

Hardware



Papers Dock

COMPUTER SCIENCE 9618 PAPER I

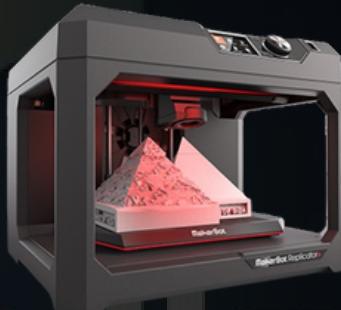
Hardware

TYPES OF HARDWARE



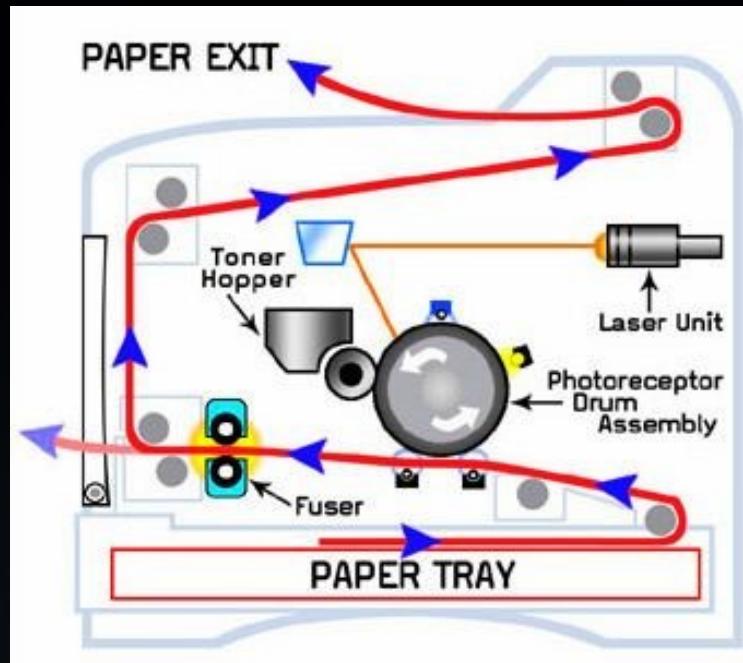
Principal Operation Of Hardware Devices

1) 3D Printer



- The object is designed using computer-aided design software
- The software splits the object into slices
- The data about the slices is sent to the printer
- The solid plastic is melted and transferred to the nozzle
- A stepper motor moves the nozzle into position
- The nozzle extrudes the molten plastic
- The previous steps are repeated until the layer is complete
- A fan cools the layer
- Each layer is printed by following the same steps

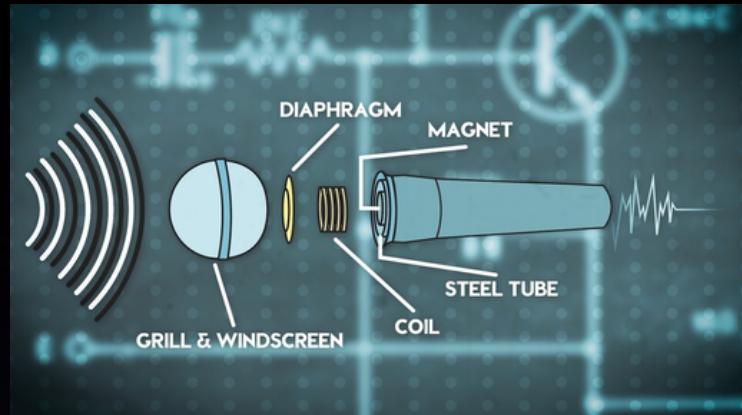
2) Laser Printer



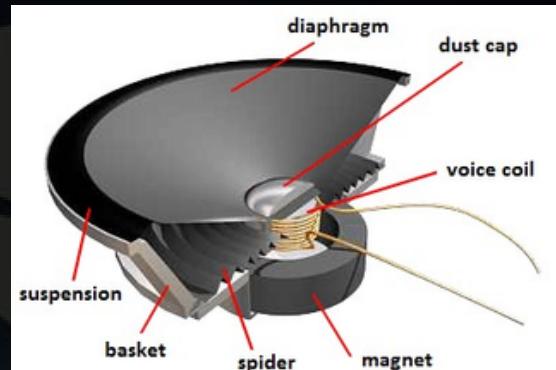
- The revolving drum is initially given electrical charge.
- A laser beam bounces off moving mirror scans back and forth across the drum.
- Discharging certain points such as letters or images to be printed as electrical charges.
- The drum is coated with oppositely charged toner which only sticks to charged areas.
- The pattern on the drum is transferred to the paper.
- The paper is passed through the fuser to seal the image.
- The electrical charge is removed from the drum and excess toner is collected.

