmid vectors in yeast can be broadly divided into two main categories. These are yeast centromeric plasmid and yeast episomal plasmid vectors.

8. Yeast centromeric plasmid (YCp50) contains ampicillin and tetracycline resistant gene.

- a) True
- b) False

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Answer: a

Explanation: Yeast centromeric plasmid contains ampicillin and tetracycline resistance gene along with an origin of replication.

9. CEN4 in YCp50 is an example of \_\_\_\_\_

- a) tetracycline resistant gene
- b) ampicillin resistant gene
- c) chromosomal centromeric sequence
- d) autonomously replicating sequence

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Answer: c

Explanation: CEN4 in YCp50 is an example of chromosomal centromeric sequence. It allows partitioning of the plasmid in the same way as endogenous chromosomes are partitioned.  
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10. Yeast episomal plasmids have the following feature?

- a) They contain ARS and CEL both
- b) They contain ARS but not CEL
- c) They contain CEL but not ARS
- d) CEL is necessarily present but ARS may or may not be present

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Answer: b

Explanation: Yeast episomal plasmids are those plasmids which contain ARS sequence but CEL may not be present necessarily.

11. Cis-acting REP 3 sequence is present in Yeast episomal plasmids. Choose the statement which holds true for it?

- a) It is present along with chromosomal centromeric sequence
- b) It is the site of action of proteins that help in partitioning
- c) It gives less stability to that of YCs
- d) The copy number is low than that of YCs

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Answer: b

Explanation: Cis acting REP3 sequence is present in Yeast Episomal plasmids. It is a substitution for chromosomal centromeric sequence. It is having similar stability than that of YCs but a higher copy number than that of it.

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# Genetic Engineering Questions and Answers – YAC and Expression Systems

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “YAC and Expression Systems”.

1. When YAC is used to clone DNA. What is the size of the DNA that can be cloned?

- a) Large (upto megabases)
- b) Small (upto few hundred bases)
- c) No size restriction
- d) Medium (upto kilobases)

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Answer: a

Explanation: YACs are sophisticated cloning vectors that are used for propagating large stretches of DNA which are upto a few megabases.

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2. TEL is the \_\_\_\_\_ sequence derived from the ends of ribosomal RNA-encoding molecules from the macromolecules of the protozoan Tetrahymena.

- a) centromeric
- b) telomeric
- c) can be either centromeric or telomeric
- d) can be present anywhere on the chromosome

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Answer: b

Explanation: TEL is the telomeric sequence derived from the ends of ribosomal RNA-encoding molecules from the macromolecules of the protozoan Tetrahymena. It is a part of YAC.

3. Choose the incorrect statement for YAC vectors.

- a) The YAC molecule is approximately 10 kb in size
- b) It contains both yeast origin of replication and prokaryotic origin of replication
- c) It doesn't contain ampicillin resistant gene

d) It contains TEL sequence

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Answer: c

Explanation: YAC vectors are approximately 10kb in size. It contains both yeast origin of replication and prokaryotic origin of replication. It also contains TEL sequence and an ampicillin resistant gene.

4. If YAC DNA is digested with BamHI and ECoRI, how many fragments are generated?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: c

Explanation: If YAC DNA is digested with BamHI and ECoRI, three fragments are generated. Two fragments are having TEL sequence and one is lacking this sequence.

5. Transformed cells in the case of YAC can be selected by the presence of both URA3 and TRP1 genes.

- a) True
- b) False

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Answer: a

Explanation: Transformed cells in the case of YAC can be selected by the presence of both URA3 and TRP1 genes. The presence of both these indicates that both the arms of YAC are acquired.

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6. GAL1 is a controllable promoter and is obtained from genes for galactose metabolism. It is known for encoding \_\_\_\_\_

- a) UDP-galactose-4-empirase
- b) Galactokinase
- c) Both UDP-galactose-4-empirase and galactokinase
- d) Glucokinase

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Answer: b

Explanation: GAL1 is a controllable promoter and is obtained from genes for galactose metabolism. It encodes for galactokinase and GAL10 encodes for UDP-galactose-4-empirase.

7. Transcription of GAL1 and GAL10 is suppressed in the presence of \_\_\_\_\_

- a) glucose
- b) galactose
- c) maltose
- d) fructose

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Answer: a

Explanation: Transcription of GAL1 and GAL10 is suppressed in the presence of glucose and elevated in the presence of galactose.

8. How many deletion variations of GAL1 promoter are there?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: In GAL1 promoter, there are 2 deletion variations present. These deletion variations are known as GALL and GALS.

9. Promoters such as GAL1 can be used to direct synthesis of either unmodified or fusion proteins.

- a) True
- b) False

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Answer: a

Explanation: Promoters such as GAL1 can be used to direct synthesis of either unmodified or fusion proteins. The fusion proteins can incorporate products of GAL1 or other sequences such as lacZ.

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10. Which of the following are advantageous to be used for expression of eukaryotic cells?

- a) Prokaryotic systems
- b) Yeast cells
- c) Fungi cells
- d) Algae cells

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Answer: b

Explanation: It is advantageous to use yeast cells for expression of eukaryotic cells in place of prokaryotic cells. It is so because in yeast cells post-translational modifications can be done but these modifications are not possible in prokaryotic cells.

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## Genetic Engineering Questions and Answers – Other Systems

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This set of Genetic Engineering Assessment Questions and Answers focuses on “Other Systems”.

1. Secretion of overexpressed proteins by fusion to a secretion signal can be useful because it helps in bringing about correct \_\_\_\_\_ and \_\_\_\_\_ protein folding.

- a) glycosylation, enhance
- b) glycosylation, not affect
- c) phosphorylation, enhance
- d) phosphorylation, not affect

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Answer: a

Explanation: Secretion of overexpressed proteins can be useful because it helps in bringing about correct glycosylation and also enhances protein folding. It also assists in purification.

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2. The enzyme used for breaking down of sucrose into glucose and fructose is called as \_\_\_\_\_

- a) sucrase
- b) glucanase
- c) maltase
- d) invertase

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Answer: d

Explanation: Invertase is the enzyme which is used for breaking down of sucrose into glucose and fructose. Invertase is used as a secretion signal and is product of SUC2 gene.

3. For introduction of exogenous DNA into *S.cerevisiae* \_\_\_\_\_ is added along with polyethylene glycol and heat shock treatment.

- a) calcium chloride
- b) sodium acetate
- c) lithium acetate
- d) magnesium chloride

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Answer: c

Explanation: There are mainly three methods which are used for the introduction of exogenous DNA into *S.cervisiae*. Lithium acetate is added along with polyethylene glycol and heat shock treatment.

4. Protoplast transformation is less time consuming than lithium acetate for transformation.

- a) True
- b) False

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Answer: b

Explanation: Protoplast transformation is a method used for carrying out transformation but is more time consuming than method based on lithium acetate. But protoplast transformation gives a higher efficiency than method based on lithium acetate.

5. *Schizosaccharomyces pombe* is yeast and it reproduces by \_\_\_\_\_

- a) budding
- b) fission
- c) either budding or fission
- d) a method of reproduction other than budding or fission

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Answer: b

Explanation: *Schizosaccharomyces pombe* is yeast which produces by fission but other yeast *Saccharomyces cerevisiae* reproduces by budding.

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6. The leu1+ marker encodes which enzyme?

- a) orotidine-5'-phosphate decarboxylase
- b) beta isopropylmalate dehydrogenase
- c) orotidine-5'-phosphate decarboxylase or beta isopropylmalate dehydrogenase
- d) orotidine-5'-phosphate decarboxylase & beta isopropylmalate dehydrogenase

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Answer: b

Explanation: The leu1+ marker encodes beta isopropylmalate dehydrogenase. Orotidine-5'-phosphate decarboxylase is another selectable marker and is encoded by ura4+ gene.

7. The replacement of one plasmid by another by introduction of the second plasmid into strain containing the first, followed by removal of the first by counterselection is known as \_\_\_\_\_

- a) shuffle vector
- b) plasmid shuffle
- c) counterselection plasmid
- d) combination plasmid

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Answer: b

Explanation: Plasmid shuffle is the system where one plasmid is replaced by another via introduction of the second plasmid into the strain containing first. It is followed by the removal of first by counterselction.

8. Promoters can be divided basically into how many types?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: Promoters can be mainly divided into two types mainly and these are known as constitutive and inducible promoters.

9. nmt1+ gene is used for \_\_\_\_\_ biosynthesis.

- a) uracil
- b) adenine
- c) cytosine
- d) thiamine

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Answer: d  
Explanation: nmt1+ gene is used for thiamine biosynthesis. It is the gene from which inducible promoter is obtained.  
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10. The promoter from fbp1+ gene is suppressed in the presence of glucose.

- a) True
- b) False

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Answer: a

Explanation: The promoter from fbp1+ gene is greatly suppressed in the presence of glucose and is activated in absence of glucose. In place of glucose, glycerol is used as a carbon source.

11. Species which can grow on \_\_\_\_\_ as a carbon source are called as methylotrophic.

- a) methylase
- b) methanol
- c) methane
- d) methanoic acid

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Answer: b

Explanation: Methylotrophic species are those species which can grow on methanol as a carbon source. It induces expression of genes for enzymes such as methanol oxidase.

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# Genetic Engineering Questions and Answers – Algae

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Algae”.

1. Chlamydomonas reinhardtii is a green \_\_\_\_\_ algae.

- a) unicellular
- b) di-cellular
- c) multicellular
- d) either unicellular or di-cellular

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Answer: a

Explanation: Chlamydomonas reinhardtii is a green, unicellular algae. It has been used as a model system and studies have been carried out.

2. Chlamydomonas genome is \_\_\_\_\_ rich.

- a) AT
- b) GC
- c) Only A
- d) Only C

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Answer: b

Explanation: Chlamydomonas genome is very GC rich. Hence, heterologous genes can't be expressed until they come from a GC rich genome.

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3. Integration of DNA into the Chlamydomonas genome is via homologous recombination.

- a) True
- b) False

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Answer: b

Explanation: Integration of DNA into the Chlamydomonas genome is via non-homologous recombination. And because of this gene disruption can't be carried out efficiently.

4. Transformation of Chlamydomonas is most efficient in which method?

- a) Lithium acetate method
- b) Electroporation
- c) Protoplast based method
- d) Both electroporation and protoplast based method

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Answer: c

Explanation: Transformation of Chlamydomonas is most efficient in the protoplast method. In this autolysin is used in order to carry out cell wall degradation.

5. OEE1 gene encodes a component of \_\_\_\_\_

- a) photosystem I
- b) photosystem II
- c) both photosystem I and II
- d) which neither belongs to photosystem I nor II

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Answer: b

Explanation: OEE1 gene encodes a component which is a component of photosystem II. It allows mutant cells lacking that polypeptide to grow photoautotrophically.

6. Homologue of yeast ARG4 in Chlamydomonas is \_\_\_\_\_

- a) ARG1
- b) ARG2
- c) ARG5
- d) ARG7

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Answer: d

Explanation: ARG4 is present in yeast and is used for the production of arginine and as a selectable marker. Homologue of yeast ARG4 in Chlamydomonas is ARG7.

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7. cw15 is a mutant strain, it \_\_\_\_\_ and thus called as \_\_\_\_\_

- a) lacks cell wall, natural protoplast
- b) lacks cell wall, artificial protoplast
- c) has cell wall, artificial protoplast
- d) has cell wall, natural protoplast

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Answer: a

Explanation: cw15 is a mutant strain. It lacks a cell wall and thus it is called as natural protoplast. It is so because protoplasts are those structures which lack a cell wall.

8. Genetic manipulation of Volvox carteri is carried out using nitrogen reductase or antibiotic resistance.

- a) True
- b) False

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Answer: a

Explanation: Genetic manipulation of green algae such as Volvox carteri is carried out by using nitrogen reductase or antibiotic resistance. They act as selectable markers.

9. For Chlorella, which method is used for DNA uptake?

- a) Electroporation
- b) Direct uptake of naked DNA
- c) Conjugation
- d) Chemically induced uptake by protoplast

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Answer: d

Explanation: For Chlorella biolistic transformation is used. And apart from it, chemically induced uptake of DNA by protoplast is also used.

10. Members of genera Haematococcus are used for production of \_\_\_\_\_

- a) xanthenoid
- b) carotenoid
- c) chlorophyll
- d) carotenoid and xanthenoid both

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Answer: b

Explanation: Members of genera Haematococcus and Dunaliella are of economic importance and are used for the production of carotenoids.

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## Genetic Engineering Questions and Answers – Vascular Plants

This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Vascular Plants”.

1. The disease crown gall is caused by which bacteria?

- a) Agrobacterium tumefaciens
- b) Agrobacterium rhizogenes
- c) Agrobacterium tumefaciens & rhizogenes bacterium causes the disease crown gall
- d) Any bacteria belonging to genera Rhizobium

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Answer: a

Explanation: The disease crown gall is caused by Agrobacterium tumefaciens. Agrobacterium rhizogenes causes the disease hair root. Agrobacterium mediated transfer forms a basis for the transfer of DNA in vascular plants.

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2. Agrobacterium tumefaciens form \_\_\_\_\_ plasmids and Agrobacterium rhizogenes form \_\_\_\_\_ plasmids.

- a) root inducing, tumour inducing
- b) tumour inducing, root inducing
- c) tumour inducing, shoot inducing
- d) non-tumour inducing, shoot inducing

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Answer: b

Explanation: The former bacterium forms tumour inducing plasmids whereas the second bacterium forms root inducing plasmids. These plasmids are large in size.

3. The region which is transferred from bacterium to the nucleus of the plant cell is called as T-DNA.

- a) True
- b) False

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Answer: a

Explanation: T-DNA (Transferred DNA) is the region which is to be transported from the bacterium to the nucleus of the vascular plant and thus it is very important.

4. Transfer of T DNA depends on a set of genes called as \_\_\_\_\_ if they are present on \_\_\_\_\_

- a) vir, chromosome
- b) chv, tumour inducing plasmid
- c) chv, chromosome
- d) vir, whether they are present on tumour inducing plasmid or chromosome

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Answer: c

Explanation: Transfer of TDNA depends on a set of genes known as vir if present on tumour inducing plasmids and chv if they are present on chromosome.

5. What is the function of onc genes in TDNA?

- a) Tumour suppressing potential
- b) Tumour inducing potential
- c) Either tumour inducing or suppressing depending on the conditions
- d) Act as replicative genes

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Answer: b

Explanation: Onc genes present in TDNA act as tumour inducing genes. Tumour inducing potential is also known as oncogenicity.

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6. Which of the plant growth regulators are produced by TDNA?

- a) Salicylic acid
- b) Cytokinin
- c) Cytokinin and Auxin
- d) Jasmonic Acid

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Answer: c

Explanation: TDNA is having oncogenes and apart from it also produces plant growth regulators cytokinins and auxin. These plant growth regulators are plant hormones and are called as phytohormones.

7. If a small intermediate vector system is used along with a selectable marker, then it is called as \_\_\_\_\_

- a) fusion plasmids
- b) hybrid plasmids
- c) co-integrative plasmids
- d) complex plasmids

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Answer: c

Explanation: Tumour inducing plasmids are very large in size and thus they can be manipulated easily. In order to overcome this, small integrating plasmids

with a selectable marker are used and it is known as co-integrative plasmid. They are then further inserted into the bacterium.

8. Binary vector systems can also be used for transferring the DNA via agrobacterium.

- a) True
- b) False

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Answer: a

Explanation: As, we know Ti plasmid is difficult to manipulate because of larger size, other alternatives are used. Binary vector system contains the gene of interest flanked by border repeats. Border repeats are the sequences present in the Ti plasmid originally. With the help of it, transfer is done into the plants.

9. If transfer of DNA from Agrobacterium to plants is done via incubation of explanted material and the vector containing DNA of interest and then selection is done via selectable marker then this method is called as \_\_\_\_\_

- a) transformation
- b) co-cultivation
- c) co-transformation
- d) floral dipping

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Answer: b

Explanation: Co-cultivation is the method of incubation of explanted material and the vector containing DNA of interest. Further selection is done via selectable marker such as antibiotic resistance. Floral dipping is an approach used for plant Arabidopsis.

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10. If gene of interest is inserted into protoplasts but the transformation is not stable, then it is called as \_\_\_\_\_ expression systems.

- a) permanent
- b) temporary
- c) transient
- d) unstable

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Answer: c

Explanation: If the gene of interest is inserted into protoplasts but the transformation is not stable, then it is called as transient expression systems.

11. 35S promoter is obtained from \_\_\_\_\_

- a) Tobacco mosaic virus
- b) Cauliflower mosaic virus
- c) Agrobacterium
- d) Arabidopsis

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Answer: b

Explanation: 35S promoter is obtained from cauliflower mosaic virus (CaMV). It is responsible for the generation of 35S transcript in infected cells.

12. Which of the following promoter is having high tissue specificity?

- a) 35S promoter
- b) nos promoter
- c) 35S & nos promoters are having high specificity
- d) neither of the promoter is having high specificity

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Answer: d

Explanation: Both the promoters, 35S and CaMV are having low tissue specificity. Tissue specificity can be achieved by insertion of sequences from other promoters.

13. What is the function of glyphosate?

- a) It is a fungicide
- b) It is an herbicide
- c) It is an enzyme used in place of glucose as a carbon source
- d) It is used for adding phosphate groups

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Answer: b

Explanation: Glyphosate is an herbicide. It inhibits an enzyme which is necessary for shikimic acid pathway.

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14. *Bacillus thuringiensis* is used for the production of toxins which can be used as \_\_\_\_\_

- a) insecticides
- b) pesticides
- c) germicides
- d) fungicides

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Answer: a

Explanation: *Bacillus thuringiensis* is used for the production of toxins which are proteinaceous in nature and are produced during sporulation. These toxins are insecticidal in nature.

15. Which of the following compounds control ripening in tomatoes?

- a) Auxin
- b) Cytokinin
- c) Ethylene
- d) Jasmonic acid

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Answer: c

Explanation: Ripening of tomatoes is controlled by ethylene. It is a plant hormone. Other plant hormones such as auxin and cytokinin are growth hormones.

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# Genetic Engineering Questions and Answers – Organelle Transformation

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Organelle Transformation”.

1. Mitochondrial genome encodes tRNAs \_\_\_\_\_ and polypeptides involved in \_\_\_\_\_
- a) mRNAs, oxidative phosphorylation
  - b) rRNAs, oxidative phosphorylation
  - c) rRNAs, reductive phosphorylation
  - d) mRNAs, reductive phosphorylation

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Answer: b

Explanation: Mitochondrial genome encodes tRNAs, rRNAs and polypeptides which are required for oxidative phosphorylation. tRNAs and rRNAs are also encoded by chloroplast genome.

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2. Atrazine is a herbicide and it acts on \_\_\_\_\_
- a) reaction centre in photosystemI
  - b) reaction centre in photosystemII
  - c) reaction centre in both the photosystems

d) neither of the photosystems

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Answer: b

Explanation: Atrazine is a herbicide and it acts on a reaction centre present in photosystem II. This herbicide is a product of chloroplast psbA gene.

3. Allotopic gene expression is the case when the presence of a normal gene in an organelle is not a problem in expression.

a) True

b) False

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Answer: a

Explanation: At times, the presence of a normal gene in the organelle doesn't create a problem and thus inserting modified organelle genes into the nucleus may be expressed well. Such an expression is called a allotropic gene expression.

4. atpB encodes \_\_\_\_\_ subunit of ATP synthase, an enzyme used for generation of \_\_\_\_\_

a) beta, ADP

b) alpha, ATP

c) beta, ATP

d) alpha, ADP

[View Answer](#)

Answer: c

Explanation: atpB encodes a beta subunit of ATP synthase, it is a multisubunit complex used for generation ATP and it is done in the presence of light reaction.

5. Bacterial aadA gene is responsible for conferring resistance to \_\_\_\_\_

a) spectinomycin

b) streptomycin

c) ampicillin

d) spectomycin and streptomycin

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Answer: d

Explanation: Bacterial aadA gene is responsible for conferring resistance to both streptomycin and spectomycin. It is used a selectable marker for chloroplast transformation.

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6. How many types of the chloroplast are there in Chlamydomonas?

a) 1

b) 2

c) 3

d) 4

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Answer: a

Explanation: Chlamydomonas is having only one type of chloroplast and this property makes it easier to use it for transformation.

7. For transformation of the chloroplast of higher plants, a vector is used which \_\_\_\_\_ in the chloroplast.

a) doesn't replicates

b) replicates

c) may or may not replicate

d) replicates under certain specified conditions

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Answer: a

Explanation: For transformation of the chloroplast of higher plants, a vector is used which doesn't replicates in the chloroplast. There is a selectable marker which is present and the gene of interest is flanked by chloroplast DNA.

8. Chloroplast can be transferred through pollen in all crops.

a) True

b) False

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Answer: b

Explanation: Chloroplast can't be transferred through pollen for all the crops. Thus incorporation of transgenes in chloroplast may offer more biological containment than that incorporation into nucleus may offer.

9. Mutant strains of *Saccharomyces cerevisiae* in which endogenous DNA are deleted are called as \_\_\_\_\_

a) rho0

b) synthetic rho

c) rho+

d) rho-

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Answer: a

Explanation: Mutant strains of *Saccharomyces cerevisiae* in which endogenous DNA are deleted are called as rho0. Synthetic rho- strains are produced when DNA is introduced into mitochondria and concatamers are produced.

10. COX3 gene is a selectable marker. Choose the correct statement with respect to it.

- a) It confers the ability to grow by anaerobic respiration
- b) It confers the ability to grow by aerobic respiration
- c) It confers the ability to grow in absence of uracil
- d) It confers the ability to grow in lithium acetate medium

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Answer: b

Explanation: COX3 gene is used as a selectable marker. It confers the ability to grow by aerobic respiration in the mutant cells for mitochondrial COX3 gene.

11. The ARG8m gene which produces an enzyme for arginine biosynthesis is located in \_\_\_\_\_ and is of \_\_\_\_\_ origin.

- a) mitochondrial, nuclear
- b) nuclear, mitochondrial
- c) nuclear, nuclear
- d) mitochondrial, mitochondrial

[View Answer](#)

Answer: a

Explanation: The ARG8m gene which produces an enzyme for arginine biosynthesis is located in the mitochondria but is of nuclear origin. It is designed for expression in the mitochondrion and will confer the ability to grow in the absence of arginine.

12. Barstar is \_\_\_\_\_

- a) RNase
- b) RNase inhibitor
- c) DNase
- d) DNase inhibitor

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Answer: b

Explanation: Barstar is RNase inhibitor. And Barsar is RNase and inhibitor is used as a selectable marker. Barsar is used for degrading the mitochondrial RNA. Barstar added helps in suppressing the function of Barsar and thus restoration of mitochondrial function takes place.