3) Microphone

- The microphone has a diaphragm
- The incoming sound wave causes vibration
- causing a coil to move past a magnet
- An electric signal is produced



4) Speakers



- Takes an electrical signal and translates it into physical vibrations to create sound waves
- An electric current in the coil creates an electromagnetic field
- Changes in the audio signal cause the direction of the electric current to change
- The direction of the current determines the polarity of the electromagnet
- The electromagnet is repelled by or attracted to permanent magnet
- Causing the coil to vibrate
- The movement of the coil causes the cone to vibrate
- The vibration is transmitted to the air in front of the cone
- The amount of movement will determine the frequency and amplitude of the sound wave produced

What are the components of the speaker?

- Cone, Coil of wire, Permanent Magnet, Dust cap

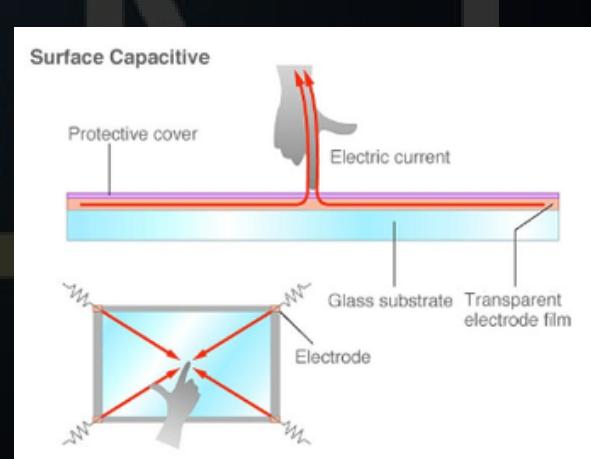
5) Resistive Touch Screen

- Consist of two charged plates
- Pressure causes the plates to touch
- Completing the circuit
- Point of contact registered
- Coordinates used to calculate the position



6) Capacitive Touch Screen

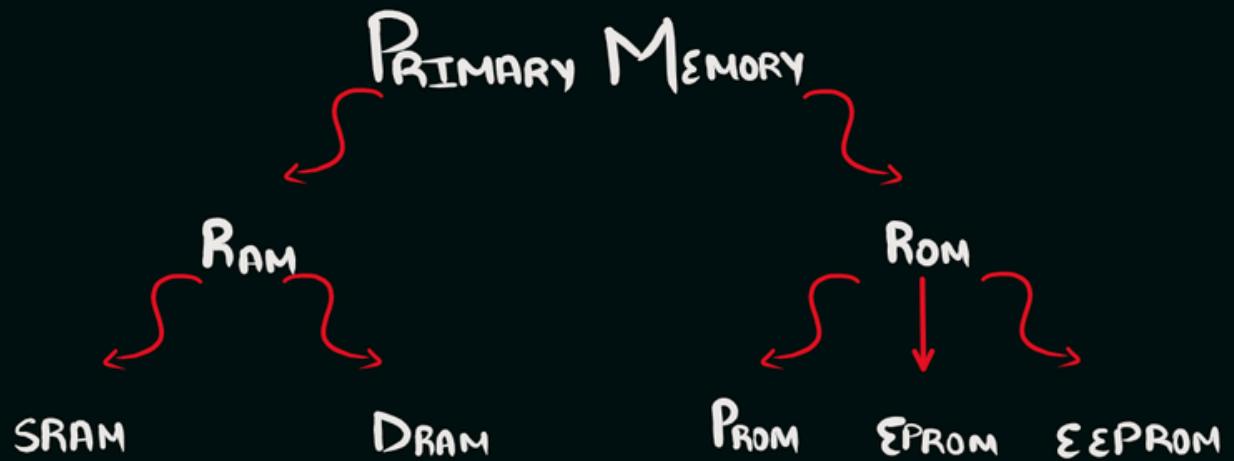
- Made from materials that store electric charge
- When touched, charge transferred to the finger
- Sensors at the screen corners detect the change
- Points of contact registered
- Coordinates used to calculate the position



7) Virtual Reality Headset



- **Headset can have one or two LCD displays/screens/lenses that output images to the user.**
- **Headset includes speakers that output surround sound for a realistic experience.**
- **Head movements are detected using a sensor.**
- **Sensor is typically a gyroscope or accelerometer.**
- **Data from the sensor is transmitted to a microprocessor for analysis.**
- **Microprocessor identifies the direction and speed of head movements.**
- **Some headsets use digital cameras to record and analyze the user's eye movements.**



What is the difference between RAM and ROM?