13. Caenorhabditis elegans is a model organism of great importance in biological systems. It is a/an \_\_\_\_\_

- a) algae
- b) parasite
- c) fungi
- d) nematode

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Answer: d

Explanation: Caenorhabditis elegans is a model organism of great importance in biological systems and it is a nematode. The genetic manipulation of the organism is quite complex.

14. DNA can be injected into Caenorhabditis elegans by biolistic transformation. The injected DNA forms arrays of extrachromosomal copies which are stable in nature.

- a) True
- b) False

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Answer: b

Explanation: DNA can be injected into Caenorhabditis elegans by biolistic transformation. The injected DNA forms extrachromosomal copies but these are not stable in nature. This can be avoided by the incorporation of poison sequences.

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## Genetic Engineering Questions and Answers – Cultured Cells And Bacillovirus

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This set of Genetic Engineering Problems focuses on “Cultured Cells And Bacillovirus”.

1. Autographa californica nuclear polyhedrosis virus (AcNPV) is commonly used bacillovirus for infecting cultured cells. The virus is \_\_\_\_\_ and \_\_\_\_\_
- a) single stranded, linear
  - b) double stranded, linear
  - c) double stranded, circular
  - d) single stranded, circular

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Answer: c

Explanation: AcNPV is a commonly used bacillovirus for infecting cultured cells. It is double stranded and circular. It is isolated from caterpillar and infects around 30 species.

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2. DNA replication of the AcNPV takes 6 hours after infection. After how many hours of infection new virus particles are produced by budding?
- a) 8 hrs
  - b) 10 hrs
  - c) 12 hrs
  - d) 16 hrs

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Answer: b

Explanation: After 10 hrs of infection, new virus particles are produced. And these virus particles are termed as extracellular virus particles.

3. The virus particles are held together by polyhedron and p10 protein.

- a) True
- b) False

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Answer: a

Explanation: The virus particles are held together by polyhedron and p10 proteins. Polyhedron protein is of 29kDa. The virus particles are held together as occlusion bodies.

4. The polyhedrin and p10 protein are produced in \_\_\_\_\_ amount and other genes are expressed in \_\_\_\_\_ amount.

- a) low, high
- b) high, high
- c) high, low
- d) low, low

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Answer: c

Explanation: The polyhedron and p10 protein are expressed in large amounts and other genes are expressed in low amount. The former proteins are up to 20% of protein synthesis.

5. Expression of proteins using nuclear polyhedrosis viruses is advantageous because it gives \_\_\_\_\_ protein yields and post-translational modifications are \_\_\_\_\_

- a) high, not possible
- b) high, possible
- c) low, possible
- d) low, not possible

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Answer: b

Explanation: Expression of proteins using nuclear polyhedrosis viruses is advantageous because it gives high protein yields and post-translational modifications are also possible. These modifications are not possible in prokaryotic systems and yeast or are carried out very less.

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6. The size of the viral genome is large and thus poses a problem. This problem can be resolved by using \_\_\_\_\_

- a) transfer vector
- b) co-integration plasmid
- c) hybrid vector
- d) fusion vector

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Answer: a

Explanation: The size of the viral genome is a problem because it is very large. It is solved by using a transfer vector. Transfer vector is composed of sequences that allow propagation of E.coli, the viral promoter, the polyhedrin mRNA polyadenylation signal and the polyhedron gene is flanked by the viral sequences.

7. The gene of interest is inserted into transfer vector and then further into viral genome leading to the formation of modified virus. How can plaques from modified virus differentiated from plaques from wild-type virus?

- a) Chemically
- b) Visually
- c) On the basis of magnetic properties
- d) On the basis of longevity of plaques

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Answer: b

Explanation: Plaques from the recombinant virus and from the wild type virus can be differentiated simply visually.

8. If the DNA is linearized, what is the effect on the recombination frequency?

- a) The recombination frequency decreases
- b) The recombination frequency increases
- c) The recombination may increase or decrease depending on the amount of DNA
- d) There is no effect on the recombination frequency

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Answer: b

Explanation: If the DNA is linearized, the recombination frequency increases. It is so because it makes the DNA more recombinogenic.

9. The recombinant virus can be propagated in E.coli and this is referred to as bacmid.

- a) True
- b) False

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Answer: a

Explanation: The recombinant virus can be propagated in E.coli and this is called as bacmid. This arrangement can be used as shuttle vector.

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10. For the generation of recombinant baculovirus, recombinants can be selected by \_\_\_\_\_

- a) blue-white screening
- b) antibiotic resistance
- c) either antibiotic resistance or blue white screening
- d) radioactivity

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Answer: a

Explanation: For the generation of recombinant baculovirus, recombinants can be selected by blue-white screening. After this, the recombinant baculovirus is introduced into insect cells for expression.

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## Genetic Engineering Questions and Answers – Drosophila

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Drosophila”.

1. Transgenic Drosophila can be created by microinjection of DNA into the embryos. These embryos are at which stage of development?

- a) One-cell stage
- b) Pre-blastoderm stage
- c) Blastoderm
- d) Morula

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Answer: b

Explanation: Transgenic Drosophila can be created by microinjection of DNA into the embryos. The embryo should be at pre-blastodermal stage. Other developmental stages such as blastoderm and morula follow the pre-blastodermal stage.

2. Syncytium is a layer of \_\_\_\_\_ that have not been separated into individual cells.

- a) nuclei
- b) mitochondria
- c) cytoplasm
- d) nuclei and cytoplasm

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Answer: a

Explanation: Syncytium is a layer of nuclei which is not divided into separate individual cells. This is found at pre-blastodermal stage of development.

3. In Drosophila, only nuclei cells give rise to germline cells.

- a) True
- b) False

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Answer: a

Explanation: In Drosophila, only nuclei cells give rise to germline cells. These germline cells are located at one end of the embryo and acquire DNA stably.

4. \_\_\_\_\_ integration systems are used for the transfer of DNA in Drosophila and it is composed of \_\_\_\_\_

- a) Artificial, P elements
- b) Artificial, S elements
- c) Natural, P elements
- d) Natural, S elements

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Answer: c

Explanation: In Drosophila, the natural integration systems are used for the transfer of DNA and it is composed of transposable elements. These transposable elements are known as P elements.

5. Only the \_\_\_\_\_ part of Drosophila is transgenic and the rest is not. This is known as \_\_\_\_\_

- a) germline cell, mosaic
- b) nurse cells, mosaic
- c) germline cells, hybrid
- d) nurse cells, hybrid

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Answer: a

Explanation: Only the germline cells portion (but not necessarily all germline cells) is modified and the rest is non-transgenic. This is collectively known as mosaic.

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6. rosy gene is used as a selectable marker for transformation in Drosophila, it produces an enzyme required for the synthesis of \_\_\_\_\_

- a) wing pigment
- b) eye pigment
- c) both eye and wing pigment
- d) thorax pigment

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Answer: b

Explanation: Rosy gene is used as a selectable marker for transformation in Drosophila, it produces enzyme xanthine dehydrogenase and it is required for pigments of the eye.

7. Wild type flies have crimson red eyes whereas rosy mutant have brick-red eyes.

- a) True
- b) False

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Answer: b

Explanation: Wild type genes have brick-red eyes whereas rosy mutant have crimson red eyes. Thus, rosy genes can be used as selectable marker.

8. Wild-type Drosophila flies are \_\_\_\_\_ to ethanol supplied in food.

- a) resistant
- b) non-resistant
- c) resistant at low concentration and non-resistant at higher concentration
- d) resistant at higher concentrations and non-resistant at lower concentration

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Answer: a

Explanation: The wild type flies are resistant to ethanol supplied in the food. This property can be exploited as a selectable marker and which is in the form of alcohol dehydrogenase gene.

9. Cis-acting sites should be present in the vector for \_\_\_\_\_

- a) replication
- b) selecting recombinants by acting as a marker
- c) transposition
- d) providing high copy number

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Answer: c

Explanation: Apart from selectable markers, cis acting sites should also be present. These are required for transposition.

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10. The host should \_\_\_\_\_ P elements, these elements lead to \_\_\_\_\_

- a) not have, instability
- b) have, stability
- c) not have, increase the time taken for integration
- d) have, reduces the time taken for integration

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Answer: a

Explanation: The host should not have P elements, these elements lead to instability. It is so because they are responsible for transposition.

11. Where do P elements integrate into the genome?

- a) At specifically defined sites
- b) Randomly
- c) Only at the ends of the genome
- d) Integration depends on reaction conditions

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Answer: b

Explanation: P elements integrate into the genome randomly. This makes it non-feasible to be used directly for gene disruption.

12. Transient gene silencing can be carried out by microinjecting \_\_\_\_\_

- a) single stranded RNA
- b) double stranded DNA
- c) double stranded RNA

d) either double stranded DNA or RNA

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Answer: c

Explanation: Transient gene silencing is carried out by microinjecting double stranded RNA. Long term gene silencing can be carried out by synthesizing an inverted copy of the target gene.

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## Genetic Engineering Questions and Answers – Cultured Cells in Mammals and Restricted Areas in Intact Organisms – 1

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Cultured Cells in Mammals and Restricted Areas in Intact Organisms – 1”.

1. Lesch-Nyhan syndrome is caused by the deficiency of the enzyme hypoxanthine-guanine phosphoribosyl transferase (HGPRT). Cells deficient in HGPRT die in a medium containing which of the following?
  - a) Hypoxanthine and thymidine
  - b) Thymidine
  - c) Aminopterin and thymidine
  - d) Hypoxanthine, thymidine and aminopterin (HAT medium)

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Answer: d

Explanation: HGPRT deficient cells in the medium containing all three hypoxanthine, thymidine and aminopterin. It is so because aminopterin blocks the endogenous synthesis of purines needed for the synthesis of nucleic acid.

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2. Presence of wild-type DNA onto the HGPRT—in the presence of \_\_\_\_\_ led to DNA uptake and stable transformation.

- a) lithium acetate
- b) calcium phosphate
- c) sodium chloride
- d) aluminum sulphate

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Answer: b

Explanation: Presence of wild type in HGPRT—in the presence of calcium phosphate led to DNA uptake and stable transformation.

3. Cells deficient in thymidine kinase (TK) are also killed in HAT medium.

- a) True
- b) False

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Answer: a

Explanation: Cells deficient in thymidine kinase are also killed in HAT medium. It is so because pyrimidine synthesis is also blocked in the presence of aminopterin and utilization of thymidine in the HAT medium requires a functional TK.

4. Hygromycin is used as a selectable marker in mammalian cultured cells. It is used for \_\_\_\_\_

- a) initiating protein synthesis
- b) inhibiting protein synthesis
- c) initiating DNA binding process
- d) inhibiting DNA binding process

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Answer: b

Explanation: Hygromycin is used as a protein synthesis inhibitor. It is conferred by a bacterial hph gene which encodes hygromycin phosphotransferase. Resistance to hygromycin is used as a selectable marker.

5. Puromycin is a protein synthesis inhibitor. It is conferred by \_\_\_\_\_ gene.

- a) streptococcal
- b) bacilovirus
- c) streptomyces
- d) both streptococcal and streptomyces

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Answer: c

Explanation: Puromycin is a protein synthesis inhibitor and is conferred by streptomyces gene. It does so by encoding puromycin-N-acetyltransferase.  
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6. Resistance to bleomycin (zeocin) is used as a selectable marker for mammalian cultured cells and its function is \_\_\_\_\_

- a) DNA damaging agent
- b) DNA synthesis promoter
- c) Inhibiting RNA synthesis
- d) Activating RNA synthesis

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Answer: a

Explanation: Resistance to bleomycin (zeocin) is used as a selectable marker for mammalian cultured cells and it is a DNA damaging agent. It does so by expression of a binding protein.

7. Resistance to methotrexate, which inhibits the enzyme dihydrofolate reductase (DHFR) is used as a selectable marker. This enzyme is involved in the synthesis of \_\_\_\_\_ carbon units and is required for \_\_\_\_\_ biosynthesis.

- a) two, nucleoside
- b) two, nucleotide
- c) one, nucleotide
- d) one, nucleoside

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Answer: d

Explanation: Resistance to methotrexate, which is used as a selectable marker inhibits DHFR enzyme. This enzyme is involved in the synthesis of one carbon units and is required for nucleoside synthesis.

8. Histidinol dehydrogenase allows synthesis of histidine from exogenous histanol.

- a) True
- b) False

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Answer: a

Explanation: Histidinol dehydrogenase is also used as a selectable marker. It allows synthesis of histidine from exogenous histanol and protects from toxic effects of histidinol.

9. Many mammalian cells contain Thymidine Kinase, the mammalian enzyme uses the analogue \_\_\_\_\_ than does the viral enzyme.

- a) more efficiently
- b) less efficiently

- c) with same efficiency
- d) either with same or more efficiency

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Answer: b

Explanation: Many mammalian cells contain thymidine kinase, the mammalian enzyme uses the analogue less efficiently than the viral enzyme. If cells lack viral enzyme they are resistant to analogue and are able to grow in a mammalian enzyme.

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10. A wide range of host cell lines are available and commonly used human cell lines are obtained from \_\_\_\_\_

- a) kidney
- b) liver
- c) lymphoblast from leukaemia patient
- d) both kidney and lymphoblast from a leukaemia patient

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Answer: d

Explanation: There is a wide range of host cell lines available. Commonly used human cell lines are HeLa 293T, obtained from kidney and Jurkat which is obtained from lymphoblast from a leukaemia patient.

11. DEAE-dextran is used for introduction of DNA. It is a modified \_\_\_\_\_ and is \_\_\_\_\_

- a) polysaccharide, negatively
- b) polysaccharide, positively
- c) monosaccharide, positively
- d) monosaccharide, negatively

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Answer: b

Explanation: There are various methods for the uptake of transformation DNA such as electroporation and DEAE-dextran method. It is a modified polysaccharide and is positively charged. It forms a complex with negatively charged DNA and is taken into cells by endocytosis.

12. Cells whose contents have been removed and replaced, by swelling and shrinking in solutions of suitable osmotic strength are called as \_\_\_\_\_

- a) protoplast
- b) ghosts
- c) shrunken cells
- d) vacuole

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Answer: b

Explanation: Ghosts are those cells whose contents have been removed and replaced by swelling and shrinking in solutions of suitable osmotic strength. Red blood ghosts are also used for the introduction of DNA into mammalian cells.

13. In \_\_\_\_\_ cells, virus replication doesn't take place and viral DNA \_\_\_\_\_

- a) non-permissive, is also not expressed
- b) permissive, is also not expressed
- c) non-permissive, can be expressed
- d) non-permissive, is always expressed

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Answer: c

Explanation: In non-permissive cells, virus replication doesn't take place and viral DNA can be expressed though.

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14. SV40 is a virus and it produces how many transcripts?

- a) 1
- b) 2
- c) 3
- d) 4

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Answer: b

Explanation: SV40 is a virus and it produces two transcripts. These transcripts are produced by early and late transcripts.

15. Splicing of the transcripts is necessary for efficient expression.

- a) True
- b) False

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Answer: a

Explanation: Splicing of both the transcripts is necessary and it is for efficient expression. Sequences that have not been through the splicing process are not expressed efficiently even if introns are removed.

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# Genetic Engineering Questions and Answers – Cultured Cells in Mammals and Restricted Areas in Intact Organisms – 2

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This set of Basic Genetic Engineering Questions and Answers focuses on “Cultured Cells in Mammals and Restricted Areas in Intact Organisms – 2”.

1. T protein is required for replication. It is a product of \_\_\_\_\_  
a) delayed early transcription  
b) late transcription  
c) early transcription  
d) both early and late replication

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Answer: c

Explanation: T protein is required for replication and it is a product of early transcription. If T protein is absent, the introduction of DNA takes place only by integration.

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2. Vaccinia virus is a commonly used virus and it is a member of pox virus family. It has a large genome of \_\_\_\_\_ and can accept at least \_\_\_\_\_ of foreign DNA.  
a) 200kb, 25kb  
b) 1000kb, 200kb  
c) 500kb, 50kb  
d) 800kb, 100kb

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Answer: a

Explanation: Vaccinia virus is a commonly used virus. It is having a large genome of size 200kb and can atleast accept foreign DNA of size 25kb.

3. Vaccinia virus produces its own \_\_\_\_\_ which is functional in \_\_\_\_\_ of infected cells where the virus also replicates.  
a) DNA polymerase, nucleus  
b) DNA polymerase, cytoplasm  
c) RNA polymerase, cytoplasm

d) RNA polymerase, nucleus

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Answer: c

Explanation: Vaccinia virus produces its own RNA polymerase which is functional in the cytoplasm of infected cells and virus also replicates here.

4. It is beneficial to use retrovirus for genetic manipulation of cells in the culture.

- a) True
- b) False

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Answer: a

Explanation: Use of retrovirus is quite beneficial for the manipulation of cells in the culture. It is so because they infect the susceptible cells with great efficiency and bring about stable integration.

5. LNSX is a retrovirus and is combined with \_\_\_\_\_ in order to create a shuttle vector.

- a) eukaryotic plasmid
- b) prokaryotic plasmid
- c) either eukaryotic or prokaryotic plasmid
- d) yeast plasmid

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Answer: b

Explanation: LNSX is a retrovirus and is combined with a prokaryotic plasmid so that it can act as a shuttle vector. The retrovirus contains neomycin resistance gene as a selectable marker and a promoter.

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6. The retroviral transfected DNA is infected into mammalian cells by helper retrovirus. Helper retrovirus should not be packaged and the method adopted for this is?

- a) Deletion of the packaging signal in the helper genome
- b) Deletion of multiple parts of the helper genome
- c) Division of the helper genome into several pieces
- d) All of the mentioned

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Answer: d

Explanation: Helper retrovirus is used for introduction of transfected DNA into mammalian cells. But it is necessary that helper retrovirus itself should not be packaged. It can be achieved by deletion of the packaging signal in the helper genome, deletion of multiple parts of the helper genome and division of the helper genome into several pieces.

7. Choose the incorrect statement in respect to MACs.

- a) They are mammalian or human artificial chromosomes
- b) Large stretches of DNA (in excess of 100 kb) can be inserted
- c) A selectable marker is required
- d) It can be maintained for long term

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Answer: c

Explanation: Nowdays, MACs have been developed and they are the mammalian or human artificial chromosomes. They can carry large stretches of DNA and can be maintained for long term without the requirement of being selected.

8. Centromere is the most important component of the human artificial chromosome. It is constructed from tandemly repeated copies of 171 bp of \_\_\_\_\_ DNA sequence.

- a) alpha satellite
- b) beta satellite
- c) satellite 2
- d) satellite 1

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Answer: a

Explanation: Centromere is the most important component of the human artificial chromosome. It is constructed from tandemly repeated copies of 171 bp of alpha satellite DNA sequence. There are other satellite DNA sequences such as beta, satellite 1 and 2.

9. Constitutive promoters are majorly obtained from \_\_\_\_\_

- a) fungi
- b) bacteria
- c) mammalian cells
- d) viral cells

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Answer: d

Explanation: Constitutive promoters are majorly obtained from viral cells. They commonly include, SV40 promoters, adenovirus major late promoter etc. In some cases they are also obtained from mammalian cells.

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10. In naturally occurring bacterial systems, tetracycline binding repressor protein binds in the \_\_\_\_\_ of tetracycline to the control sequence and \_\_\_\_\_ transcription.

- a) presence, activates
- b) absence, activates
- c) absence, inactivates
- d) presence, inactivates

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Answer: c

Explanation: In naturally occurring bacterial systems, tetracycline binding repressor protein binds in the absence of tetracycline to the control sequence tetO and inactivates transcription.

11. Tetracycline binding repressor protein when fused to transcription activator protein from herpes simple virus, then it is called as transactivator protein (tTA).

- a) True
- b) False

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Answer: a

Explanation: Transactivator protein is the protein formed by fusion of tetracycline binding repressor protein to the transcription activator protein from herpes simple virus. The protein which is repressing originally transforms into activating in nature.

12. Expression of tTA gene is \_\_\_\_\_ by doxycycline which is \_\_\_\_\_ analogue.

- a) activated, tetracycline
- b) inactivated, chloramphenicol
- c) activated, chloramphenicol
- d) inactivated, tetracycline

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Answer: d

Explanation: Expression of tTA gene is inactivated by doxycycline which is tetracycline analogue. It is very strong and the expression is very less in the presence of doxycycline.

13. Glucocorticoid-responsive element is \_\_\_\_\_ promoter from \_\_\_\_\_ of mouse mammary tumour virus (MMTV).

- a) inducible, short terminal repeat region
- b) inducible, long terminal repeat region
- c) constitutive, short terminal repeat region
- d) constitutive, long terminal repeat region

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Answer: b

Explanation: Glucocorticoid-responsive element is an inducible promoter from the long terminal repeat region of MMTV. Promoters are basically of two types constitutive and inducible.

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14. There are a group of promoters from the genes for metallothioneins. These are a group of proteins rich in \_\_\_\_\_ residues.

- a) cysteine
- b) methionine
- c) either cysteine or methionine
- d) cysteine and methionine both

[View Answer](#)

Answer: a

Explanation: These are rich in cysteine residues which chelate heavy metals to reduce their toxicity. The promoter is induced by treatment of cells with heavy metal ions such as zinc and cadmium.

15. The amount of expression of DNA inserted into a vector \_\_\_\_\_ on promoter and \_\_\_\_\_ on chromosomal location.

- a) depends only on, not depends
- b) depends, depends also
- c) doesn't depend, but depends
- d) neither depends, nor depends

[View Answer](#)

Answer: b

Explanation: The amount of expression of DNA inserted into a vector is not only dependent on the promoter used but also depends on chromosomal location.

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# Genetic Engineering Questions and Answers – Generation of Transgenic Organisms

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on "Generation of Transgenic Organisms".

1. If the embryo is at one-cell stage then it is found in \_\_\_\_\_  
a) ovary  
b) oviduct  
c) uterus  
d) either ovary or uterus

[View Answer](#)**Answer: b**

**Explanation:** When embryo is at one-cell stage it is found in oviduct. This is important for the generation of whole organisms that are transgenic. Isolation of one-cell embryo is done and then it is micro-injected into the pro-nucleus.

2. Embryonic stem cells are also used for generation of transgenic organisms. They are obtained from \_\_\_\_\_ of a developing \_\_\_\_\_.  
a) trophoectoderm, gastrula  
b) trophoectoderm, blastula  
c) inner cell mass, blastula  
d) inner cell mass, gastrula

[View Answer](#)**Answer: c**

**Explanation:** Embryonic stem cells are also used for generation of transgenic organisms. They are obtained from the inner cell mass of a developing blastula. A developing blastula composes of inner cell mass and it is surrounded by trophoectoderm.

3. Embryonic stem cells (ES) are isolated and are injected again into the blastocoel of a developing embryo. The embryo which develops is entirely made up of these cells only.

- a) True  
b) False

[View Answer](#)**Answer: b**

**Explanation:** ES cells are isolated and are injected into the blastocoel of the developing embryo. But the embryo is not composed wholly of ES cells and thus it is said to be chimeric.

4. ES cells are used in order to ensure that insertion is done at the required chromosomal location and it is called as \_\_\_\_\_.  
a) gene targeting  
b) knocking out  
c) knocking in

d) gene disruption  
View Answer

Answer: a

Explanation: ES cells are used in order to ensure that insertion is done at the required chromosomal location and the process is termed as gene targeting. In some cases, it is not necessary to ensure that integration is taking place at a normal chromosomal location.

5. If a gene is inactivated by gene targeting then it is called as \_\_\_\_\_

- a) knock-in gene
- b) knock-out gene
- c) gene disruption
- d) insertional inactivation

View Answer

Answer: b

Explanation: If a gene is inactivated by gene targeting then it is called a knock-out gene. If a gene is replaced by some other gene then it is called as knocking in.  
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6. Integration events may be insertional involving \_\_\_\_\_ crossover or replacement involving \_\_\_\_\_ crossovers.

- a) single, single
- b) double, double
- c) double, single
- d) single, double

View Answer

Answer: d

Explanation: Integration can be done by either insertion or replacement. Insertion is carried out by using single crossover and replacement is carried out by double crossover.

7. It is necessary to analyze the genome of transgenic cells to confirm that the site of integration is correct. This is carried out by southern blotting.

- a) True
- b) False

View Answer

Answer: a

Explanation: It is necessary to analyze the genome of transgenic cells to confirm that the site of integration is correct and it is carried out by southern blotting. DNA from cultures derived from individual transformed cells is used for screening.

8. The gene targeting approach produces individuals which are \_\_\_\_\_ for inactivation of the gene.

- a) homozygous
- b) heterozygous
- c) either only homozygous or only heterozygous
- d) both heterozygous and homozygous

View Answer

Answer: b

Explanation: The gene targeting approach produces individuals which are heterozygous for inactivation of the gene. But it is necessary to generate homozygotes and they are produced by crossing heterozygous individuals and then screening is carried out.

9. If controlled inactivation of a gene is carried out and some of the consequences when inactivation of a target gene is deleterious are avoided. It is referred as

- a) specialized gene targeting
- b) controlled gene targeting
- c) conditional gene targeting
- d) specific gene targeting

View Answer

Answer: c

Explanation: Conditional gene targeting is that where controlled inactivation is carried out. If inactivation leads to deleterious effects then they are avoided.  
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10. For carrying out gene manipulation, the use of cultured cells is \_\_\_\_\_ transgenic organisms.

- a) less reliable
- b) more reliable
- c) may be less or more reliable
- d) is same reliable as

View Answer

Answer: a

Explanation: For carrying out gene manipulation, the use of cultured cells is less reliable than that of transgenic organisms. Thus, these transgenic organisms are used greatly.

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# Genetic Engineering Questions and Answers – Applications of Genetic Engineering

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This set of Genetic Engineering Multiple Choice Questions & Answers (MCQs) focuses on “Applications of Genetic Engineering”.

1. Amplification of specific region can be done by using primers for specific regions. If the PCR product is \_\_\_\_\_ and is in sufficient quantity, then sequence can be determined \_\_\_\_\_

- a) non-specific, directly
- b) non-specific, indirectly or directly
- c) specific, directly
- d) specific, indirectly

[View Answer](#)

Answer: c

Explanation: Amplification of specific region can be done by using primers for specific regions. If the PCR product is specific, it means that only a single band is obtained in gel electrophoresis and is insufficient quantity then the sequence can be determined directly.

2. Which of the following is not suitable if the PCR product is non-specific?

- a) Adjusting the concentration of magnesium ions
- b) Increasing annealing temperature
- c) Using touchdown PCR
- d) Using inverse PCR

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Answer: d

Explanation: In case, products are non-specific then sequence can't be known directly. Optimization of PCR should be carried out and various other strategies should be used such as adjusting the concentration of magnesium ions, increasing annealing temperature or using touch-down PCR.

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3. The disadvantage in the approach based on using PCR is that there is no permanent record until some of the bacterial cells are preserved.

- a) True

b) False  
View Answer

Answer: a

Explanation: The disadvantage of this approach is that there is no permanent record until some of the bacterial cells are preserved. If enough bacteria are there initially then genomic library can be constructed.

4. How many approaches are there in order to clone the complete genome?

- a) 1
- b) 2
- c) 3
- d) 4

View Answer

Answer: b

Explanation: There are basically two approaches in order to clone the complete genome. In the first approach, systematic cloning is carried out. The second approach is based on cloning overlapping fragments at random.

5. If a full proteomic analysis of growth medium is carried out and is combined with \_\_\_\_\_ genome sequence, genes for other \_\_\_\_\_ proteins are also obtained.

- a) partial, defensive
- b) partial, secreted
- c) complete, defensive
- d) complete, secreted

View Answer

Answer: d

Explanation: If a full proteomic analysis of growth medium is carried out and is combined with complete genome sequence, genes for other secreted proteins can also be obtained.

6. If a putative protein sequence is cloned in an expression vector and the expressed protein is not showing protease activity, then which of the following is not correct?

- a) The protein is not protease
- b) The protein can be incorrectly folded which can block the protease activity
- c) There might be some other cofactor required for protease activity
- d) The most commonly used expression system is E.coli

View Answer

Answer: a

Explanation: If the putative protein sequence is cloned and the expressed protein is not showing protease activity, it is not necessary that it is not protease. Suppression of protease activity can be because of incorrect folding or that some cofactor is required for protease activity. The most commonly used expression system is E.coli.

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7. For getting a large amount of proteins to crystallize, which of the following should be used as an expression system?

- a) Bacterial system
- b) Yeast systems
- c) Eukaryotic systems
- d) Both eukaryotic and bacterial systems can be used

View Answer

Answer: d

Explanation: The system to be used for getting large amounts of proteins to crystallize can be either bacterial or eukaryotic. It depends on the source of the gene and whether post-translational modification is necessary or not.

8. If a mutation perturbs the structure, then stability and folding are not affected.

- a) True
- b) False

View Answer

Answer: b

Explanation: At times mutated proteins are not expressed well. Mutation perturbs a structure at times and it affects the stability and folding of the protein.

9. The RNA level \_\_\_\_\_ the steady-state level of the corresponding protein directly and the post-translational modification of the protein \_\_\_\_\_

- a) reflects, can be determined
- b) reflects, can't be determined
- c) doesn't necessarily reflects, can be determined
- d) doesn't necessarily reflects, can't be determined

View Answer

Answer: d

Explanation: The RNA level doesn't necessarily correspond to the steady level of corresponding protein directly and the post-translational modification or location of the protein can't be determined.

10. For a convenient transformation system, \_\_\_\_\_ can be used for gene silencing.

- a) antisense RNA

- b) transposon insertion
- c) either antisense RNA or transposon insertion
- d) transposon insertion followed by antisense RNA

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Answer: a

Explanation: If a convenient transformation system is used, antisense RNA can be used for gene silencing. If the transformation system is not convenient then transposon insertion is used for silencing.

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# Instrumentation Transducers Questions and Answers – Digital to Analog Converters

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Digital to Analog Converters”.

1. Which of the following are used in DAC?
  - a) Ladder network
  - b) Successive approximation technique
  - c) Both Ladder and successive approximation technique
  - d) None of the mentioned

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Answer: a

Explanation: Ladder network of resistors are employed for the conversion of digital data to analog data.

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2. Which of the following is an indication by settling time?

- a) Accuracy of conversion
- b) Speed of conversion
- c) Precision in conversion

d) All of the mentioned

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Answer: b

Explanation: Settling time is the time between the start and end of conversion, it indicates the speed of conversion.

3. Filling data between impulses in DAC is known as \_\_\_\_\_

- a) Reconstruction
- b) Sampling
- c) Interpolation
- d) None of the mentioned

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Answer: c

Explanation: Interpolation is the method of filling data between digital signals in order to form a continuous analog signal.

4. Which of the following represents over sampling DAC?

- a) PWM DAC
- b) Delta-sigma DAC
- c) Binary weighted DAC
- d) Switched resistor DAC

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Answer: b

Explanation: Delta sigma DAC is an over sampled DAC characterized according to its sampling rate.

5. Which of the following is a binary weighted DAC?

- a) R-2R ladder DAC
- b) PWM DAC
- c) Switched resistor DAC
- d) Sampling DAC

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Answer: a

Explanation: R-2R ladder type DAC is known as binary weighted DAC, which consist of a resistor arranged as a ladder.

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6. Segmented DAC uses \_\_\_\_\_

- a) Thermometer coded principle conversion only
- b) Binary weighted principle only
- c) Both thermometer coded and Binary weighted principle
- d) None of the mentioned

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Answer: c

Explanation: Segmented DAC uses the thermometer coded principle for MSB bits and binary weighted principle for LSB bits.

7. Ability of analog output to move only in the direction of digital input move is known as \_\_\_\_\_

- a) Monotonicity
- b) Resolution
- c) Sampling rate
- d) Dynamicity

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Answer: a

Explanation: Monotonicity of DAC is its ability to follow digital output to analog input.

8. Dynamic range is expressed in \_\_\_\_\_

- a) Volts
- b) Ampere
- c) Hz
- d) Decibel

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Answer: d

Explanation: Dynamic range of DAC is expressed in decibel unit.

9. Thermal noise is absent in DAC.

- a) True
- b) False

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Answer: b

Explanation: Thermal noise is present in DAC due to the presence of passive components like resistors.

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10. SFDR stands for \_\_\_\_\_

- a) Spurious free dielectric range
- b) Signal free dynamic range
- c) Spurious free dynamic range
- d) None of the mentioned

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Answer: c

Explanation: SFDR indicates in dB, and it is the ratio between powers of the converted main signal and undesired spur.

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## Instrumentation Transducers Questions and Answers – Analog to Digital Converters

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Analog to Digital Converters”.

1. Typical conversion speed of ADC is \_\_\_\_\_

- a) Less than 1 $\mu$ s
- b) Less than 100  $\mu$ s
- c) Less than 500  $\mu$ s
- d) Greater than 1000  $\mu$ s

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Answer: b

Explanation: Typical conversion speed of ADC is between 1 $\mu$ s and 100  $\mu$ s.

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2. Which of the following type output is provided by ADC?

- a) Serial type
- b) Parallel type

c) Both serial and parallel type  
d) None of the mentioned

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Answer: c

Explanation: ADC provides both serial and parallel type output according to application.

3. Which of the following method is employed for ADC?

- a) Ladder network
- b) Successive approximation type
- c) PWM type
- d) None of the mentioned

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Answer: b

Explanation: In successive approximation method input value is constantly compared with a reference value.

4. Successive approximation is slow for large bit application.

- a) True
- b) False

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Answer: b

Explanation: Successive approximation method is much faster in large bit application.

5. Which of the following represents range of frequency measured by ADC?

- a) Bandwidth
- b) Threshold frequency
- c) Peak frequency
- d) None of the mentioned

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Answer: a

Explanation: Bandwidth of ADC is the maximum range of frequency measured by ADC.  
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6. Dynamic range of ADC is depended on \_\_\_\_\_

- a) Resolution
- b) Linearity
- c) Accuracy
- d) All of the mentioned

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Answer: d

Explanation: Dynamic range of ADC is depended on both resolution, linearity and accuracy.

7. Small timing errors in ADC additional to noise is known as \_\_\_\_\_

- a) Jitter
- b) Aliasing
- c) Super noise
- d) None of the mentioned

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Answer: a

Explanation: Jitter is a type of noise that is produced additional to noise.

8. ENOB in ADC stand for \_\_\_\_\_

- a) Effective number of bytes
- b) Effective number of bits
- c) Effective nibble baud
- d) None of the mentioned

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Answer: b

Explanation: Effective number of bits (ENOB) represents the number of bits measured by ADC.

9. ENOB is a negation of resolution.

- a) True
- b) False

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Answer: b

Explanation: ENOB or effective number of bits is the number of bits measured by ADC and it is equal to resolution.  
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10. Rotary encoder is an ADC.

- a) True

b) False  
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Answer: a

Explanation: Rotary encoder can be treated as an encoder which converts analog quantity to digital quantity.

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## Instrumentation Transducers Questions and Answers – Multiplexers and Demultiplexers

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Multiplexers and Demultiplexers”.

1. Which of the following is correct for multiplexer?

- a) Several inputs and single output
- b) Single input and several outputs
- c) Single input and single output
- d) Several inputs and several outputs

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Answer: a

Explanation: Multiplexer has several inputs and a single output line and it is used for data selection.

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2. Multiplexers work with \_\_\_\_\_

- a) Analog signal
- b) Digital signal
- c) Both analog and digital signal
- d) None of the mentioned

View Answer

Answer: c

Explanation: Multiplexers work with both analog and digital signals.

3. TDM stands for \_\_\_\_\_

- a) Time direct measurement
- b) Time division multiplexing
- c) Time direct multiplexing
- d) Time division measurement

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Answer: b

Explanation: TDM or Time division multiplexing is a type of multiplexing.

4. Which of the following is analogous to multiplexer?

- a) Data selector
- b) Data multiplexer
- c) Data filter
- d) None of the mentioned

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Answer: a

Explanation: Multiplexer is similar to data selector which is used to select data from multiple input data.

5. Which of the following represent multiple input single output switch?

- a) Multiplexer
- b) De multiplexer
- c) Both multiplexer and demultiplexer
- d) None of the mentioned

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Answer: a

Explanation: Multiplexer select one data line among multiple data lines and they represent multiple input single output switch.

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6. Schematic symbol of multiplexer is \_\_\_\_\_

- a) Isosceles triangle
- b) Isosceles trapezoid
- c) Equilateral triangle
- d) Rectangle

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Answer: b

Explanation: Multiplexer and demultiplexer is schematically represented using isosceles trapezoid.

7. In digital multiplexer selector line is \_\_\_\_\_

- a) Analog value
- b) Digital value
- c) Unpredictable
- d) None of the mentioned

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Answer: b

Explanation: In digital multiplexer selector line is of digital value.

8. Which of the following is not a multiplexer?

- a) 8-to-1 line
- b) 16-to-1 line
- c) 4-to-1 line
- d) 1-to-4 line

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Answer: d

Explanation: Multiplexer is a multiple input single output system.

9. Demultiplexer act as an encoder.

- a) True
- b) False

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Answer: b

Explanation: Demultiplexer is basically a decoder in function.

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10. Multiplexer can be used as PLD.

- a) True
- b) False

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Answer: a

Explanation: Multiplexer can be used as PLD, by specifying the logic arrangement in the input signals, a custom logic circuit can be created.

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# Instrumentation Transducers Questions and Answers – Microprocessors

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Microprocessors”.

1. Which of the following is correct for microprocessor Intel 8085?

- a) 8 bit microprocessor
- b) 16 bit microprocessor
- c) 4 bit microprocessor
- d) 32 bit microprocessor

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Answer: a

Explanation: Microprocessor Intel 8085 is an 8 bit microprocessor.

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2. MOS stands for \_\_\_\_\_

- a) Material Operating Semiconductor
- b) Metal Oxide Semiconductor
- c) Metal Operating Segment
- d) None of the mentioned

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Answer: b

Explanation: MOS or Metal Oxide Semiconductor is an IC technology.

3. Microprocessor contains large on-chip memory.

- a) True

b) False  
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Answer: b  
Explanation: Microprocessor is a small version of the processor which lack on-chip memory.

4. Which of the following part of the microprocessor is close related to register?

- a) Processor
- b) CPU
- c) ALU
- d) Memory

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Answer: d  
Explanation: Registers are basically memory segments used for storing the address of locations.

5. Which of the following is not a special function register?

- a) Program counter
- b) Instruction pointer
- c) Accumulator
- d) Stack pointer

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Answer: c  
Explanation: Accumulator is a general function register, which can be used for multiple functions.

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6. SP stands for \_\_\_\_\_

- a) Stack pointer
- b) Segment pointer
- c) Status pointer
- d) State pointer

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Answer: a  
Explanation: SP is the short form of stack pointer which store address of stack top.

7. Which of the following is not a valid instruction type?

- a) Zero operant
- b) Single operand
- c) Two operand
- d) None of the mentioned

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Answer: d  
Explanation: Instructions are divided into different types according to the number of operands.

8. How many flags does 8085 have?

- a) 4
- b) 5
- c) 8
- d) 9

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Answer: c  
Explanation: 8085 contains 5 flags such as sign flag, zero flag, parity flag, auxiliary carry flag, and carry flag.

9. Which of the following is used for storing flag registers?

- a) Status register
- b) Control register
- c) Buffer register
- d) None of the mentioned

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Answer: a  
Explanation: Status registers are used for storing flag registers.

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10. Which of the following function relate to stack?

- a) Push and pop
- b) Call and return
- c) Both push pop and call return
- d) None of the mentioned

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Answer: a  
Explanation: Push function is used for inserting value to stack and pop is used for retrieving data from the stack.

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# Instrumentation Transducers Questions and Answers – Recording Systems

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Recording Systems”.

1. Data acquisition system acquire data from \_\_\_\_\_

- a) Transducers
- b) Flip flop
- c) Memory
- d) None of the mentioned

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Answer: a

Explanation: Data acquisition system is used for retrieving data from transducer or sensor.

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2. SBOD stands for \_\_\_\_\_

- a) Status bunch of disc
- b) Switched bunch of disc
- c) Status bunch of display
- d) None of the mentioned

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Answer: c

Explanation: SBOD or status bunch of disc is a memory system for data recorders.

3. Data recorders acquire data from \_\_\_\_\_

- a) Transducers
- b) Sensors
- c) Both transducers and sensors

d) None of the mentioned

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Answer: c

Explanation: Data recorders record data from both transducers and sensors.

4. RAID stands for \_\_\_\_\_

- a) Recorded Array of Inexpensive Disc
- b) Redundant Array of Inexpensive Disc
- c) Redundant Array of Intelligent Disc
- d) Redundant Array of Inexpensive Display

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Answer: b

Explanation: RAID is a storage type and it stands for Redundant Array of Inexpensive Disc.

5. Which of the following is correct for SBOD?

- a) Based on fibre channel
- b) Based on RF technology
- c) Based on Fibre and RF
- d) None of the mentioned

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Answer: a

Explanation: SBOD technology is based on fibre channel only.

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6. Which of the following represents the storage capability of flip-flop?

- a) 1 bit
- b) 1 byte
- c) 1 kilo bit
- d) 1 kilo byte

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Answer: a

Explanation: Flip flop is the basic storage device and they can store one bit of data.

7. Which of the following can be considered as a storage device?

- a) Capacitor
- b) Resistor
- c) Both capacitor and resistor
- d) None of the mentioned

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Answer: a

Explanation: Capacitor can be used for charging discharging and considered as a storage device.

8. Dynamic RAM has to be refreshed constantly.

- a) True
- b) False

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Answer: a

Explanation: Refreshing dynamic RAM is important, otherwise it forget what to store.

9. SRAM is faster than DRAM.

- a) True
- b) False

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Answer: a

Explanation: SRAM uses flip flops and transistors and they are faster than DRAM.

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10. Which of the following can be made from SRAM?

- a) Magnetic disc
- b) Cache
- c) Floppy disc
- d) All of the mentioned

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Answer: b

Explanation: SRAM's are used to build faster memory units like cache.

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# Instrumentation Transducers Questions and Answers – Dataloggers

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Dataloggers”.

1. Which of the following is not correct for data loggers?

- a) Portability
- b) Battery less
- c) Small
- d) All of the mentioned

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Answer: b

Explanation: Data loggers are powered from an external source and they require a battery.

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2. Data loggers contains microprocessor.

- a) True
- b) False

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Answer: a

Explanation: Data loggers are small battery powered devices containing a microprocessor.

3. Data loggers need external memory for storage.

- a) True
- b) False

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Answer: b

Explanation: Data loggers are devices which are equipped with internal memory.

4. Which of the following devices are similar to electronic data loggers?

- a) Chart recorders
- b) Flip flop

- c) Memory
- d) None of the mentioned

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Answer: a

Explanation: Electronic data loggers are similar to and possibly replaced chart recorders.

5. Which of the following protocol allow the instrument to connect to a data logger?

- a) SDI-10
- b) SDI-12
- c) SAI-10
- d) SAI-12

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Answer: b

Explanation: SDI-12 protocol allows the instrument to connect to data loggers.

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6. Which of the following statement is false?

- a) All data loggers are data acquisition system
- b) All data acquisition systems are data loggers
- c) Data logger and Data acquisition systems are same in operation
- d) All of the mentioned

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Answer: b

Explanation: All Data logger systems are data acquisition system, but all data acquisition systems are not necessarily data loggers.

7. Data logger system have \_\_\_\_\_

- a) Slow sampling rate
- b) Fast sampling rate
- c) Unpredictable sampling rate
- d) None of the mentioned

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Answer: a

Explanation: Data logger system have a slow sampling rate and 1Hz of sample rate may be considered to be very fast for a data logger.

8. Which of the following is correct for data loggers?

- a) Simple single channel instrument
- b) Medium channel instrument
- c) Complex multiple channel instrument
- d) All of the mentioned

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Answer: d

Explanation: Data loggers may vary from simple single channel instruments to complex multiple channel instruments.

9. Device for monitoring various electrical activity of cardio vascular system is \_\_\_\_\_

- a) Diagnostic trouble coder
- b) Holter monitor
- c) Cardio event decoder
- d) Electronic health logger

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Answer: b

Explanation: Holter monitors are used for monitoring various electrical activity of cardio vascular system.

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10. Data logger deals with \_\_\_\_\_

- a) Digital signals
- b) Analog signals
- c) Both digital and analog signals
- d) None of the mentioned

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Answer: a

Explanation: Data loggers generally deals with digital signals and ADC is essential for conversion.

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## Instrumentation Transducers Questions and Answers – Analog Indicators

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Analog Indicators”.

1. Indicating measurements are used for \_\_\_\_\_

- a) Static measurements
- b) Dynamic measurements
- c) Both static and dynamic measurements
- d) None of the mentioned

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Answer: a

Explanation: Indicating instruments are helpful in static measurements.

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2. Indicating instruments can be used for measuring \_\_\_\_\_

- a) AC quantities
- b) DC quantities
- c) Both AC and DC
- d) None of the mentioned

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Answer: c

Explanation: Indicating instruments can be used for measuring both AC and DC quantities.

3. Which of the following have a low loading effect?

- a) Electronic system
- b) Electrical system
- c) Both have equal effect
- d) None of the mentioned

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Answer: a

Explanation: Electronic systems have low loading effect than an electrical system.

4. Which of the following act as end devices in the pneumatic system?

- a) Bourden tubes
- b) Mechanical gears

- c) Electronic devices
- d) All of the mentioned

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Answer: a

Explanation: Due to the use of air pressure, bourden tubes are used as the end devices are pneumatic system.

5. Scale calibration of indicating instruments are always linear.

- a) True
- b) False

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Answer: b

Explanation: Scale calibration may not be always linear and accuracy in reading becomes poorer in portions of scale where it is cramped.  
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6. Majority of indicators are \_\_\_\_\_

- a) Current operated devices
- b) Voltage operated devices
- c) Pressure operated devices
- d) None of the mentioned

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Answer: a

Explanation: Most of the indicators are current-operated devices and they can be used for both AC and DC.

7. AC indicators are used at frequency \_\_\_\_\_

- a) Very low value of less than 1Hz
- b) Less than 200Hz
- c) Greater than 1KHz
- d) Higher value of about 1MHz

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Answer: b

Explanation: AC indicators are used for frequency less than 200 Hz.

8. PMMC devices in indicators create \_\_\_\_\_

- a) Stationary magnetic field
- b) Rotating magnetic field
- c) Electric field
- d) None of the mentioned

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Answer: a

Explanation: Permanent magnet moving coil instruments in indicators are used for creating stationary magnetic field.

9. Which of the following represents a stationary part of PMMC device?

- a) Coil
- b) Control system
- c) Magnetic system
- d) None of the mentioned

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Answer: c

Explanation: In PMMC devices, magnetic system remains a stationary part.

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10. Which of the following represent a function of spring in PMMC device?

- a) Control system
- b) Path for current in and out of coil
- c) Both control and path for current
- d) None of the mentioned

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Answer: c

Explanation: Spring in PMMC devices act as both control system and path for current in and out of the coil.

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# Instrumentation Transducers Questions and Answers – Digital Readout Systems

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This set of Instrumentation Transducers online quiz focuses on “Digital Readout Systems”.

1. VDU stands for \_\_\_\_\_  
a) Virtual display unit  
b) Verbal display unit  
c) Variable display unit  
d) Visual display unit  
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Answer: d

Explanation: VDU is the short of visual display unit, which act as output device.

2. Which of the following cannot be used for constructing alpha-numeric devices?  
a) LED  
b) Neon lamp  
c) Seven segment display  
d) None of the mentioned  
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Answer: d

Explanation: Alpha numeric devices are which can display both alphabetic and numeric characters.

3. Which of the following are closely related to LED?  
a) Conductors  
b) Semiconductors  
c) Superconductors  
d) Insulators  
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Answer: b

Explanation: LED's are constructed using semiconductor materials.

4. Which of the following represent forward bias voltage for LED?  
a) Less than 0.7V

- b) 1.5 V
- c) 2.4 V
- d) 5.6 V

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Answer: b

Explanation: Usually 1.5 V is the forward bias voltage for LED.

5. Which of the following is closely related to LED?

- a) Passive device
- b) Active device
- c) May passive or active
- d) None of the mentioned

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Answer: a

Explanation: LED's are passive devices.

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6. VDU's are used for displaying \_\_\_\_\_

- a) Alphabetic letters
- b) Numerical characters
- c) Graphical contents
- d) All of the mentioned

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Answer: d

Explanation: VDU's are displays that can display all form of parameters.

7. Line rast technique is used for \_\_\_\_\_

- a) Generating character
- b) Character alignment
- c) Character spacing
- d) Character brightening

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Answer: a

Explanation: Line rast technique is used for generating characters in display unit.

8. CRT can be used for representing \_\_\_\_\_

- a) Amplitude of signal
- b) Rise time of signal
- c) Frequency of signal
- d) All of the mentioned

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Answer: d

Explanation: Cathode Ray Tube can be used for representing different parameters of a signal.

9. What will be the response time for LCD?

- a) Less than 100ns
- b) Less than 100ms
- c) 1S
- d) Unpredictable

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Answer: b

Explanation: Usually response time for LCD will be between 20 and 100ms.

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10. Which of the following is not true for LCD?

- a) Low reliability
- b) Short life span
- c) Short response time
- d) None of the mentioned

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Answer: d

Explanation: LCD is a device with low reliability, low life span and short response time.

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# Instrumentation Transducers Questions and Answers – Analog Recorders

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Analog Recorders”.

1. Pen recorders are used for signals with frequency \_\_\_\_\_  
a) Less than 0.1Hz  
b) Less than 1Hz  
c) Medium frequency  
d) High as 1KHz

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Answer: a

Explanation: Pen recorders are used for signals with very low frequency as less than 0.1Hz.

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2. Which of the following device is used in low-level dc voltages?  
a) PMMC recorders  
b) Self-balancing potentiometers  
c) Pen recorders  
d) Circular recorders

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Answer: b

Explanation: Self-balancing potentiometers are used for low level dc voltages.

3. Which of the following device can be used for concurrent measurement of two variables?  
a) PMMC devices  
b) Pen recorders  
c) X-Y plotter  
d) Circular recorder

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Answer: c

Explanation: X-Y recorders are devices which can be used for measuring two variables concurrently.

4. CRT act as converter of \_\_\_\_\_

a) Displacement to voltage

- b) Voltage to displacement
- c) Voltage to voltage converter
- d) None of the mentioned

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Answer: b

Explanation: CRT convert input voltage to displacement of electron beam.

5. Band width of CRT will be \_\_\_\_\_

- a) Up to 10 KHz
- b) Up to 100 KHz
- c) Up to 1 MHz
- d) up to 10 MHz

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Answer: d

Explanation: Bandwidth of CRT may vary up to 10 MHz.

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6. Which of the following factors determine the accuracy of CRT?

- a) Size of screen
- b) Gain of amplifier
- c) Both size of screen and gain of an amplifier
- d) None of the mentioned

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Answer: c

Explanation: Accuracy of CRT is determined by both the size of screen and constancy of gain of amplifier used.

7. Transient recorder is a storage oscilloscope.

- a) True
- b) False

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Answer: a

Explanation: Transient recorder is a type of storage recorder which can store data for a short duration.

8. Fibre optic oscilloscope is a \_\_\_\_\_

- a) Single channel CRO
- b) Dual channel CRO
- c) Multi channel CRO
- d) None of the mentioned

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Answer: a

Explanation: Fibre optic oscilloscope is a single channel CRO.

9. Input impedance of oscilloscope is \_\_\_\_\_

- a) Low as below 1Hz
- b) 1KHz
- c) As high as 1MHz
- d) None of the mentioned

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Answer: c

Explanation: Input impedance of oscilloscope is as high as 1MHz.

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10. CRO enable storage of data.

- a) True
- b) False

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Answer: b

Explanation: Conventional oscilloscope doesn't support storage of data.

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# Instrumentation Transducers Questions and Answers – Magnetic Tape Recorders

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Magnetic Tape Recorders”.

1. In magnetic tape, data are recorded for \_\_\_\_\_

- a) Storage
- b) Visualising
- c) Transfer
- d) None of the mentioned

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Answer: a

Explanation: In magnetic tape recorders, data are recorded for storage and then retrieved for processing.

2. How many variables can be stored in a magnetic tape with track number 16?

- a) 2
- b) 16
- c) 256
- d) 65536

[View Answer](#)

Answer: b

Explanation: In a magnetic tape recorder, the number of the track will be equal to a number of variables that can be simultaneously stored.

3. Magnetic tape can be used to store \_\_\_\_\_

- a) Analog data
- b) Digital data
- c) Both analog and digital data
- d) None of the mentioned

[View Answer](#)

Answer: c

Explanation: Magnetic tape can be used for storage of both analog and digital data.

4. Which of the following classes record head belong to?

- a) Electromagnetic system
- b) Electronic circuitry

- c) Mechanical system
  - d) None of the mentioned
- [View Answer](#)

Answer: a  
Explanation: Record head found in a magnetic tape recorder belongs to the electromagnetic system of a recorder.

5. Which of the following represents allowed bit rate of digital signal?

- a)  $10^1$
- b)  $10^2$
- c)  $10^4$
- d)  $10^5$

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Answer: d

Explanation: Digital signals of bit rate up to  $10^5$  can be used with magnetic tape recorders.  
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6. Record head is similar to erase head.

- a) True
- b) False

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Answer: a

Explanation: Record head and erase head of magnetic tape is similar in operating principle.

7. Digital tape recorder is direct compatible with the computer.

- a) True
- b) False

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Answer: a

Explanation: Digital tape recorders are direct compatible with the computer and they can be directly connected.

8. Which of the following represents the bias frequency of entertainment tape recorder.

- a) 100 Hz
- b) 100 KHz
- c) 100 MHz
- d) 100 GHz

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Answer: b

Explanation: Bias frequency of entertainment tape system will be about 100 KHz.

9. Highest frequency in FM recording is \_\_\_\_\_

- a) 4 Hz
- b) 40 Hz
- c) 40 KHz
- d) 40 MHz

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Answer: c

Explanation: Highest frequency in Frequency modulated recording is 40 KHz.  
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10. Effect due to sudden speed change in tape is \_\_\_\_\_

- a) Flutter effect
- b) Wow effect
- c) Surge effect
- d) Cracking

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Answer: a

Explanation: Flutter effect is due to sudden change in the speed of the tape system.

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# Instrumentation Transducers Questions and Answers – Digital Input Output Devices

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Digital Input Output Devices”.

1. Punched cards are \_\_\_\_\_

- a) Display system
- b) Sound system
- c) Memory system
- d) None of the mentioned

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Answer: c

Explanation: Punched cards are a memory device, which have been replaced by modern memory techniques.

2. Punched cards are used in \_\_\_\_\_

- a) Low speed computers
- b) High speed computers
- c) Super computers
- d) Mac devices

[View Answer](#)

Answer: a

Explanation: Punched cards are one of the oldest methods of memory and are used in low speed computers.

3. Printers are \_\_\_\_\_

- a) Asynchronous devices
- b) Synchronous devices
- c) Unpredictable
- d) None of the mentioned

[View Answer](#)

Answer: b

Explanation: Printers are synchronous devices.

4. Which of the following category tele printer belong to?

- a) Serial printer
- b) Parallel printer

- c) Laser printer
- d) None of the mentioned

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Answer: a

Explanation: Tele printers are a serial printer, which prints one character at a time.

5. Which of the following category line printer belong to?

- a) Serial printer
- b) Parallel printer
- c) Unpredictable
- d) None of the mentioned

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Answer: b

Explanation: Line printers are parallel printers which can print a block of data at a time.

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6. Printing speed of line printer will be \_\_\_\_\_

- a) Less than 600 lines/sec
- b) Between 600-1200 lines/sec
- c) Between 600-1200 lines/minute
- d) Greater than 1200 lines/minute

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Answer: c

Explanation: Line printers have a typical printing speed of 600 to 1200 lines/minute.

7. Which of the following doesn't belong to the class of line printer?

- a) Bar type
- b) Wheel type
- c) Chain type
- d) None of the mentioned

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Answer: d

Explanation: Line printers may be divided into different types as bar type, wheel type, chain type, cylinder type etc.

8. Production of graphical image on VDU is called \_\_\_\_\_

- a) Computer graphics
- b) Virtual graphics
- c) Virtual imaging
- d) Image processing

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Answer: a

Explanation: Computer graphics is the process of creation of a graphical image on visual display unit.

9. Which of the following is/are used in low speed computers?

- a) Punched cards
- b) Paper tape device
- c) Both punched card and paper tape
- d) None of the mentioned

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Answer: c

Explanation: Punched cards or paper tape equipment are used in computers operating in low speed.

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10. Storage unit is important between input and output devices.

- a) True
- b) False

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Answer: a

Explanation: Storage unit between input and output unit enable the storage of data for a short duration.

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# Instrumentation Transducers Questions and Answers – Data Transmission

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Data Transmission”.

1. Piezo electric crystals are low impedance sources.

- a) True
- b) False

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Answer: b

Explanation: Piezo electric crystals are considered to be high impedance sources.

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2. Modulation is used for \_\_\_\_\_

- a) Reducing loss in transmission
- b) Amplification of signal
- c) Conversion of signal
- d) None of the mentioned

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Answer: a

Explanation: For transmission over long range message signal is mixed with a carrier signal for reducing loss during transmission.

3. In line code transmission, signal is represented by \_\_\_\_\_

- a) Impulses
- b) Train of pulses
- c) DC signal
- d) Continuously varying signal

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Answer: b

Explanation: In Line code transmission, signal is represented by a train of pulses known as baseband transmission.

4. Which of the following process is explained as detection?

- a) Modulation
- b) Demodulation
- c) Amplification
- d) None of the mentioned

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Answer: b

Explanation: Demodulation or retrieving data from the signal is known as demodulation or detection.

5. Which of the following is represented as digital transmission?

- a) Baseband bit stream transfer
- b) Passband bit stream transfer
- c) All of the mentioned
- d) None of the mentioned

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Answer: c

Explanation: Both baseband and passband signals representing bit streams are considered to be a digital transmission.

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6. PCM stands for \_\_\_\_\_

- a) Pulse create message
- b) Pulse carry modulation
- c) Pulse code modulation
- d) None of the mentioned

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Answer: c

Explanation: Pulse code modulation is the process of conversion of analog signals to bit stream.

7. Codec equipment is used for \_\_\_\_\_

- a) Source coding
- b) Source decoding
- c) All of the mentioned
- d) None of the mentioned

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Answer: c

Explanation: Codec equipment are used for source coding and decoding processes.

8. TCP stands for \_\_\_\_\_

- a) Tele Call Protocol
- b) Transmission Control Protocol
- c) Transmission Carry Protocol
- d) Transmission Control Parity

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Answer: b

Explanation: TCP stands for transmission control protocol.

9. Tele-transmission is the process of transfer of \_\_\_\_\_

- a) Analog signals
- b) Digital signals
- c) Analog and digital signals
- d) None of the mentioned

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Answer: c

Explanation: Tele-transmission is the process of both analog and digital transmission.

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10. Which of the following is not a digital modulation method?

- a) FSK
- b) PSK
- c) ASK
- d) None of the mentioned

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Answer: d

Explanation: Frequency shift keying, phase shift keying and amplitude shift keying are different methods of digital modulation.

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## Instrumentation Transducers Questions and Answers – Telemetry Systems

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Telemetry Systems”.

1. Which of the following represents telemetry?

- a) Fetching data from inaccessible point
- b) Fetching data from accessible point
- c) Communication over telephone
- d) None of the mentioned

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Answer: a

Explanation: Telemetry is the process of accessing or collecting data from remote inaccessible points.

2. Telemetry includes data transfer over \_\_\_\_\_

- a) Wireless modes
- b) Optical fibre link
- c) Computer link
- d) All of the mentioned

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Answer: d

Explanation: Telemetry is the process of data transmission which may include over any known modes.

3. Which of the following represents a telemeter?

- a) Analog device
- b) Digital device
- c) Both analog and digital device
- d) None of the mentioned

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Answer: c

Explanation: Telemeter is the device used for the purpose of telemetry, and it may be analog or digital in nature.

4. Which of the following mode of signals cannot be transmitted using telemetry?

- a) Audio
- b) Visual
- c) Pictures
- d) None of the mentioned

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Answer: d

Explanation: All kind of information can be transferred using the telemetry system.

5. All kind of informations are converted into \_\_\_\_\_

- a) Magnetic data
- b) Electrical data
- c) Optical data
- d) All of the mentioned

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Answer: b

Explanation: Before transmission, data is converted into electrical signals and then transmitted.

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6. Telemetry allow data flow in \_\_\_\_\_

- a) Single direction
- b) Both direction
- c) Depend on design
- d) None of the mentioned

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Answer: a

Explanation: Telemetry allows data flow only in a single direction, that is from source to receiver.

7. Telemetry systems are of electrical type only.

- a) True
- b) False

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Answer: b

Explanation: Telemetry system may be of electrical, pneumatic or any other systems.

8. Which of the following is not true for telemeter?

- a) Designed for all variable
- b) Designed for specific range
- c) Designed for data transmission
- d) Wireless data transmission possible

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Answer: a

Explanation: Telemeters are designed for specific to certain variables.

9. Process of utilizing one data link for multiple data transfer is called \_\_\_\_\_

- a) Multiplexing
- b) Over transfer
- c) Multiprocessing
- d) None of the mentioned

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Answer: a

Explanation: Multiplexing is the process of use of a single data link for transferring multiple data.

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10. Telemechanics and telemetry are related.

- a) True
- b) False

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Answer: a

Explanation: Tele mechanics deals with operations as desired for remote control and telemetry.

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## Instrumentation Transducers Questions and Answers – Landline Telemetry

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Landline Telemetry”.

1. Medium of transmission in landline telemetry may be \_\_\_\_\_
- a) Electrical line
  - b) Pneumatic line
  - c) Electrical and pneumatic line
  - d) None of the mentioned

[View Answer](#)

Answer: c

Explanation: Direct data transfer over an electrical or pneumatic line is known as land line telemetry.

2. Which of the following is correct for electrical line telemetry?
- a) Transmission of electrical voltage
  - b) Transmission of electrical current
  - c) Transmission of analog signal
  - d) All of the mentioned

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Answer: d

Explanation: Electrical line telemetry consist of transmission of electrical voltage or current waves in analog form.

3. Feedback type telemetry systems are possible.
- a) True
  - b) False

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Answer: a

Explanation: Feedback type telemetry systems or closed loop telemetry systems are used for providing a higher degree of accuracy, less error etc.

4. What happens to the linearity of the telemetry system when feedback is applied?
- a) Increases
  - b) Decreases
  - c) Nothing happens
  - d) None of the mentioned

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Answer: a

Explanation: An increased rate of linearity is seen when feedback is applied.

5. Amplitude of data from pulse telemetry will be \_\_\_\_\_
- a) Cannot retrieve amplitude data
  - b) Pulse characteristics

- c) Number of pulses
- d) None of the mentioned

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Answer: b

Explanation: In pulse telemetry, any one of the parameters of a pulse represents the amplitude of data.

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6. Pulse encoding is important in digital telemetry.

- a) True
- b) False

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Answer: a

Explanation: Pulse encoding of a sampled signal is an important step in digital telemetry.

7. Power transmission in telephone lines are \_\_\_\_\_

- a) Open loop telemetry
- b) Closed loop telemetry
- c) May be open loop or closed loop
- d) None of the mentioned

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Answer: a

Explanation: Power transmission in telephone line is an example of open loop telemetry which uses a pair of wires only.

8. Attenuation and phase shift in receiver end is important due to \_\_\_\_\_

- a) Length of cable used
- b) Impedance of cable
- c) Mode of data transfer
- d) All of the mentioned

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Answer: b

Explanation: Due to the impedance of transmission line, attenuation and phase shifting in receiver end are important.

9. Which of the following is favoured less?

- a) Cable telemetry
- b) Wireless telemetry
- c) Both cable and wireless telemetry
- d) None of the mentioned

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Answer: a

Explanation: Due to the problem created by the impedance of the cable and other parameters, cable telemetry is a less favoured one.

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10. Low level signals can be transmitted using cables up to \_\_\_\_\_

- a) 500 m
- b) 2 Km
- c) 10 Km
- d) 50 Km

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Answer: b

Explanation: Cable telemetry can be used for transferring low level signals(10 mV) over short range up to 2 Km.

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## Instrumentation Transducers Questions and Answers – Radio Telemetry

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Radio Telemetry”.

1. Radio telemetry is useful when source and receiver is at \_\_\_\_\_  
a) Long distance separation  
b) Short distance separation  
c) Varying separation distance  
d) All of the mentioned

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Answer: d

Explanation: Radio telemetry can be used where the distance between source and receiver may vary.

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2. PLCC stands for \_\_\_\_\_  
a) Power Load Carrier Current  
b) Power Line Carrier Current  
c) Peak Line Carrier Current  
d) None of the mentioned

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Answer: b

Explanation: PLCC is the short of power line carrier current.

3. Multiplexing is not possible in radio telemetry.  
a) True  
b) False

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Answer: b

Explanation: Multiplexing of data in radio telemetry is possible.

4. Carrier frequency in radio telemetry will be \_\_\_\_\_  
a) Very low value  
b) Very high value  
c) Any value greater than 100 Hz  
d) Frequency appropriate to conductor size

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Answer: d

Explanation: For multiplexing in radio telemetry, carrier frequency should be appropriate to conductor size.

5. For space telemetry, carrier frequency should be \_\_\_\_\_  
a) Very high value  
b) Very low value  
c) Frequency appropriate to distance  
d) Any value greater than 100 Hz

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Answer: a

Explanation: Very high value of carrier frequency helps in reducing antenna size.  
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6. Frequency range of space telemetry should be \_\_\_\_\_

- a) Less than 216 MHz
- b) Between 216 – 235 MHz
- c) Between 235 – 412 MHz
- d) Above 412 MHz

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Answer: b

Explanation: Carrier frequency range of space telemetry system should be between 216 MHz and 235 MHz.

7. Which of the following represent stability relaxation for RF carrier?

- a) 0 %
- b) +/- 1 %
- c) +/- 0.1 %
- d) None of the mentioned

[View Answer](#)

Answer: c

Explanation: RF carrier must remain stable within +/- 0.1 %.

8. For FM/FM modulation, what is the bandwidth allowed?

- a) 0.2 MHz
- b) 0.5 MHz
- c) 0.9 MHz
- d) 1 MHz

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Answer: b

Explanation: For FM/FM modulation, bandwidth allowed is 0.5 MHz.

9. Output power of transmitter will be \_\_\_\_\_

- a) Very low
- b) Very high
- c) Varying
- d) None of the mentioned

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Answer: a

Explanation: Output power of the transmitter is kept very low.

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10. Output power of transmitter will be \_\_\_\_\_

- a) 2 to 10 w
- b) 2 to 50 w
- c) 2 to 100 w
- d) Above 100 w

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Answer: c

Explanation: Output power of the transmitter is always kept very low and it lies in the range of 2 to 100 w.

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## Instrumentation Transducers Questions and Answers – Frequency Division Multiplexers

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This set of Instrumentation Transducers Question Bank focuses on “Frequency Division Multiplexers”.

1. FDM is associated with \_\_\_\_\_  
a) FM/FM modulation  
b) PDM/FM modulation  
c) Both FM/FM and PDM/FM modulation  
d) None of the mentioned

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Answer: a

Explanation: FDM or frequency division multiplexing is associated with FM/FM modulation.

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2. In FDM, carrier signal have \_\_\_\_\_  
a) Low frequency  
b) Very high frequency  
c) Multiplexing is not possible  
d) None of the mentioned

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Answer: b

Explanation: For multiplexing in FDM, carrier signal has a very high frequency.

3. FM/FM telemetry is a/an \_\_\_\_\_  
a) Analog telemetry system  
b) Digital telemetry system  
c) Analog or digital depending on design  
d) None of the mentioned

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Answer: a

Explanation: FM/FM telemetry is an analog telemetry system.

4. Baseband frequency of FDM will be \_\_\_\_\_  
a) Less than 70 Hz  
b) Less than 70 KHz  
c) Less than 70 MHz  
d) Less than 70 GHz

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Answer: b

Explanation: Baseband frequency for FDM will be between DC to 70 KHz.

5. Upper frequency limit of FDM is constant.  
a) True  
b) False

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Answer: b

Explanation: In FDM, upper frequency limit varies widely.

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6. VCO is used for \_\_\_\_\_

- a) Amplification
- b) Frequency modulation
- c) Amplitude modulation
- d) None of the mentioned

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Answer: b

Explanation: VCO or voltage controlled oscillator is used for frequency modulation.

7. SCO stands for \_\_\_\_\_

- a) Signal controlled oscillator
- b) Switch controlled oscillator
- c) Sub carrier oscillator
- d) Sweep controlled oscillator

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Answer: c

Explanation: SCO is short of sub carrier oscillator.

8. Centre frequency of sub carrier signal varies \_\_\_\_\_

- a) +/- 10%
- b) +/- 7.5%
- c) +/- 5%
- d) +/- 2.5%

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Answer: b

Explanation: Variation of centre frequency of sub carrier signal will be +/- 7.5%.

9. What will be the frequency modulation index of SCO?

- a) 1
- b) 2
- c) 5
- d) 9

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Answer: c

Explanation: Frequency modulation index of SCO is standardised to be 5.

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10. For  $m_f=5$ , how many side-bands will have for a modulated signal?

- a) 2
- b) 4
- c) 6
- d) 8

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Answer: d

Explanation: For a modulated signal with index 5 will have eight side-bands.

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## Instrumentation Transducers Questions and Answers – Time Division Multiplexing

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Time Division Multiplexing”.

1. Time division multiplexing includes \_\_\_\_\_  
a) Wired link  
b) Radio link  
c) Radio or wire link  
d) None of the mentioned

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Answer: c

Explanation: Time division multiplexing includes both radio or wired link according to application.

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2. Which of the following data is correct for TDM?  
a) Analog data is transmitted  
b) Digital data is transmitted  
c) Both analog and digital data transmitted  
d) None of the mentioned

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Answer: a

Explanation: Using TDM analog data is transmitted.

3. PAM stands for \_\_\_\_\_  
a) Pulse Amplitude Modulation  
b) Power Amplitude Modulation  
c) Pulse Additive Modulation  
d) Pulse Amplitude Masking

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Answer: a

Explanation: Term PAM stands for process Pulse Amplitude Modulation.

4. Commutators are mechanical switches in operation.  
a) True  
b) False

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Answer: a

Explanation: Commutators perform an operation of on and off and they function as mechanical switches.

5. Which of the following represents a number of samples per second?  
a) Product of frame rate and number of samples per frame  
b) Frame rate  
c) Ratio of samples per frame and frame rate  
d) None of the mentioned

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Answer: a  
Explanation: Number of samples taken per second will be equal to the product of frame rate and number of samples per frame.  
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6. What will be the general number of samples per frame?

- a) 18
- b) 30
- c) 18 or 30
- d) None of the mentioned

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Answer: c

Explanation: Generally a number of samples per frame will be 18 or 30.

7. Maximum rate of commutation will be \_\_\_\_\_

- a) 800 sample per second
- b) 900 sample per second
- c) 1200 sample per second
- d) 1000 sample per minute

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Answer: b

Explanation: Maximum rate of commutation in TDM will be 900 samples/sec.

8. Amplitude of each pulse of PAM train conveys the amplitude of particular channel sampled.

- a) True
- b) False

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Answer: a

Explanation: Amplitude data of particular sampled channel can be obtained from the amplitude of PAM train.

9. PTM stand for \_\_\_\_\_

- a) Pulse train modulation
- b) Pulse time modulation
- c) Power train modulation
- d) None of the mentioned

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Answer: b

Explanation: PTM is the short form of pulse train modulation.

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10. Which of the following can be generated from the PDM signal?

- a) PPM
- b) PTM
- c) PAM
- d) PFM

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Answer: a

Explanation: If PDM signals are available, PPM signal can be generated from PDM signals.

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## Instrumentation Transducers Questions and Answers – Sensor Systems

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Sensor Systems”.

1. Which of the following is correct for tactile sensors?

- a) Touch sensitive
- b) Pressure sensitive
- c) Input voltage sensitive
- d) Humidity sensitive

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Answer: a

Explanation: Tactile sensors are those which sensitive to touch.

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2. Change in output of sensor with change in input is \_\_\_\_\_

- a) Threshold
- b) Slew rate
- c) Sensitivity
- d) None of the mentioned

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Answer: c

Explanation: Sensitivity of a sensor is the change in output for a change in input.

3. Which of the following can be cause for non-zero output when zero input?

- a) Bias
- b) Slew
- c) Offset
- d) Offset or bias

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Answer: d

Explanation: For ideal condition, zero input produces zero output.

4. Sensitivity of a sensor can be depicted by \_\_\_\_\_

- a) Niquist plot
- b) Pole- zero plot
- c) Bode plot
- d) None of the mentioned

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Answer: c

Explanation: Bode plot can be used for describing the sensitivity of a sensor.

5. Which of the following error is caused by a reversal of measured property?

- a) Hysteresis
- b) Noise
- c) Digitization error
- d) Quantization error

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Answer: a

Explanation: Digitization error is caused by a reversal of measured value.

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6. Smallest change which a sensor can detect is \_\_\_\_\_

- a) Resolution
- b) Accuracy
- c) Precision
- d) Scale

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Answer: a

Explanation: Resolution is the smallest change a sensor can detect.

7. Thermocouple generate output voltage according to \_\_\_\_\_

- a) Circuit parameters
- b) Humidity
- c) Temperature
- d) Voltage

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Answer: c

Explanation: Thermocouple is a device which is capable of producing output voltage according to input temperature.

8. Sensor is a type of transducer.

- a) True
- b) False

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Answer: a

Explanation: Sensor is a device which enables measurement of input value.

9. Which of the following is not an analog sensor?

- a) Potentiometer
- b) Force-sensing resistors
- c) Accelerometers
- d) None of the mentioned

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Answer: d

Explanation: All of the mentioned devices are analog sensors.

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10. Measured property have no relation with error.

- a) True
- b) False

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Answer: a

Explanation: Error of a system is independent of the measured value.

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## Instrumentation Transducers Questions and Answers – Semiconductor Sensors

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Semiconductor Sensors”.

1. Semiconductor used in sensors will be \_\_\_\_\_

- a) Pure form
- b) Doped form
- c) Pure or doped form
- d) None of the mentioned

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Answer: c

Explanation: Semiconductor used in sensors will be in its pure form or doped with some impurities.

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2. A semiconductor can act as \_\_\_\_\_

- a) Insulator
- b) Semi conductor
- c) Pure conductor
- d) All of the mentioned

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Answer: d

Explanation: A semiconductor can act as both conductor, semiconductor and insulators on different temperatures.

3. Which of the following represent permalloy?

- a) Nickel iron alloy
- b) Nickel platinum alloy
- c) Nickel gold alloy
- d) Nickel bronze alloy

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Answer: a

Explanation: Nickel iron alloy is also known as permalloy.

4. Permalloy are most suitable for \_\_\_\_\_

- a) Pressure measurement
- b) Temperature measurement
- c) Voltage measurement
- d) All of the mentioned

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Answer: b

Explanation: Due to high temperature coefficient of resistance, permalloy is more suitable for temperature measurement.

5. Silicon and germanium can act as piezo resistive materials.

- a) True
- b) False

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Answer: a

Explanation: Under doped condition, silicon and germanium can act as piezo resistive materials.

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6. Which of the following act as magneto-resistive material?

- a) Bismuth
- b) Antimonide
- c) Both bismuth and antimonide
- d) None of the mentioned

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Answer: c

Explanation: Both Bismuth and Antimonide act as magneto-resistive materials.

7. In piezo junction diode, energy domain will be \_\_\_\_\_

- a) Electrical
- b) Mechanical
- c) Radiation
- d) Thermal

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Answer: b

Explanation: Energy domain in piezo junction will be mechanical energy.

8. PVDF stands for \_\_\_\_\_

- a) Poly Vinyledene Fluoride
- b) Poly Vinyl Duro Fluoride
- c) Penta Valent Di Fluoride
- d) Poly Valent Duro Flourisher

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Answer: a

Explanation: PVDF is the short form of Poly vinylidene Fluoride.

9. Pyro electric coefficient of PVDF will be \_\_\_\_\_

- a)  $1 \text{ VK}^{-1}$
- b)  $8 \text{ VK}^{-1}$
- c)  $20 \text{ VK}^{-1}$
- d)  $50 \text{ VK}^{-1}$

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Answer: b

Explanation: Pyro electric coefficient of PVDF will be  $8\text{VK}^{-1}$ .

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10. Amorphous materials will be \_\_\_\_\_

- a) Isulators
- b) Semi conductors
- c) Super conductors
- d) All of the mentioned

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Answer: d

Explanation: Amorphous materials can act as insulators, semiconductors or superconductors at low temperature.

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## Instrumentation Transducers Questions and Answers – Smart Sensors

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Smart Sensors”.

1. \_\_\_\_\_ handle mathematical operations necessary to deliver the output signal.

- a) Small sensors
- b) Mat sensors
- c) Soft sensors
- d) Super sensors

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Answer: c

Explanation: Soft sensors are those which handle mathematical operations.

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2. Which of the following is not a configuration of a smart sensor?

- a) Transducer
- b) Network interface
- c) Processor
- d) None of the mentioned

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Answer: d

Explanation: A smart sensor configuration contains physical transducer, network interface, processor and memory.

3. A/D conversion is not needed in the smart sensor.

- a) True
- b) False

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Answer: b

Explanation: Smart sensors include conversion of input analog value to a digital value.

4. Input signal to smart sensor is fed from \_\_\_\_\_

- a) Power supply
- b) Transducer
- c) Volt meter
- d) All of the mentioned

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Answer: b

Explanation: Input to the smart sensor is fed from transducer measuring input value.

5. Storage of data possible in smart sensors.

- a) True
- b) False

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Answer: a

Explanation: Smart sensors contains a memory unit, which means they support the storage of data.

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6. Signal conditioning is carried out in \_\_\_\_\_

- a) Transducer housing

- b) Processor
- c) Network interface
- d) None of the mentioned

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Answer: a

Explanation: Signal conditioning of smart sensors is carried out inside of transducer housing.

7. Output of smart sensors will of \_\_\_\_\_

- a) Analog
- b) Digital
- c) Analog and digital
- d) None of the mentioned

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Answer: b

Explanation: Output of smart sensor is taken from the processor and they are of digital value.

8. Which of the following defines smartness of sensor?

- a) Quality of data
- b) Circuit size
- c) Circuit components
- d) All of the mentioned

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Answer: a

Explanation: Quality of output data defines the smartness of the sensor.

9. Input data of smart sensor will be \_\_\_\_\_

- a) Analog
- b) Digital
- c) Analog and digital
- d) None of the mentioned

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Answer: a

Explanation: Input quantity of smart sensor is the analog quantity which is converted to digital.

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10. Which of the following represents network bus?

- a) Instrumentation contact
- b) Field instrumentation bus
- c) Data bus
- d) Bit line contact

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Answer: b

Explanation: Network bus in a smart sensor is also known as field instrumentation bus.

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## Instrumentation Transducers Questions and Answers – Micro Sensors

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Micro Sensors”.

1. MEM stands for \_\_\_\_\_  
a) Macro electro magnetism  
b) Macro electro mechanism  
c) Micro electro mechanism  
d) Micro electro magnetism

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Answer: c

Explanation: MEM is the short form of Micro electro mechanism.

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2. Which of the following represents the inverse transducer of a microphone?  
a) Micro speaker  
b) Pressure transducer  
c) Bourden element  
d) All of the mentioned

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Answer: a

Explanation: Inverse transducer system of microphone is microspeaker.

3. Which of the following provides high thermal stability as bimorph?  
a) Silicon nitride  
b) Parylene D  
c) Silicon oxide  
d) None of the mentioned

[View Answer](#)

Answer: b

Explanation: Parylene D provides high thermal stability as a bimorph.

4. Gyroscopes are \_\_\_\_\_  
a) Inertial sensors  
b) Pressure sensors  
c) Voltage sensors  
d) Humidity sensors

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Answer: a

Explanation: Gyroscopes are inertial sensors, intended for detecting inertial motion.

5. Polymer thick film can act as a sensing element.  
a) True  
b) False

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Answer: a

Explanation: Polymer thick film can act as a sensing element for different measures.

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6. Which of the following is not a polymer matrix?  
a) Epoxy resin  
b) Silicon resin

- c) Phenolic resin
- d) None of the mentioned

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Answer: d

Explanation: All of the mentioned materials are polymer matrix.

7. Which of the following is not a conductive paste?

- a) Copper
- b) Carbon particles
- c) Silver particles
- d) None of the mentioned

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Answer: b

Explanation: Carbon particles are resistive paste.

8. Polymers can act as humidity sensors.

- a) True
- b) False

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Answer: a

Explanation: Polymers can act as humidity sensors since they absorb water and change resistance.

9. PZT stands for \_\_\_\_\_

- a) Poly zirconate titanate
- b) Lead zirconate tartarate
- c) Poly zirconate trioxide
- d) Poly zirconate tetranitrate

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Answer: b

Explanation: Lead zirconate tartarate is also known as PZT.

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10. Which of the following is not a piezo electric sensor?

- a) PZT
- b) Roscelle salt
- c) Quartz
- d) None of the mentioned

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Answer: d

Explanation: PZT, roselle salt, and quartz can act as piezo electric sensors.

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## Instrumentation Transducers Questions and Answers – IR Radio Sensors

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “IR Radio Sensors”.

1. Which of the following is not a part of electro magnetic radiation?

- a) UV
- b) Visible region
- c) IR spectra
- d) None of the mentioned

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Answer: d

Explanation: All three regions mentioned are part of electro magnetic radiation.

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2. Which of the following represents IR wavelength?

- a) 100 nm to 700 nm
- b) 700 nm to 2500 nm
- c) 2500 nm to 5000 nm
- d) Greater than 2500 nm

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Answer: b

Explanation: IR radiation wavelength is in the region between 700 nm and 2500 nm.

3. Infra red radiation sources may be \_\_\_\_\_

- a) Thermal source
- b) Non-thermal source
- c) Thermal or non-thermal source
- d) None of the mentioned

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Answer: c

Explanation: Sources that produce IR radiation may be thermal or non-thermal in behaviour.

4. Every hot body emits IR radiation.

- a) True
- b) False

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Answer: a

Explanation: IR radiation is the heat wave and every hot body emits IR radiation.

5. Tungsten filament lamp is a \_\_\_\_\_

- a) Thermal source
- b) Non-thermal source
- c) Thermal or non-thermal source
- d) None of the mentioned

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Answer: b

Explanation: Tungsten filament lamp is a non-thermal source of IR radiation.

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6. Which of the following is correct for non-thermal source?

- a) Need external supply
- b) Doesn't need an external source
- c) Can act as thermal source
- d) All of the mentioned

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Answer: b

Explanation: Non thermal source of IR radiation doesn't need an external power supply.

7. LED and laser emit radiation in \_\_\_\_\_

- a) Narrow range
- b) Wide range
- c) Medium bandwidth
- d) Unpredictable bandwidth

[View Answer](#)

Answer: a

Explanation: LED and laser emit radiation in narrow range bandwidth.

8. Sensing element in IR thermal detector will be \_\_\_\_\_

- a) Thermo couple
- b) Thermo pile
- c) Bolometer
- d) All of the mentioned

[View Answer](#)

Answer: d

Explanation: All of the mentioned devices can act as a sensing element in the IR thermal detector.

9. Which of the following is the correct relationship for sensitivity?

- a) Volt/watt
- b) Watt/volts
- c) Volt/amp
- d) Volts

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Answer: a

Explanation: Sensitivity is the ratio of a signal obtained to power.

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10. Sensitivity can represent in terms of the lumen.

- a) True
- b) False

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Answer: a

Explanation: In photonic applications, sensitivity is expressed in terms of the lumen.

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# Instrumentation Transducers Questions and Answers – Ultrasonic Sensors

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Ultrasonic Sensors”.

1. Basically sound waves are \_\_\_\_\_  
a) Voltage signals  
b) Pressure waves  
c) Current  
d) Radiation  
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Answer: b

Explanation: Sound waves are pressure waves in character.

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2. Which of the following is not a character of a sensor of a sound wave?  
a) Causes no health hazard  
b) They are suitable in a harsh environment  
c) They are only suitable in cold environment  
d) They can be used in corrosive environment  
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Answer: c

Explanation: Sound sensors can be used in any environment.

3. Sound waves are similar to light waves in all aspects.  
a) True  
b) False  
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Answer: b

Explanation: While considering reflection and refraction, sound waves and light waves are similar.

4. SONAR stands for \_\_\_\_\_  
a) Sound navigation and ranging  
b) Sound number approximation and ranging  
c) Sound nullifying ranging  
d) None of the mentioned  
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Answer: a

Explanation: Sonar is the short form of sound navigation and ranging.

5. Which of the following type sound generators are not possible?  
a) Piezo electric  
b) Magnetostrictive  
c) Both piezo electric and magnetostrictive  
d) None of the mentioned  
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Answer: d

Explanation: Both piezo electric and magnetostrictive devices are successful sources of sound waves.

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6. Mosaic regarding sonar is \_\_\_\_\_  
a) Surface of sonar  
b) Frequency of sound wave  
c) Pattern of vibrating elements  
d) Depth of sea to which it is applicable  
[View Answer](#)

Answer: c

Explanation: Specific pattern of the vibrating element is known as mosaic.

7. All elements of sonar are driven electrically.

- a) True
- b) False

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Answer: a

Explanation: All elements of sonar are driven electrically using an external power supply.

8. Piezo electric materials are well cut for \_\_\_\_\_

- a) Good dimension
- b) Good coupling coefficient
- c) Compact shape of device
- d) Increasing frequency

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Answer: b

Explanation: Piezo electric materials are so cut as to have maximum coupling coefficient between mechanical strain and electrical polarization direction.

9. Which of the following can be used in sonar?

- a) ADP
- b) Rescelle salt
- c) ADP and Roscelle salt
- d) ADP and Roscelle salt in sealed condition

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Answer: d

Explanation: ADP and Roscelle salt are used as sealed with oil since they are soluble in water.

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10. Magnetostriction transmitter uses \_\_\_\_\_

- a) Electrostrictive phenomena
- b) Horizontal vibration of nickel tube
- c) Longitudinal vibration of nickel tube
- d) All of the mentioned

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Answer: c

Explanation: Magnetostriction transmitter uses longitudinal vibration of nickel tube used.

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# Instrumentation Transducers Questions and Answers – Fibre Optic Sensors

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Fibre Optic Sensors”.

1. OTDR stands for \_\_\_\_\_

- a) Optical time domain reflectometer
- b) Optical transfer data rate
- c) Optical time data registers
- d) None of the mentioned

[View Answer](#)

Answer: a

Explanation: OTDR is the short form of optical time domain reflectometer.

2. Which of the following is not correct for fibre optic sensors?

- a) Immune to electro magnetic interference
- b) Immune to radiation hazard
- c) Can be used in harsh environments
- d) None of the mentioned

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Answer: d

Explanation: All of the mentioned are qualities of fibre optic sensors.

3. Fluoride glass is used with \_\_\_\_\_

- a) IR waves
- b) UV rays
- c) Normal light
- d) All of the mentioned

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Answer: a

Explanation: Fluoride glass is suitable for IR rays of wavelength upto 3200 nm.

4. Silica glass of hydroxyl concentration can be used for \_\_\_\_\_ of wavelength.

- a) 100 nm to 250 nm
- b) 250 nm to 800 nm
- c) 800 nm to 1500 nm
- d) 100 nm to 3400 nm

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Answer: b

Explanation: Silica glass with hydroxyl concentration is used for wavelength 250 nm to 800 nm.

5. General spectral range for silica glass is \_\_\_\_\_

- a) Less than 200 nm
- b) Between 200 nm to 2200 nm
- c) Between 2000 nm to 5000 nm
- d) Greater than 3000 nm

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Answer: b

Explanation: General spectral range of silica glass is 200 nm to 2200 nm.

6. Epoxy material in fibre optics is intended for \_\_\_\_\_

- a) Better optical properties
- b) Better reflection
- c) Better sealing
- d) Reducing noise

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Answer: c

Explanation: Polished epoxy seal provides liquid and air tight seal.

7. Plastics optical cables can be used for \_\_\_\_\_

- a) Short range
- b) Medium range of distance
- c) Long range of distance
- d) Very high range of distance

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Answer: a

Explanation: Plastic optical cables are manufacturing for short range purposes.

8. Which of the following represents loss associated with glass fibres?

- a) 3 dB/Km
- b) 10 dB/Km
- c) 0 dB/Km
- d) 50 dB/Km

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Answer: a

Explanation: Glass fibres have a net loss of 3 dB on every single kilometre.

9. Loss associated with plastic fibre is less than glass fibres.

- a) True
- b) False

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Answer: b

Explanation: Loss associated with plastic fibre is about 100-1250 dB/Km and it is several times larger than glass fibres.  
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10. Cladding in glass fibre have high refractive index than the core.

- a) True

- b) False

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Answer: b

Explanation: Cladding in glass fibre is always kept at a low refractive index than the core.

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# Instrumentation Transducers Questions and Answers – Chemical Sensors

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This set of Instrumentation Transducers Questions and Answers for Entrance exams focuses on “Chemical Sensors”.

1. Which of the following change electrical conductivity on the absorption of a gas molecule?

- a) Tin
- b) Zinc
- c) Nickel
- d) All of the mentioned

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Answer: d

Explanation: Tin, Zinc and Nickel shows change in electrical conductivity on absorption of gas molecule on semiconductor surface.

2. Polypropylene is a/an \_\_\_\_\_

- a) Inorganic sensor
- b) Organic sensor
- c) Metal sensor
- d) Gaseous sensor

[View Answer](#)

Answer: b

Explanation: Polypropylene is a type of organic sensor.

3. ISE stands for \_\_\_\_\_

- a) Ion sticking electrode
- b) Ion selective electrode
- c) Inactive segment electrode
- d) Inorganic substance electrode

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Answer: b

Explanation: ISE is the short form of Ion selective electrode.

4. Glass electrode is an ion selective electrode.

- a) True
- b) False

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Answer: a

Explanation: Glass electrode is used to measure pH which is the hydrogen ion activity.

5. Water purity is tested by \_\_\_\_\_

- a) Water activity sensor
- b) pH meter
- c) SAW sensor
- d) BAW sensor

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Answer: b

Explanation: Purity of water is tested using pH meters.

6. Heater power in thick film hybrid technology is \_\_\_\_\_

- a) 5KW
- b) 50 MW
- c) 500 MW
- d) 500 mW

[View Answer](#)

Answer: d

Explanation: Heater power in thick film hybrid technology is up to 500 mW.

7. Chemiresistor sensors are used for test gases in \_\_\_\_\_

- a) Solid form
- b) Liquid form
- c) Vapour form

d) All of the mentioned  
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Answer: c

Explanation: If the test gas is in vapour form, chem resistor sensors are used.

8. IR sensors are used in detection of \_\_\_\_\_

- a) Organic gases
- b) Inorganic gases
- c) Vapours
- d) All of the mentioned

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Answer: d

Explanation: IR sensors can be used in detecting many organic inorganic gases and vapours.

9. Photo ionization and flame ionization technique are most favoured in detection of \_\_\_\_\_

- a) Organic gases
- b) Inorganic gases
- c) Vapours
- d) All of the mentioned

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Answer: a

Explanation: Organic gases can be most effectively detected using photo ionization and flame ionization technique.  
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10. Mass sensors are a combination of SAW.

- a) True
- b) False

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Answer: a

Explanation: Mass sensors are generally a combination of sensors coming under SAW.

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# Instrumentation Transducers Questions and Answers – Bio Sensors

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Bio Sensors”.

1. SAW stands for \_\_\_\_\_

- a) Sound actuated wave
- b) Surface acoustic wave
- c) Sound activated wave
- d) Surface activated wave

[View Answer](#)

Answer: b

Explanation: SAW stands for surface acoustic wave.

2. Quartz can be used as bio sensors.

- a) True
- b) False

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Answer: a

Explanation: In QCM, piezoelectric nature of quartz is utilized.

3. Direction of acoustic wave in QCM will be \_\_\_\_\_

- a) Same as crystal surface
- b) Opposite to crystal surface
- c) Perpendicular to crystal surface
- d) None of the mentioned

[View Answer](#)

Answer: c

Explanation: In QCM, the direction of acoustic wave will be perpendicular to the crystal surface.

4. Acoustic wave in QCM meets minimum impedance when thickness of device is \_\_\_\_\_

- a) Equal to wavelength of acoustic wave
- b) Product of Half of wavelength of acoustic wave
- c) Product of quarter of wavelength of acoustic wave
- d) None of the mentioned

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Answer: b

Explanation: When thickness of device is a product of half of wavelength of acoustic wave, it meets minimum impedance.

5. Which of the following is most preferred?

- a) QCM and SAW sensor
- b) QCM and BAW sensor
- c) QCM
- d) All of the mentioned

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Answer: a

Explanation: Quartz crystal micro balance and surface acoustic wave sensors are used since it provides impressive sensitivity.

6. Magnetic bio sensor is wide used for \_\_\_\_\_

- a) Blood detection
- b) DNA detection
- c) ECG detection
- d) EMG detection

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Answer: b

Explanation: Magnetic bio sensors are used for DNA detection.

7. QCM stands for \_\_\_\_\_

- a) Quartz crystal micro balance
- b) Quality control balance
- c) Quartz crystal magnifier
- d) None of the mentioned

[View Answer](#)

Answer: a

Explanation: QCM stands for Quartz crystal micro balance which uses quartz crystals.

8. Changes in resonant frequency of QCM is proportional to \_\_\_\_\_

- a) Mass accumulated in crystal
- b) Crystal used
- c) Time of usage
- d) None of the mentioned

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Answer: a

Explanation: Deposition of a thin film on crystal surface causes change in the resonant frequency of device.

9. BAW stands for \_\_\_\_\_

- a) Bulk acoustic wave
- b) Barrier acoustic wave
- c) Barrier avoiding wave
- d) Bulk activated wave

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Answer: a

Explanation: BAW stands for Bulk acoustic wave.

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10. Non contacting type bio sensors are \_\_\_\_\_

- a) Radiation type
- b) Electromagnetic type
- c) Radiation or electromagnetic type
- d) None of the mentioned

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Answer: c

Explanation: Bio sensors may be contacting or non contacting type. Non contacting type sensors may be electromagnetic or radiation type.

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# Instrumentation Transducers Questions and Answers – Thermography and Thermometry

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Thermography and Thermometry”.

1. Which of the following produce em radiation in ir region?

- a) Body with negative temperature
- b) Body with temperature less than  $100^0\text{C}$
- c) Body with temperature less than  $600^0\text{C}$
- d) Body with temperature less than  $1000^0\text{C}$

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Answer: c

Explanation: Body with temperature between 0 to  $650^0\text{C}$  emit em radiation in infra-red region.

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2. Energy of emitted radiation from a body increases with \_\_\_\_\_

- a) Increase in temperature
- b) Decrease in temperature
- c) No relation with temperature
- d) Net energy cannot be changed

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Answer: a

Explanation: Net energy emitted by the body can be increased by increasing temperature.

3. Wavelength of peak radiation is represented by \_\_\_\_\_

- a)  $28.91 * T$
- b)  $2891/T$
- c)  $189 * T$
- d) None of the mentioned

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Answer: b

Explanation: Ratio of 2891 and temperature gives wavelength at which peak radiation is seen.

4. At  $100^0\text{C}$  wavelength of radiation will be \_\_\_\_\_

- a) Less than 10um
- b) Less than 100um
- c) Less than 1000um
- d) Less than 10nm

[View Answer](#)

Answer: a

Explanation: At  $100^0\text{C}$  90% of emitted radiation will have less than 10um wavelength.

5. Radiation thermometers are pyrometers.

- a) True
- b) False

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Answer: a

Explanation: Radiation thermometers are also known as pyrometers.

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6. Temperature sensor of silicon can detect wavelength of \_\_\_\_\_

- a) Less than 0.1 um
- b) Less than 1.1 um
- c) Less than 10nm
- d) Greater than 100nm

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Answer: b

Explanation: Silicon sensors can sense wavelength of less than 1.1 um.

7. Which of the following sensor have a large response time?

- a) Thermopile
- b) Pyroelectric sensor
- c) Lead sulphide sensor
- d) Silicon sensor

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Answer: a

Explanation: Thermopile requires large response time (100ms).

8. IR thermograph is also known as \_\_\_\_\_

- a) Thermogram
- b) Heat thermograph
- c) Thermogram
- d) None of the mentioned

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Answer: c

Explanation: Infra-red thermograph is also known as thermogram.

9. IR thermography is useful in the medical field.

- a) True
- b) False

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Answer: a

Explanation: Many types of disease can be detected by using IR thermography.  
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10. Which of the following sensors provide higher temperature capacity?

- a) Thermopile
- b) Pyroelectric sensor
- c) Lead sulphide sensor
- d) Silicon sensor

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Answer: d

Explanation: Silicon sensors have higher temperature capacity of 400<sup>0</sup>C.

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# Instrumentation Transducers Questions and Answers – Nano Instrumentation

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Nano Instrumentation”.

1. AFM stands for \_\_\_\_\_

- a) Auto focusing microscope
- b) Antenna focusing microscope
- c) Atomic force microscope
- d) None of the mentioned

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Answer: c

Explanation: AFM stands for Atomic Force Microscope.

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2. Phenomenon of producing sound under mechanical stress is called \_\_\_\_\_

- a) Magnetostriction
- b) Acoustiction
- c) Electrostriction
- d) Acoustic emission

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Answer: d

Explanation: Acoustic emission is the process of emission of sound waves under mechanical stress application.

3. Which of the following causes acoustic emission in machineries?

- a) Friction
- b) Vibration
- c) Turbulance
- d) All of the mentioned

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Answer: d

Explanation: Acoustic emission in machineries are caused by friction, vibration, turbulence cavitation etc.

4. Acoustic emission signals will be of the form \_\_\_\_\_

- a) Discrete transients
- b) Quasi continuous
- c) Discrete or quasi continuous
- d) None of the mentioned

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Answer: c

Explanation: AE signals may be of Discrete transients, quasi continuous or mix of two.

5. By placing sensor nearer to AE, SNR \_\_\_\_\_

- a) Increases
- b) Decreases
- c) Doubles
- d) No change

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Answer: a

Explanation: Signal to noise ratio is improved by placing sensor nearer to acoustic emission element.

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6. PVDF inultrasonic scanning technique can be used at temperature \_\_\_\_\_

- a) Less than 20<sup>0</sup>C
- b) Less than 70<sup>0</sup>C
- c) Greater than 100<sup>0</sup>C
- d) None of the mentioned

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Answer: b

Explanation: Polyvinylidene Fluoride is used at temperature below 70<sup>0</sup>C.

7. Thickness of PVDF film will be \_\_\_\_\_

- a) Less than 100um
- b) Less than 10nm
- c) Less than 100mm

d) Less than 1cm  
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Answer: a  
Explanation: Normally thickness of PVDF film will be between 50um and 100um.

8. Copolymer of PVDF has lower temperature capacity than PVDF.

- a) True
- b) False

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Answer: b

Explanation: Copolymer of PVDF have temperature capacity of  $145^{\circ}\text{C}$  and PVDF have temperature capacity of  $70^{\circ}\text{C}$ .

9. PVDF is \_\_\_\_\_ material.

- a) Piezoelectric
- b) Magnetostrictive
- c) Thermoelectric
- d) Electrostrictive

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Answer: a

Explanation: Both PVDF and it's copolymer shows piezoelectric nature.

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10. SNR is signal to noise ratio.

- a) True
- b) False

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Answer: a

Explanation: SNR stands for a signal to noise ratio.

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# Instrumentation Transducers Questions and Answers – Biomedical Instrumentation

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This set of Instrumentation Transducers Questions and Answers for Campus interviews focuses on “Biomedical Instrumentation”.

1. Which of the following is used as a display device to produce a permanent record of data?

- a) 7 segment display
- b) Pen recorder
- c) Electrode
- d) Needle

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Answer: b

Explanation: Pen recorder is the display device used as a display device to produce a permanent record of data.  
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2. Resting potential has a magnitude of \_\_\_\_\_

- a) 70 mV
- b) -70 mV
- c) 20 mV
- d) -20 mV

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Answer: b

Explanation: Resting potential has a magnitude of -70 mV.

3. Which of the following represents action potential?

- a) 70 mV
- b) -70 mV
- c) 20 mV
- d) -20 mV

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Answer: c

Explanation: Action potential has a magnitude of 20 mV.

4. Signals generated by body signal is known as \_\_\_\_\_

- a) Ionic voltage
- b) Monitory signal
- c) Magnetic signal
- d) None of the mentioned

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Answer: a

Explanation: Electric signals generated by the human body is known as ionic voltage or bio electric potential.

5. Resting potential is always negative.

- a) True
- b) False

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Answer: a

Explanation: Value of resting potential is always negative.

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6. Which of the following shows resting potential?

- a) Depolarised cell
- b) Polarised cell
- c) Ionic cell
- d) Resting cell

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Answer: b

Explanation: Body cell which showing resting potential is known as a polarised cell.

7. Which of the following represents re polarisation in action potential wave?

- a) Zero slop
- b) Positive slop
- c) Negative slop
- d) None of the mentioned

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Answer: c

Explanation: Negative slop region in action potential wave represents re polarisation.

8. Process of changing resting potential to action potential is known as \_\_\_\_\_

- a) Polarization
- b) Re polarization
- c) Depolarization
- d) Uni polarization

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Answer: c

Explanation: Depolarization is the process of changing from resting potential to action potential.

9. Action potential is varying over the cell.

- a) True
- b) False

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Answer: b

Explanation: For every cell action potential is always the same which is described by all or nothing law.  
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10. Which of the following have higher action potential propagation rate?

- a) Nerve cell
- b) Heart muscle
- c) Thigh muscle
- d) All of the mentioned

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Answer: a

Explanation: Nerve cell have a higher rate of propagation for action potential( 20-140 m/s).

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# Instrumentation Transducers Questions and Answers – Tomography

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Tomography”.

1. CT stands for \_\_\_\_\_

- a) Controlled tomography
- b) Computerized tomography
- c) Converted tomography
- d) Comparison tomography

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Answer: b

Explanation: CT is the short form of computerized tomography.

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2. Who invented Tomography?

- a) Radon
- b) Josef capek
- c) Curie
- d) Johnson

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Answer: a

Explanation: In 1917, Radon invented the tomographic machine.

3. Which of the following is used in tomography?

- a) X ray
- b) Gamma ray
- c) UV ray
- d) IR radiation

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Answer: a

Explanation: X ray is used in tomography to get interior data of a body.

4. ECT stands for \_\_\_\_\_

- a) Electro cardio tomography
- b) Electro capacitive tomography
- c) Electro converging tomography
- d) Electro Cornial tomography

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Answer: b

Explanation: ECT or electro capacitive tomography is a method of tomography.

5. Which of the following is not possible?

- a) ECT
- b) ERT
- c) Fibre optic tomography
- d) None of the mentioned

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Answer: d

Explanation: ECT, ERT, and fibre optic tomographies are different methods for tomography.

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6. How many conductors are used in ERT?

- a) 10
- b) 12
- c) 14
- d) 16

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Answer: d

Explanation: Normal number of conductors in ERT is 16.

7. EMT is working on the basis of \_\_\_\_\_

- a) Mutual inductance
- b) Current flow
- c) Self inductance
- d) None of the mentioned

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Answer: a

Explanation: Electro magnetic tomography is based on complex mutual inductance.

8. Fibre optic tomography is used in particle size \_\_\_\_\_

- a) Less than 10um
- b) Less than 100um
- c) Up to 1000nm
- d) Up to 100nm

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Answer: b

Explanation: Fibre optic tomography is used in particle size less than 100um.

9. Attenuation rate may vary in fibre optic tomography.

- a) True
- b) False

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Answer: a

Explanation: Attenuation rate in fibre optic tomography vary according to particle size and nature.  
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10. A femto farad is equal to \_\_\_\_\_

- a)  $10^{-15}$  farad
- b)  $10^{-10}$  farad
- c)  $10^{-5}$  farad
- d)  $10^{10}$  farad

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Answer: a

Explanation: One femto farad is equal to  $10^{-15}$  farad.

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# Instrumentation Transducers Questions and Answers – Analysis

## Instrumentation

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on "Analysis Instrumentation".

1. All bodies behave as source of \_\_\_\_\_

- a) Electromagnetic radiation
- b) IR radiation
- c) Ultra violet radiation
- d) None of the mentioned

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Answer: a

Explanation: All bodies behave as a source of electromagnetic radiation under an excited state.

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2. Which of the following represent a spectrum of frequency emission?

- a) Absorption spectra
- b) Emission spectra
- c) EM spectra
- d) None of the mentioned

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Answer: b

Explanation: All bodies behave as a source of em waves and spectrum of frequency emitted is known as emission frequency.

3. Spectrography doesn't compute the energy of frequency spectrum.

- a) True
- b) False

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Answer: b

Explanation: Spectrography can be used for calculating the energy of frequency spectrum.

4. Which of the following source is used for exciting bodies electrically?

- a) DC arc
- b) AC arc
- c) Spark
- d) All of the mentioned

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Answer: d

Explanation: Electrical excitation of body can be carried out using DC arc, AC arc and spark.

5. Which of the following is more used core in spectrometer?

- a) Graphite
- b) Carbon
- c) Aluminum
- d) Fullerine

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Answer: a

Explanation: Graphite is more used material than carbon as core in a spectrometer.

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6. Which of the following represents emission spectra?

- a) Continuous spectra
- b) Band spectra
- c) Line spectra
- d) All of the mentioned

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Answer: d

Explanation: Emission spectra are divided into continuous spectra, band spectra and line spectra.

7. Every spectrograph requires dispersion.

- a) True
- b) False

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Answer: a

Explanation: Spectrograph processes dispersed radiation.

8. Dispersion of radiation is carried out by \_\_\_\_\_

- a) Prism
- b) Grating
- c) Both prism and grating
- d) Diamond

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Answer: c

Explanation: For dispersing radiation, prism or grating elements are used.

9. IR absorption pattern in absorption spectrography is known as \_\_\_\_\_

- a) Finger print
- b) Signature
- c) Absorption code
- d) Graph

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Answer: a

Explanation: Due to uniqueness IR absorption pattern in absorption spectrography is called fingerprint.  
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10. Which of the following represents the fingerprint region?

- a) Less than 7um
- b) Between 7um to 15um
- c) Greater than 15um
- d) Greater than 100um

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Answer: b

Explanation: IR spectrum ranging between 7um to 15um wavelength offer the best discrimination between molecules and hence identified as fingerprint region.

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# Instrumentation Transducers Questions and Answers – Pollution Monitoring

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Pollution Monitoring”.

1. Ozone layer is in earth layer \_\_\_\_\_

- a) Troposphere
- b) Ionosphere
- c) Stratosphere
- d) Mesosphere

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Answer: c

Explanation: Ozone layer is mainly seen in stratosphere.

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2. CFC causes ozone layer depletion.

- a) True
- b) False

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Answer: a

Explanation: Chloro flouro carbon or CFC causes ozone layer depletion.

3. Ozone depletion is higher at \_\_\_\_\_

- a) Polar regions
- b) Near polar regions
- c) Non polar regions
- d) None of the mentioned

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Answer: a

Explanation: Ozone depletion rate of polar regions are higher than any other regions due to the motion of air.

4. Which of the following is not poisonous to humans?

- a) Flue gases
- b) Stack gases
- c) HCl
- d) None of the mentioned

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Answer: d

Explanation: Flue gases, stack gases and HCl are poisonous to humans.

5. Toxic gases such as H<sub>2</sub>S, nitrogen oxides causes \_\_\_\_\_

- a) Immediate harm to body
- b) Slow harm to body
- c) Not sure about speed of action
- d) None of the mentioned

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Answer: a

Explanation: Toxic gases such as H<sub>2</sub>S, nitrogen oxides and CO causes immediate harm to the human body.

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6. NPL stands for \_\_\_\_\_

- a) National population laboratory
- b) National pollution laboratory
- c) National physical laboratory
- d) Net pollution list

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Answer: c

Explanation: Npl stands for national physical laboratory.

7. VOC stands for \_\_\_\_\_

- a) Viable organic components
- b) Volatile organic components
- c) Varying organic components
- d) Virtual organic carriage

[View Answer](#)

Answer: a

Explanation: VOC or volatile organic components emitted by sources are harmful to human.

8. Which of the following represents the allowed rate of CO<sub>2</sub>?

- a) Less than 5000ppm
- b) Less than 700ppm
- c) Less than 300ppm
- d) Less than 100ppm

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Answer: c

Explanation: CO<sub>2</sub> rate above 300ppm causes harm to the human body.

9. Long path optical measurement uses \_\_\_\_\_

- a) IR radiation
- b) Ultraviolet radiation
- c) Both IR and UV
- d) None of the mentioned

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Answer: c

Explanation: Long path optical measurement of pollution uses IR radiation or ultraviolet radiation.

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10. Long path optical measurement has a range of several kilometres.

- a) True
- b) False

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Answer: a

Explanation: Range of long path optical measurement varies from several meters to several kilometres.

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# Instrumentation Transducers Questions and Answers – Robotic Instrumentation

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This set of Instrumentation Transducers Multiple Choice Questions & Answers (MCQs) focuses on “Robotic Instrumentation”.

1. Which of the following is correct for proximity sensors?

- a) Inductive type
- b) Capacitive type
- c) Ultrasonic wave type
- d) All of the mentioned

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Answer: d

Explanation: Proximity sensors may be of capacitive, inductive or ultrasonic type.

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2. Which of the following person used the name robot first time in print?

- a) Josef capek
- b) Karel capek
- c) Isaac asimov
- d) None of the mentioned

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Answer: c

Explanation: Isaac asimov was first to use the word robot in his book.

3. Principles of cybernetics was developed by \_\_\_\_\_

- a) Josef capek
- b) Norbert wiener
- c) Isaac asimov
- d) Karel capek

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Answer: b

Explanation: Norbert wiener developed principles of cybernetics.

4. Which of the following represents muscles of a robot?

- a) Actuators
- b) Power supply
- c) Micro controllers
- d) Robotic arm

[View Answer](#)

Answer: a

Explanation: Actuators convert stored energy into movement and hence known as muscles of a robot.

5. ZMP stands for \_\_\_\_\_

- a) Zero movement power
- b) Zero magnetic point
- c) Zero moment point
- d) Zero metric point

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Answer:

Explanation: ZMP or zero moment point is the algorithm used by robots.

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6. L293D is a/an \_\_\_\_\_

- a) Motor driver IC
- b) Micro controller
- c) Bluetooth module
- d) IR receiver/transmitter

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Answer: a

Explanation: L293D is a DC motor driver IC.

7. ANN stands for \_\_\_\_\_

- a) Artificial neural network
- b) Arithmetic neural network
- c) Artificial neural node

d) None of the mentioned

[View Answer](#)

Answer: a

Explanation: ANN stands for the artificial neural network.

8. In ANN, neurons are represented by \_\_\_\_\_

- a) Processing element
- b) Memory
- c) Wires
- d) None of the mentioned

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Answer: a

Explanation: In artificial neural networks, small processing elements represent neurons.

9. In ANN, all PE's are connected with feedback.

- a) True
- b) False

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Answer: b

Explanation: In an artificial neural network, all processing elements are connected with or without feedback.

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10. MLP is feed-forward network.

- a) True
- b) False

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Answer: a

Explanation: Multi layer perception(MLP), is a simple architecture also known as feed-forward network.

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# Instrumentation Transducers Questions and Answers – Process Control Instrumentation

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This set of Instrumentation Transducers Questions and Answers for Aptitude test focuses on “Process Control Instrumentation”.

1. Ion-isoconcentration technique is used for determination of \_\_\_\_\_

- a) Humidity
- b) Water in organic solvent
- c) pH of solution
- d) None of the mentioned

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Answer: b

Explanation: Ion-isoconcentration technique is used for determining water content in organic solvents.

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2. Which of the following is immiscible in water?

- a) Perchloro ethelyne
- b) Ethanol
- c) Acetone
- d) All of the mentioned

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Answer: a

Explanation: Perchloro ethelyne is immiscible in water, while ethanol and acetone are miscible in all proportions.

3. PICT stands for \_\_\_\_\_

- a) Proton iso-concentration technique
- b) Perchloro ion concentration technique
- c) Proton iso control technique
- d) Proton inhibition cell technique

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Answer: a

Explanation: PICT stands for proton iso concentration technique.

4. PICT has high sensitivity than FICT.

- a) True
- b) False

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Answer: a

Explanation: Proton isoconcentration technique is far sensitive than Flouro iso concentration technique.

5. Which of the following represents RH value of moisture contained sample?

- a) Water activity
- b) Moisture content
- c) Ion concentration
- d) Acidity

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Answer: a

Explanation: Water activity(AW) can be defined as the RH value obtained from measuring moisture containing sample.

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6. Which of the following IR radiation is used in measuring relative humidity?

- a) Wavelength of less than 1um
- b) Wavelength less than 3um
- c) Wavelength greater than 10um
- d) Wavelength of any value

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Answer: b

Explanation: IR radiation of wavelength less than 3um is used for measuring relative humidity.

7. Which of the following is not used for measuring moisture?

- a) IR absorption method
- b) Microwave loss method
- c) Both IR absorption and microwave loss method
- d) None of the mentioned

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Answer: d  
Explanation: Both IR absorption method and the microwave loss method are used for measuring moisture in a substance.

8. For moisture measurement, microwave of \_\_\_\_\_ wavelength is used.

- a) Less than 3um
- b) Less than 3nm
- c) Less than 3mm
- d) less than 3cm

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Answer: d

Explanation: For moisture measurement, microwave of wavelength up to 3cm is used.

9. FICT stands for \_\_\_\_\_

- a) Forced iso concentration technique
- b) Flouro iso concentration technique
- c) Flouro ion concentration technique
- d) Flouro ion carry transfer

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Answer: b

Explanation: FICT stands for flouro iso concentration technique.

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10. Which of the following is correct for water activity?

- a) Ratio of relative equilibrium moisture and 10
- b) Ratio of relative equilibrium moisture and 100
- c) Ratio of relative equilibrium moisture and 1000
- d) Relative equilibrium moisture

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Answer: b

Explanation: Ratio of relative equilibrium moisture at c and 100 gives water activity(AW).

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# Machine Tools Questions and Answers – Manufacturing Process

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This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “Manufacturing Process”.

1. Which manufacturing process includes the powder metallurgy?

- a) casting
- b) forming and shaping
- c) machining
- d) joining

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Answer: b

Explanation: Forming and shaping process includes powder metallurgy. Powder metallurgy is a process in which material or shapes are made from or by using metal powders.

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2. Which of the following is not included in forming and shaping process?

- a) rolling
- b) forging
- c) sheet forming
- d) broaching

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Answer: d

Explanation: Only rolling, forging and sheet forming are included in forming and shaping process. Broaching is included in fabrication process.

3. Expendable mold and permanent mold are the parts of \_\_\_\_ manufacturing process.

- a) machining
- b) casting
- c) none of the mentioned
- d) joining

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Answer: b

Explanation: In casting, we prepare a mould in which we pour liquid metal. Then we solidify the metal and make the product of desired shape with the help of pattern.

4. Casting includes grinding process.

- a) true
- b) false

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Answer: b

Explanation: This is false. Casting doesn't include grinding process. Machining process includes grinding process.

5. Brazing is a type of metal joining process.

- a) true
- b) false

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Answer: a

Explanation: It is a metal joining process. It joints the metal by melting and flowing a filler metal into the joint. The adjoining metal has higher melting point compare to filler metal.

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6. Which of the following is included in machining process?

- a) extrusion
- b) soldering
- c) drilling
- d) coating

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Answer: c

Explanation: Drilling is included in machining process. For drilling, the drill is rotated with a downward pressure causing the tool to penetrate into the material.

7. Which of the following processes are included in finishing?

- a) honing and welding
- b) polishing and lapping
- c) coating and milling
- d) molding and plating

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Answer: b

Explanation: Coating and plating are included in finishing .Welding is included in joining, molding is included in casting and milling is included in machining. Rest all( mentioned ) are included in finishing process.

8. Machining process deals with drawing.

- a) true
- b) false

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Answer: b

Explanation: This is false. Forming and shaping type process include the process like drawing.

9. Which of the following is not the type of finishing process?

- a) diffusion bonding
- b) burnishing
- c) both diffusion bonding and burnishing
- d) none of the mentioned

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Answer: a

Explanation: Only burnishing is an example of finishing process. Diffusion type bonding is included in the of process of joining.  
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10. Which of the following is not the type of joining process?

- a) adhesive bonding
- b) brazing
- c) soldering
- d) none of the mentioned

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Answer: d

Explanation: Adhesive bonding, brazing and soldering all are the types of joining process. In adhesive bonding, adhesive are used to manufacture an assembly. Brazing and soldering are also the type of manufacturing process.

11. Which of the following is the type of permanent joining process?

- a) welding
- b) soldering
- c) both welding and soldering
- d) none of the mentioned

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Answer: c

Explanation: In welding and soldering, once the join has made, we have to break the joint to get different part. So, both welding and soldering are known as permanent joining process.

12. Which of the following is the type of temporary joining process?

- a) brazing
- b) mechanical joining
- c) both brazing and mechanical joining
- d) none of the mentioned

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Answer: b

Explanation: Brazing is the one type of permanent joining process and mechanical joining is the one type of temporary joining process because we can remove the joint with the help of equipments like some type of bolts and so on. Breaking of joint is not necessary in this case.

13. In \_\_\_\_\_ type of manufacturing process, material is wasted. It is in the form of chips.

- a) machining process
- b) casting process
- c) joining process
- d) forming and shaping process

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Answer: a

Explanation: In machining process, some raw material is wasted in or in order to perform different operations like drilling, turning etc.  
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## Machine Tools Questions and Answers – Casting

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This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “Casting”.

1. Which type of metal is used in casting process?

- a) liquid
- b) solid
- c) gas
- d) plastic

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Answer: a

Explanation: In casting, generally we used metal in liquid form so that it can be easily poured and then we solidified it.

2. The casting can be defined as pouring of molten metal into a mould and taking it out after it becomes vapor.

- a) true
- b) false

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Answer: b

Explanation: This is false. In casting, first we take metal in liquid form, Then we pour it and after it we let it to solidify and then we take it out.

3. Which of the following is the component of foundry sand?

- a) river sand
- b) clay
- c) moisture
- d) all of the mentioned

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Answer: d

Explanation: These all are the components of foundry sand. Permeability is the important property for sand casting and this property is totally related with the foundry sand.

4. Which of the following component withstand the high temperature in casting process?

- a) clay
- b) moisture
- c) silica
- d) water

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Answer: c

Explanation: Silica has a property to withstand high temperature. Silica sand is taken out by crushing sandstone. It is mostly used because of its great abundance.  
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5. Why the porous structure provided by the silica is necessary in casting process?

- a) for the escape of gases
- b) for the escape of vapors
- c) for the escape of both gases and vapors
- d) none of the mentioned

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Answer: c

Explanation: Permeability is the important factor for sand casting. If we do not allow gases and vapor to escape from the mould it can damage the casting pattern and can also weaken the strength of the material. Silica allows the escape of gases and vapor and that's why it is necessary to provide this porous structure.

6. The upper portion of the casting flask is known as cope.

- a) true
- b) false

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Answer: a

Explanation: The upper portion of casting flask is known as cope where as lower portion of casting flask is known as drag.

7. Chills are used to increase the heating rate of metal..

- a) true
- b) false

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Answer: b

Explanation: This is false. Chills are generally used to increase the cooling rate of the metal..

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8. Which of the following provide cohesion among the sand particles?

- a) clay and moisture
- b) clay and silica
- c) moisture and silica
- d) none of the mentioned

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Answer: a

Explanation: Silica withstand the high temperature while clay and moisture provide cohesion. So among three pairs, pair of clay and moisture is the right answer.

9. Which of the following component gives the necessary plasticity to sand?

- a) silica
- b) clay
- c) moisture
- d) all of the mentioned

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Answer: b

Explanation: Clay is also used to give plasticity to sand. Clay gives plasticity to sand in order to shape the mould.

10. The mould material used for moulding is a granite.

- a) true
- b) false

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Answer: b

Explanation: The mould material used for molding is a foundry sand. In mould, inner sand is finer known as facing sand and outer sand is known as baking sand.

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# Machine Tools Questions and Answers – Forging

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This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “Forging”.

1. In forging process, metals are shaped by \_\_\_\_\_

- a) impact
- b) cohesion
- c) tense
- d) none of the mentioned

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Answer: a

Explanation: Forging is a manufacturing process which shapes the metal with the help of localized compressive force. It shapes metal with impact force.  
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2. Which method is considered as one of the oldest methods of giving required shapes to the metals ?

- a) casting
- b) forging
- c) forming
- d) none of the mentioned

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Answer: b

Explanation: Experts considered forging as the oldest method of giving required shapes. For a long time, this forging was used by the smith with hammer. After that, this method was cam into picture in industries.

3. Smithy forging can also be termed as open die forging.

- a) true
- b) false

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Answer: a

Explanation: This is true. It gives greater strength and also chances of voids are reduced in this type of forging.

4. Which of the following is the example of impact pressure forging ?

- a) striking a blow
- b) shaping by press
- c) all of the mentioned
- d) none of the mentioned

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Answer: a

Explanation: Striking a blow is an example of impact pressure and shaping by press is an example of squeeze pressure forging.

5. Cold forging is also known as simply forging.

- a) true
- b) false

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Answer: b

Explanation: This is false. Hot forging is known as simply forging.

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6. Which type of forging is done by deforming the metal at room temperature?

- a) cold forging
- b) simply forging
- c) hot forging
- d) all of the mentioned

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Answer: a

Explanation: Cold forging is done by deforming the metal at room temperature. This is done by increasing the level of stress above the elastic limit.

7. Hot forging is also known as simply forging.

- a) true
- b) false

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Answer: a

Explanation: Hot forging is also known as simply forging and metal is heated to the temperature(up to plastic temperature) in this process.

8. The upset type of forging makes increment in the diameter of the workpiece.

- a) true
- b) false

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Answer: a

Explanation: This forging makes increment in the diameter of the workpiece by compressing its length. Engine parts, coupling, bolts etc. are produced with the help of upset forging.

9. Which type of forging is done by blacksmith?

- a) hand forging
- b) machine forging
- c) both hand forging and machine forging
- d) none of the mentioned

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Answer: a

Explanation: Hand forging is done in the smithy shop. This hand forging is done with the help of hand tools or steam hammer.

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10. For which purpose, hand forging is used?

- a) maintenance work
- b) production of small articles tools
- c) repair work
- d) all of the mentioned

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Answer: d

Explanation: Hand forging has the limited application in above regions because accuracy of hand forging depends mainly upon the blacksmith.

11. In which forging process, parts are heated in open hearth?

- a) machine forging
- b) hand forging
- c) both hand forging and machine forging
- d) none of the mentioned

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Answer: b

Explanation: In hand forging, parts are heated in open hearth because it is done in smithy job manually. Shaping is carried out with hand tools.

12. In which forging process, parts are heated in closed hearth?

- a) machine forging
- b) hand forging
- c) hand forging and machine forging both
- d) none of the mentioned

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Answer: a

Explanation: Heavy forgings are produced by presses and light forgings by hammer. In this, the squeezing action is carried entirely on the centre of the part. So,

closed hearth is more preferable.

13. Press forgings are churlish in surface.

- a) true
- b) false

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Answer: b

Explanation: Press forgings are smooth in surface to provide a closed tolerance in case of machine forging.

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14. Roll forging is done with the help of \_\_\_\_\_

- a) cylindrical rolls
- b) semi-cylindrical roll
- c) both cylindrical and semi cylindrical rolls
- d) none of the mentioned

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Answer: c

Explanation: Roll forging is done with the help of both cylindrical and semi cylindrical rolls. These both rolls contains one or more shaped grooves.

15. Cast iron is forgeable.

- a) true
- b) false

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Answer: b

Explanation: This is false. Brittle metal cannot be forged.

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# Machine Tools Questions and Answers – Fabrication Process

1. Which type of process is also known as fabrication process?

- a) casting
- b) forming
- c) joining
- d) none of the mentioned

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Answer: c

Explanation: Joining process is also known as the fabrication process. In fabrication process, product is made from raw materials and not from ready made components.

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2. Which type of manufacturing process can fabrication process be termed?

- a) primary
- b) secondary
- c) tertiary
- d) none of the mentioned

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Answer: b

Explanation: Fabrication process is also known as secondary manufacturing process. Fabrication process doesn't produce raw material. It produce products from raw materials. That's why it is known as secondary process.

3. Which of the following process is not included in fabrication process?

- a) welding
- b) riveting
- c) pressing
- d) surface finish

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Answer: d

Explanation: Welding, riveting and pressing are included in fabrication process, Where as surface finish is included in machining process.

4. Which of the following pair is the part of fabrication process?

- a) welding and metal removal
- b) brazing and sintering
- c) cohesion and sintering
- d) all of the mentioned

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Answer: b

Explanation: Metal removal is the type of machining process and cohesion is included in casting process. Rest are included in fabrication process.

5. Which of the following fabrication process is mainly responsible for the fabrication of very high pressure boilers and nuclear reactors?

- a) welding
- b) sintering
- c) brazing
- d) pressing

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Answer: a

Explanation: Invention of welding has made a revolution in the fabrication process. Complex fabrication processes are also possible because of welding.

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6. Which of the following is not the type of conventional welding process?

- a) gas welding
- b) friction welding
- c) resistance welding
- d) air welding

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Answer: b

Explanation: Only gas welding and resistance welding are the types of conventional welding. friction welding is the type of recent welding process.

7. Which of the following is the type of gas welding?

- a) atomic hydrogen arc welding
- b) shielded metal arc welding
- c) inert gas arc welding
- d) none of the mentioned

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Answer: d

Explanation: None of them is type of gas welding. All are included in welding process of type air welding.

8. Spot welding and seam welding are the types of gas welding.

- a) true
- b) false

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Answer: b

Explanation: This is false. Spot welding and seam welding are included in resistance welding according to the classification of welding.

9. Which of the following is the type of the recent welding process?

- a) laser beam
- b) friction
- c) ultrasonic
- d) all of the mentioned

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Answer: d

Explanation: These all are the types of recent welding process base on the classification of welding process. These all are high accurate welding process with better production rate.

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10. Friction welding is mostly used for rail and road work and joining heavily sections.

- a) true
- b) false

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Answer: b

Explanation: This is false. Thermit welding is used for rail and road work and joining heavily sections.

11. Pressure must be applied in welding process.

- a) true
- b) false

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Answer: b

Explanation: Its not necessary that pressure must be applied in welding process. Pressure may be applied or may not be applied in the process of welding.

12. Oxy acetylene welding and oxy-hydrogen welding are the examples of \_\_\_\_ welding.

- a) gas
- b) air
- c) resistance
- d) friction

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Answer: a

Explanation: These are the types of gas welding base on the classification of welding. Sometimes, this oxy acetylene welding is also known as oxyfuel welding.

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## Machine Tools Questions and Answers – Metal Working and Cutting Tools

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This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “Metal Working and Cutting Tools”.

1. In which operation, motion of job is rotary and motion of cutting tool is forward translating?

- a) turning
- b) planning
- c) milling
- d) all of the mentioned

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Answer: a

Explanation: Turning is done when motion of job is rotary and motion of cutting tool is forward translating. In turning operation, metal is removed from the outer diameter of the surface. It is very basic operation.

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2. Which type of job motion is there in drilling operation?

- a) rotary
- b) translating
- c) fixed
- d) none of the mentioned

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Answer: c

Explanation: Motion of job is fixed in drilling operation. The drilling machine is one of the most important machine tool in workshop after lathe.

3. In which type of operation, motion of cutting tool is translating?

- a) drilling and milling
- b) milling and turning
- c) boring and drilling
- d) turning and planning

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Answer: c

Explanation: Motion of cutting tool is translating in case of boring and milling. Boring is generally performed to enlarge the holes which are previously made and milling is generally performed to remove the material from the metal.

4. In which type of operation, motion of cutting tool is rotary as well as translating?

- a) planning
- b) milling
- c) drilling
- d) turning

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Answer: c

Explanation: In drilling, both type of motion of cutting tool is necessary. For drilling, the drill is rotated with a downward pressure causing the tool to penetrate into the material.

5. In drilling motion of job is rotary.

- a) true
- b) false

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Answer: b

Explanation: This is false. In drilling, motion of job is fixed.

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6. Motion of cutting tool is rotary in milling machine.

- a) true
- b) false

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Answer: b

Explanation: This is false. Motion of cutting tool is intermittent translating in milling operation.

7. Which type of cutting tools have wide application on lathes?

- a) single point
- b) multi point
- c) both single point and multi point
- d) none of the mentioned

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Answer: a

Explanation: Single point cutting tools have wide application on slotting machines. Shear tools, boring tools, planner tools etc. are the examples of single point cutting tools.

8. Which of the following is the example of multi point cutting tool?

- a) milling cutter
- b) broaching tool
- c) both milling cutter and broaching tool
- d) none of the mentioned

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Answer: c

Explanation: Milling cutter and broaching tools use multi point cutting tool to perform their operations. In milling, material is removed as the work is fed against a rotating multipoint cutter. Broaching also remove material but high accuracy. Although its cost is high, it is largely used.

9. In how many groups, cutting tools can be divided?

- a) 2
- b) 3
- c) 4
- d) none of the mentioned

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Answer: a

Explanation: Cutting tools can be classified in two groups : single point cutting tools and multi point cutting tools.

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10. Motion of job is forward rotary in broaching operation.

- a) true
- b) false

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Answer: b

Explanation: This is false. Motion of job is forward translating in broaching operation.

11. Which of the following is an example of non cutting shaping process?

- a) turning
- b) forging
- c) drilling
- d) milling

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Answer: b

Explanation: Only forging is an example of non cutting shaping process, while turning, drilling and milling are the examples of cutting shaping process.

12. Which of the following is the example of cutting shaping process?

- a) knurling
- b) forging
- c) pressing
- d) drawing

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Answer: a

Explanation: Only knurling is an example of cutting shaping process. Where as forging, pressing and drawing are the examples of non cutting shaping process.

13. The process of metal cutting is affected by the relative motion between the piece of work and the hard type edge of a cutting tool against the work piece.

- a) true
- b) false

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Answer: a

Explanation: The relative motion which is produced by the combination of rotary and translating movements either of work piece or of the cutting tool or of both affect the metal cutting process.

14. In how many groups, various metal working processes can be classified?

- a) 2
- b) 3
- c) 4
- d) none of the mentioned

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Answer: 2

Explanation: Metal working process can be classified in two groups : as cutting shaping process and non cutting shaping process.

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## Machine Tools Questions and Answers – Machining Process

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This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “Machining Process”.

1. Why metal removal process is costly?

- a) more energy is required
- b) some of the material is wasted
- c) both more energy is required and some of the material is wasted
- d) none of the mentioned

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Answer: c

Explanation: As we require more energy, cost will definitely increase and again some material is also removed(lost) in this process.

2. In which machining process, removed metal is negligible?

- a) surface finishing
- b) metal removal

- c) none of the mentioned
- d) both surface finishing and metal removal

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Answer: a

Explanation: Metal which is removed, is more ( can't negligible ) in case of metal removal process but in surface finishing metal removal is negligible.

3. Dimension accuracy is not affected in metal removal process?

- a) true
- b) false

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Answer: b

Explanation: This is false. Accuracy of dimension is not affected in surface finishing process.

4. Which of the following process is not grouped under metal removal process?

- a) boring
- b) milling
- c) tumbling
- d) rolling

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Answer: c

Explanation: Only boring and milling are grouped under metal removal process. Tumbling is the type of surface finishing process.

5. Which of the following is not grouped under the surface finishing process?

- a) sawing
- b) tapping
- c) buffing
- d) polishing

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Answer: a

Explanation: Only tapping, buffing and polishing are grouped under surface finishing process. Sawing is the type of metal removal process.  
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6. Metal removal process gives poor contour on the compound.

- a) true
- b) false

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Answer: b

Explanation: This is false. Metal removal process gives poor contour on the compound.

7. In how many groups, metal removal process can be classified?

- a) 2
- b) 3
- c) 4
- d) 5

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Answer: b

Explanation: Metal removal process can be classified as conventional machining, abrasive process and nontraditional machining.

8. In which type of metal removal process, grinding is included?

- a) conventional machining
- b) abrasive process
- c) nontraditional machining
- d) none of the mentioned

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Answer: b

Explanation: As per the classification of metal removal process, it is included in abrasive process. When we remove metal with the help of single or multiple abrasive particle, the process is called abrasive process.

9. \_\_\_\_\_ metal removal process includes milling.

- a) conventional machining
- b) abrasive process
- c) nontraditional machining
- d) none of the mentioned

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Answer: a

Explanation: As per the classification of metal removal process, it is included in conventional process. Conventional machines are machines which requires human efforts and that are not fully automated. Metal removal process need some human efforts.

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10. In which type of metal removal process, thermal energy is included?

- a) conventional machining
- b) abrasive process
- c) nontraditional machining
- d) none of the mentioned

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Answer: c

Explanation: It is included in nontraditional machining. Thermal energy is an energy which is generated from the heat like kinetic energy of molecule, chemical energy of particle and so on.

11. Which of the following is the type of nontraditional machining?

- a) turning
- b) drilling
- c) milling
- d) none of the mentioned

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Answer: d

Explanation: Turning, drilling and milling are the types of nontraditional machining. Drilling means make a hole by using drilling machine and milling machine is a machine tool that removes metal as the work is fed against multipoint cutter. Turning is basic operation generally carried out on lathe machine.

12. In which metal removal process, material is removed by particles?

- a) conventional machining
- b) abrasive process
- c) nontraditional machining
- d) none of the mentioned

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Answer: b

Explanation: It can be understood from the definition of abrasive process. Like in abrasive water jet operation, material is removed by erosion.

13. In which process, various energy forms other than sharp cutting tool is used to remove materials?

- a) conventional machining
- b) abrasive process
- c) nontraditional machining
- d) none of the mentioned

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Answer: c

Explanation: It can be understood from the definition of nontraditional machining. Non-traditional machining is an operation which do not use shear as their primary sources of energy.

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14. Metal removal process is also termed as primary production process.

- a) true
- b) false

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Answer: b

Explanation: This is false. Metal removal process is also termed as secondary production process.

15. Which of the following is not the type of nontraditional machining?

- a) electrochemical process
- b) chemical machining
- c) mechanical energy process
- d) none of the mentioned

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Answer: d

Explanation: Electrochemical process, chemical machining and mechanical energy process are all the types of nontraditional machining. Apart from these, photochemical, chemical milling, ultrasonic machining, laser beam machining etc. are also the type of nontraditional machines.

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# Machine Tools Questions and Answers – Classification of Machine Tools

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This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “Classification of Machine Tools”.

1. Which of the following is included in basic machine tools?

- a) lathe machine
- b) production milling machine
- c) production drilling machine
- d) none of the mentioned

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Answer: a

Explanation: According to the definition of basic type of machine tools, lathe is basic machine tool while production milling machine and production drilling machines are special purpose drilling machines.

2. Which type of machine tool is used for mass production of essentially small parts?

- a) general purpose
- b) special purpose
- c) automatic screw cutting
- d) none of the mentioned

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Answer: c

Explanation: The automatic type of screw cutting is used for this purpose. The automatic screw cutting is used because of its high accuracy.

3. Which of the following does all the work of lathe machine?

- a) turning centre of CNC type
- b) machining centre of CNC type
- c) turning centre of CNC type and machining centre of CNC type both
- d) none of the mentioned

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Answer: a

Explanation: This type of turning centre does most of jobs of lathe. Lathe is a basic machine used for producing cylindrical machine. It is considered as father of machine tool.

4. CNC machining centre does all the work \_\_\_\_\_

- a) milling machine
- b) drilling machine
- c) both milling and drilling machine
- d) none of the mentioned

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Answer: c

Explanation: CNC machining centre perform almost all jobs of milling and drilling machines. Drilling machine is used to produce holes and milling machines remove metal as the work is fed against a rotating multipoint cutter.

5. Which of the following is the type of lathe machine?

- a) capstan
- b) turret
- c) both capstan and turret
- d) none of the mentioned

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Answer: c

Explanation: These both are categorized under the types of lathe machine. Turret and capstan lathe are generally used for the production of duplicate parts  
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6. The development of machine tools (which are used for metal cutting) started from the invention of cylinder.

- a) true
- b) false

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Answer: a

Explanation: According to the history of machine tools, Egyptians were the first, who used that. They used the cylinder.

7. DNC stands for \_\_\_\_\_

- a) digital numerical control
- b) direct numerical control
- c) double numerical control
- d) none of the mentioned

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Answer: b

Explanation: DNC is the abstract form of direct numerical control.

8. Machine tools are economical for producing large lots.

- a) true
- b) false

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Answer: b

Explanation: This is false. Machine tools are only economical, when it is used for producing small number of pieces.

9. The capacity and the efficiency of the universal machine tools are high.

- a) true
- b) false

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Answer: b

Explanation: This is false. It is comparatively low in case of universal machine tool.  
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10. Machine tools can be classified as \_\_\_\_\_

- a) geometric shape of the work piece
- b) number of the work piece
- c) function of the machine
- d) all of the mentioned

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Answer: d

Explanation: These all are the aspects, which are responsible for the classification. In machine tools, lathe is the most important machine tool followed by drilling machine and shaper machine.

11. Revolver machine tool is an example of special purpose machine tool.

- a) true
- b) false

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Answer: a

Explanation: This is false. Revolver machine tool is an example of production machine tool.

12. The demand of instruments or parts, which are used for purpose of measurements are more in NC machine tool.

- a) true
- b) false

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Answer: b

Explanation: This is false. The demand are less in case of NC machine tool.

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# Machine Tools Questions and Answers – Lathe : Working Principle

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This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “Lathe Working Principle”.

1. Which machine tool is known as the mother machine tool?

- a) drill
- b) milling
- c) lathe
- d) none of mentioned

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Answer: c

Explanation: Lathe is known as the mother machine tool because it can perform various type of operations. It is a versatile machine.

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2. Lathe is primarily used for producing \_\_\_\_ surfaces.

- a) flat
- b) curve
- c) taper
- d) none of the mentioned

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Answer: d

Explanation: Lathe is primarily used for producing cylindrical surfaces. But today it can perform various operations and perform various surfaces like curvilinear surface, flat surface and so on.

3. Which type of surface is produced by turning operation in lathe machine?

- a) flat

- b) cylindrical
  - c) taper
  - d) none of the mentioned
- [View Answer](#)

Answer: b

Explanation: Cylindrical surface is produced by turning operation in lathe machine. This turning can be done on the external surface. Boring is a type of turning which is performed in the internal surface.

4. What is the necessary condition for turning?

- a) material of work piece should be harder than the cutting tool
- b) cutting tool should be harder than the material of work piece
- c) hardness of the cutting tool and material of piece should be same
- d) none of the mentioned

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Answer: b

Explanation: Cutting tool should be harder than the material of work piece, so that it can be able to cut the work piece into the desire shape.

5. Traversing of tool parallel to the axis of job is termed as \_\_\_\_\_

- a) cross feed
- b) longitudinal feed
- c) both cross feed and traversing feed
- d) none of the mentioned

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Answer: b

Explanation: It is the definition of longitudinal feed. Similarly, traversing of tool perpendicular to the axis of job is known as cross feed.  
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6. The swing diameter over the bed is the largest diameter.

- a) true
- b) false

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Answer: a

Explanation: This is true. Swing diameter over the lathe is the largest diameter of work over the bed that will revolve without touching height of the centres measured from the bed of the lathe.

7. Lathe cannot produce internal features like holes.

- a) true
- b) false

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Answer: b

Explanation: This is false. Lathe is a versatile machine tool. It can produce holes, flat surfaces and so on.

8. Which type of feed is needed in facing operation?

- a) longitudinal
- b) cross
- c) both cross and longitudinal
- d) none of the mentioned

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Answer: b

Explanation: Facing operation is done by the cross feed. In facing, workpiece is rotated against the single point cutting tool.

9. Which type of surface is produced in facing operation?

- a) cylindrical
- b) taper
- c) flat
- d) none of the mentioned

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Answer: c

Explanation: Flat surface is produced in facing operation as per the definition. In facing operation, metal is removed by the tool from the end of the metal and flat surface is produced.

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10. Traversing of tool at any angle to the job axis produces curve surfaces.

- a) true
- b) false

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Answer: b

Explanation: This is false. Traversing of tool at any angle to the job axis produces taper surfaces.

11. In taper operation, which type of surface is produced?

- a) flat
- b) curve
- c) circular
- d) none of the mentioned

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Answer: d

Explanation: Taper type surface is produced in the process of taper turning. Taper is a shape in which the diameter of the both ends of bar are different.

12. Which type of feed is needed in turning operation?

- a) longitudinal
- b) cross
- c) both cross and longitudinal
- d) none of the mentioned

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Answer: a

Explanation: As per definition, longitudinal feed is needed in turning operation. Longitudinal feed is always parallel to the axis of rotation of the spindle.

13. Which type of surface can be produced by lathe?

- a) flat
- b) cylindrical
- c) curvilinear
- d) all of the mentioned

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Answer: d

Explanation: Lathe is a versatile machine. It can perform various types of jobs. It is primarily intended for producing only cylindrical surface but it can produce various types of surfaces.

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# Machine Tools Questions and Answers – Types of Lathe

This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “Types of Lathe”.

1. Which type of lathe is also known as centre lathe?

- a) engine lathe
- b) bench lathe
- c) room lathe
- d) capstan lathe

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Answer: a

Explanation: Engine lathe is also known as the centre lathe. This centre lathe is generally used for the production of cylindrical surfaces.  
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2. Wheel lathe is the type of \_\_\_\_

- a) engine lathe
- b) centre lathe
- c) speed lathe
- d) special purpose lathe

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Answer: d

Explanation: Wheel lathe is the type of special purpose lathe. This lathe is generally used for the purpose of turning wheels of railways locomotives and so on.

3. Wood working lathe is the type of \_\_\_\_

- a) engine lathe
- b) centre lathe
- c) speed lathe
- d) special purpose lathe

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Answer: c

Explanation: Wood lathe is the type of speed lathe. Speed lathe can revolve spindle with great speed. It is also used for turning small objects.

4. Geared lathe is the type of \_\_\_\_

- a) engine lathe
- b) centre lathe
- c) speed lathe
- d) special purpose lathe

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Answer: a

Explanation: Geared lathe is the type of engine lathe. Engine lathe is a screw cutting type lathe. It has back-geared cone-driven headstock.

5. Belt driven lathe is the type of \_\_\_\_

- a) engine lathe
- b) centre lathe
- c) speed lathe
- d) special purpose lathe

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Answer: b

Explanation: Belt driven lathe is the type of centre lathe. In practical, various types of belt driven machines are used like V belt driven machine and so on.  
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6. Duplicating lathe is the type of \_\_\_\_

- a) engine lathe
- b) centre lathe
- c) speed lathe
- d) special purpose lathe

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Answer: d

Explanation: As per the classification of lathe, duplicating lathe the type of special purpose lathe. It is rarely used.

7. Spinning lathe is the type of \_\_\_\_

- a) engine lathe
- b) centre lathe
- c) speed lathe
- d) special purpose lathe

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Answer: c

Explanation: Spinning lathe is the type of speed lathe. Spinning lathe is a lathe generally used the purpose of shaping metal holloware with the help of flat stock over a form (of revolving type) with the help of hand tool.

8. Which of the following is the type of engine lathe?

- a) centering lathe
- b) individual motor driven lathe
- c) duplicating lathe
- d) all of the mentioned

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Answer: b

Explanation: Centering lathe is the example of speed lathe and duplicating lathe is the type of special purpose lathe while individual motor driven lathe is an example of engine lathe.

9. Which of the following is special purpose lathe?

- a) polishing lathe
- b) centering lathe
- c) spinning lathe
- d) none of the mentioned

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Answer: d

Explanation: Polishing lathe, centering lathe and spinning lathe are the examples of speed lathe.  
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10. Which of the following is the example of speed lathe?

- a) wheel lathe
- b) polishing lathe
- c) gap bed lathe
- d) all of the mentioned

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Answer: b

Explanation: Wheel lathe and gap bed lathe are the examples of the special purpose lathe while polishing lathe is an example of speed lathe.

11. T – lathe is the example of bench lathe.

- a) true
- b) false

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Answer: b

Explanation: This is false. T – lathe is the example of special purpose lathe.

12. Which of the following is the type of lathe?

- a) bench lathe
- b) tool room lathe
- c) capstan and turret lathe
- d) all of the mentioned

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Answer: d

Explanation: These all are the types of lathe as per the lathe classification. Lathe is primarily intended for the purpose of producing cylindrical surfaces although today it becomes a versatile tool.

13. Lathe can be classified on the basis of \_\_\_\_\_

- a) designs and construction
- b) fundamental principle
- c) function performance
- d) all of the mentioned

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Answer: a

Explanation: All types of lathe machine employ the same fundamental principle of operation and perform the same function. They differ only in the terms of their designs and constructions.

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14. Wood working lathe is the example of capstan and turret lathe.

- a) true
- b) false

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Answer: b

Explanation: This is false. Wood working lathe is the example of speed lathe.

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# Machine Tools Questions and Answers – Lathe : Bed

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This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “Lathe : Bed”.

1. Which of the following is the base of the lathe machine?
  - a) bed
  - b) tailstock
  - c) headstock
  - d) none of the mentioned

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Answer: a

Explanation: Bed is the base of the lathe machine. This provides the necessary working height for the lathe.

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2. Which of the following is fitted on the bed?
  - a) headstock
  - b) tailstock
  - c) headstock and tailstock both
  - d) none of the mentioned

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Answer: c

Explanation: These both are fitted on the bed as per the definition. This is the structure on which the entire lathe parts are situated.

3. The bed generally rest on copper structure.

a) true

b) false

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Answer: b

Explanation: This is false. Actually, the bed generally rest on cast iron or welded structure.

4. Which of the following is not the part of the bed?

a) vee slide

b) tailstock

c) carriage

d) none of the mentioned

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Answer: d

Explanation: All are the part of the bed. Tailstock is a sliding unit on the bed-ways of the lathe bed. Carriage is the part of the lathe which slides over the bed-ways.

5. Which of the following provides foundation for the whole machine?

- a) tailstock
- b) bed
- c) headstock
- d) carriage

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Answer: b

Explanation: As per the definition of the bed. It is the base of lathe which provides needed height as well as foundation for whole machine.  
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6. Small lathes have a sliding bed.

- a) true
- b) false

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Answer: b

Explanation: This is false. Generally, small lathes don't need a sliding bed. Very large lathes have a sliding bed.

7. There are some beds, which hold a gap closer to the headstock.

- a) true
- b) false

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Answer: a

Explanation: It can be easily seen from the definition of the bed. The headstock is a fixed unit of the lathe on the left hand side of the lathe bed.

8. Which type of bed design offers more rigidity and thermal stability?

- a) true slant bed
- b) flatbed
- c) conventional bed
- d) none of the mentioned

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Answer: a

Explanation: True slant bed provides more rigidity and thermal stability as compare to others. It is very necessary for chips to fall to the chip plan. Slant bed do this job better than flat bed and conventional bed.

9. In which slant angles, the slant bed design is offered?

- a) 30 and 60
- b) 60 & 45
- c) 30, 60 and 45
- d) 30 and 45

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Answer: c

Explanation: Mainly this bed design is offered in 30 and 45 slant angles, but sometimes slant bed of 60 degree type is also offered.  
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10. In which type of bed, length of guide rail is bounded to the deepness of the casting?

- a) true slant bed
- b) flat bed
- c) conventional bed
- d) none of the mentioned

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Answer: b

Explanation: It can be easily seen from the definition of the flat bed. The guide way is the surface of the bed in contact with the sliding units of lathe.

11. There are some beds, which hold a gap closer to the headstock.

- a) true
- b) false

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Answer: a

Explanation: The gap is there so that it can permit bigger diameters to be turned.

12. Which of the following is the part of bed?

- a) vee slide

- b) machine ways
  - c) headstock
  - d) all of the mentioned
- [View Answer](#)

Answer: d

Explanation: All are the parts of the bed. This bed and its parts generally assigned iron casting.

13. In which type of bed, a heavy machine along with a smaller footprint achieved?

- a) true slant bed
- b) flat bed
- c) conventional bed
- d) all of the mentioned

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Answer: a

Explanation: This is the advantage of true slant bed. It takes up less space, everything is rotated about the centerline which is slightly away from the operator which is capable of putting the spindle closer to get parts in and out.

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## **Machine Tools Questions and Answers – Lathe : Cone Pulley Drive**

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This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “Lathe : Cone Pulley drive”.

1. Which of the following are the advantages of cone pulley drive?

- a) easy to maintain
- b) can take up heavy load
- c) positive drive when the back gear is in engagement.
- d) all of the mentioned

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Answer: d

Explanation: These all are the advantages of the cone pulley drive. It is stepped pulley mounted on the main spindle which is free to revolve.  
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2. Number of spindle speeds is limited to the number of steps in the cone pulley drive.

- a) true
- b) false

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Answer: a

Explanation: It can be easily seen from the definition of cone pulley drive. This cone pulley gets the drive from the main motor.

3. What happens during the overload in the cone?

- a) number of steps in cone pulley increases
- b) belt slips off
- c) nothing happens
- d) none of the mentioned

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Answer: b

Explanation: During the overload in the cone, the belt slips off so that no major damage happens to the lathe.

4. It doesn't take time to change spindle speeds.

- a) true
- b) false

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Answer: b

Explanation: This is false. In practical work, it takes time to change the spindle speed.

5. Cone pulley drive without back gear arrangement means \_\_\_\_\_

- a) back gear in
- b) back gear out
- c) back gear neutral
- d) none of the mentioned

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Answer: b

Explanation: It can be easily seen from the definition of the back gear. The headstock having cone pulley drive is known as cone pulley headstock.

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6. Cone pulley drive with back gear arrangement means \_\_\_\_\_

- a) back gear in
- b) back gear out
- c) back gear neutral
- d) none of the mentioned

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Answer: a

Explanation: It can be easily seen from the definition of the back gear. The axis of this back gear shaft is parallel to the axis of the main spindle.

7. Which of the following is mounted on the bush bearing?

- a) speed motor
- b) spindle
- c) both spindle and speed motor
- d) none of the mentioned

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Answer: b

Explanation: As per the construction of lathe, spindle is fitted on the bush bearing. It is mounted in the headstock casting and a gear wheel called bull gear is keyed to it.

8. Stepped pulley mounted on the main spindle is fixed.

- a) true
- b) false

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Answer: b

Explanation: This is false. Stepped pulley is free to revolve.

9. The back gear unit has a shaft, which carries \_\_\_\_\_

- a) a gear
- b) a pinion
- c) a gear and a pinion both

d) none of the mentioned

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Answer: c

Explanation: The back gear unit has a shaft, which carries a gear and a pinion. The number of teeth of the gear and a pinion on the back gear shaft corresponds to the number of teeth on the bull gear and the pinion on the cone pulley.

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10. The axis of the back gear is \_\_\_\_\_ to the axis of the main spindle.

- a) parallel
- b) perpendicular
- c) at any angle other than 0 and 90
- d) none of the mentioned

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Answer: a

Explanation: The axis of the back gear is parallel to the axis of the main spindle and the back gear is bought in engagement or disengagement with the cone pulley system by means of a lever.

11. A three-stepped cone pulley headstock provides three direct ranges of speeds.

- a) true
- b) false

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Answer: a

Explanation: This is true. A three-stepped cone pulley headstock provides three direct ranges of speeds through the belt connection and with the back gear in engagement, three further ranges of reused speeds can be obtained.

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## **Machine Tools Questions and Answers – Lathe : All Gear Drive**

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This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “All Gear Drive”.

1. It is a box section having a top cover. For which of the following part of lathe, above sentence is true?

- a) cone pulley drive
- b) all gear drive
- c) carriage
- d) none of the mentioned

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Answer: b

Explanation: The mentioned sentence is true for all gear drive as per the definition of it. The headstock having all gear drive is known as all-gear headstock.  
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2. The top cover of all gear drive is \_\_\_\_\_

- a) removable
- b) non-removable
- c) can't say anything
- d) none of the mentioned

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Answer: a

Explanation: The top cover of all gear drive is removable if needed. All gear drive is like a box section of lathe.

3. All gear drive is equipped with \_\_\_\_\_

- a) clutches
- b) a brake
- c) clutches and a brake both
- d) none of the mentioned

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Answer: c

Explanation: All gear drive is equipped with these both clutches and a bark. Clutch is a device which is used to connect and disconnect an engine and power transmission.

4. All gear drive has external webs.

- a) true
- b) false

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Answer: b

Explanation: This is false. All gear drive has internal webs for shaft bearing and some other purposes.

5. Output shaft is connected by means of V belts to the main motor.

- a) true
- b) false

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Answer: b

Explanation: This is false. Actually, input shaft is connected by means of V belts to the main motor.  
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6. Sliding gears may be mounted on \_\_\_\_\_ intermediate shafts.

- a) only one
- b) only two
- c) two or more than two
- d) none of the mentioned

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Answer: c

Explanation: There may be two or more intermediate shafts on which sliding gears are mounted. It has an input shaft which is connected by means of V belts to the main motor.

7. The main spindle is the first driven shaft in the headstock assembly.

- a) true
- b) false

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Answer: b

Explanation: This is false. The main spindle is the last driven shaft in the headstock assembly.

8. Which of the following operates the forks of the sliding gears?

- a) lever
- b) spindle
- c) clutch
- d) none of the mentioned

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Answer: a

Explanation: The lever operates the forks of the sliding gears. These levers are situated outside the front of the headstock assembly.

9. The nose of the spindle is outside the headstock casting.

- a) true
- b) false

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Answer: a

Explanation: This is true. These noses are designed to accommodate the work holding devices.

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10. What is the purpose of having webs in all gear drive?

- a) for stiffening
- b) for taking shaft bearings
- c) for stiffening and taking shaft bearing both
- d) none of the mentioned

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Answer: c

Explanation: The webs are used for these two purposes: for taking shaft bearings and for stiffening. This gear drive also has shafts equipped with clutches and a brake.

11. Which of the following is not true regarding the all gear drive?

- a) the headstock having all gear drive is known as all geared headstock
- b) the nose of the spindle is designed to accommodate the work holding devices
- c) the nose of the spindle is inside the headstock casting
- d) none of the mentioned

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Answer: c

Explanation: All the mentioned sentences are true except the one which says that the nose of the spindle is inside the headstock casting. Actually, the nose of the spindle is outside the headstock casting.

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# Machine Tools Questions and Answers – Lathe : Tailstock

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This set of Machine Tools Multiple Choice Questions & Answers (MCQs) focuses on “Tailstock”.

1. Which of the following is not true regarding tailstock?

- a) tailstock is also known as loose headstock
- b) it is a fixed unit on the bed ways
- c) it provides support to the other end of the work when it is being machined
- d) none of the mentioned

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Answer: b

Explanation: The all above mentioned statements are correct except one which says that it is a fixed unit on the bed ways. Actually, it is a sliding unit on the bed ways

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2. For performing which kind of operations, it ( tailstock ) holds a tool?

- a) drilling
- b) reaming
- c) tapping
- d) all of the mentioned

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Answer: d

Explanation: Tail stock holds a tool for performing operations such as drilling, reaming, tapping etc. To accommodate different lengths of work, the body of the tailstock can be adjusted along the ways chiefly by sliding it to the desired position.

3. The body of the tailstock can be adjusted by clamping with the help of\_\_\_\_\_

- a) bolts
- b) plates
- c) bolts and plates both
- d) none of the mentioned

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Answer: c

Explanation: The body of the tailstock can be adjusted by clamping with the help of bolts and plates to adjust with job's dimensions. The body of tailstock is situated on the right hand side of the lathe bed.

4. The upper casting of the body can be moved\_\_\_\_\_ from the operator.

- a) toward
- b) away
- c) toward or away both
- d) none of the mentioned

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Answer: c

Explanation: The upper casting of the body can be moved toward or away from the operator. This movement is done with the help of setover screw to offset the tailstock for taper turning and to realign the tailstock centers for straight turning.

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5. Which of the following is not the part of spindle?

- a) dead center
- b) hand wheel
- c) setover screw
- d) none of the mentioned

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Answer: d

Explanation: All above mentioned are the parts of spindle. In tailstock, the spindle holds dead center. In headstock, the spindle is able to hold live center.

6. Offset of tailstock is done for\_\_\_\_\_

- a) taper turning
- b) straight turning
- c) both turning of taper type and straight type
- d) none of the mentioned

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Answer: a

Explanation: Offset is done for the purpose of taper turning. Taper is a shape in which the diameter of the both ends are different.

7. Realign of tailstock center is done for\_\_\_\_\_

- a) taper turning
- b) straight turning

c) taper turning and straight turning  
d) none of the mentioned

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Answer: b

Explanation: Realign is done for the purpose of straight turning. The body is bored to act as the barrel which carries the tailstock spindle that moves in and out of the barrel by means of a screw when the tailstock hand wheel is turned.

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8. Which type of rotation of the hand wheel causes the spindle to be drawn inward?

- a) clockwise
- b) anticlockwise
- c) either anticlockwise or clockwise
- d) none of the mentioned

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Answer: b

Explanation: Anticlockwise rotation of the hand wheel causes the spindle to be drawn inward. This spindle has a keyway in the underside which mates with a small key fitted on the barrel to prevent rotation.

9. The front of the spindle has a taper hole.

- a) true
- b) false

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Answer: a

Explanation: The front of the spindle has a taper hole into which the dead centre or other tools fit.

10. Anticlockwise rotation of the hand wheel causes the spindle to advance.

- a) true

- b) false

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Answer: b

Explanation: This is false. Clockwise rotation of the hand wheel causes the spindle to advance. Due to this clockwise and anticlockwise movement, the end of the screw strikes the back of the dead center or any tool that is fitted into the hole.

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