- Ram is volatile memory (Temporary memory)
- Rom is non-volatile (Permanent memory)
- Data can be altered in RAM
- Data cannot be changed in Rom
- Ram stores data in use
- Rom stores boot-up instructions
- Ram is read/write
- Rom is read-only

Uses Of RAM and Rom in 3D Printer

RAM

- Stores current running parts of 3D printer software
- Stores the content of buffer
- Stores the current progress of printer
- Stores the data about the layers being printed
- Stores the data about the printer e.g. Nozzle position

ROM

- Stores the operating system for the 3D printer
- Stores the setup instructions for the 3D printer

Uses of RAM and ROM in laser printer

RAM

- Stores the currently running part of laser printer
- Stores the data being printed or in buffer
- Stores the current progress of printing
- Stores the information of printer e.g. toner level

ROM

- Stores the operating software of printer
- Stores the boot-up instruction of printer



DRAM (Dynamic Random Access Memory)



SRAM (Static Random Access Memory)

Explain the difference between DRAM and SRAM

- DRAM has to be refreshed
- SRAM no refresh required
- DRAM uses a single transistor and capacitor
- SRAM uses more than one transistor
- DRAM stores each bit as a charge
- SRAM stores each bit using flip-flop
- DRAM higher power consumption
- SRAM less power consumption
- DRAM less expensive as fewer transistors
- SRAM more expensive as more transistors
- DRAM slow access time as refresh is required
- SRAM faster access time as no refresh
- DRAM more storage
- SRAM less storage
- DRAM used in main memory
- SRAM used in cache memory

Explain why Static RAM is used in the laptop instead of Dynamic Ram

- **Static RAM has faster access time**
- ... because it does not need to be refreshed
- ... used on the CPU for improvement of CPU cache speed
- **Static RAM has lower**

NOTE: SRAM uses transistors arranged as flip-flops, and DRAM uses transistors and capacitors.

Read Only Memory

PROM: Programmable Read Only Memory

EPROM: Erasable Programmable Read Only Memory

EEPROM: Electrically Erasable Programmable Read Only Memory

PROM

- Initially Empty
- User can write data on it only once
- If there is any error in writing instructions, the error cannot be removed
- The chip becomes unusable

EPROM

- Initially Empty
- Can be overwritten multiple times
- If there is an error in writing instructions, the error can be removed
- EPROM can be erased using UV light
- EPROM needs to be removed from the device
- EPROM must be entirely erased before writing

EEPROM

- Initially Empty
- Can be overwritten multiple times
- If there is an error in writing instructions, the error can be removed
- EEPROM can be erased using voltage
- EEPROM can be erased in its original position
- EEPROM does not have to be entirely erased before writing

Explain the difference between PROM, EPROM, and EEPROM

- PROM can be set once, EPROM and EEPROM can be overwritten multiple times
- EPROM can be erased using UV light, EEPROM can be erased using voltage
- EPROM needs to be removed from the device, EEPROM can be erased on-site
- EPROM must be entirely erased before writing, but EEPROM does not have to be entirely erased before writing

Buffer: Buffer memory is a temporary storage area in the RAM that stores data transferring between two or more devices.

The computer uses a buffer when transmitting data to the VR headset.

Explain how a buffer is used when data is transmitted between the computer and the VR headset

- **The buffer is used as a temporary store for data going to the headset**
- **Data is transferred into the buffer by the computer**
- **Data is retrieved from the buffer by the headset**
- **When the buffer is empty/full an interrupt is sent to the computer requesting more data/stopping further data being sent**
- **When the headset has enough data/needs more data, an interrupt is sent by the headset to the computer to stop sending data from buffer**

Describe how the laser printer makes use of buffer.

- **The print instructions and data are sent by the laptop to a buffer (at laptop speed)**
- **The data is transferred from the buffer to the printer (at printer speed)**
- **allowing user to continue using the laptop**
- **instead of waiting for relatively slower printer**
- **When the buffer is empty an interrupt is sent to the laptop**
- **requesting more data**

Benefits of EEPROM In Virtual Headset

- EEPROM allows frequent/multiple read/write/erase operations
- so the headset can take advantage of new features
- without fully erasing the contents of the firmware in the headset first // can erase a particular byte or the whole EEPROM
- without removing the chip(s)/firmware from the headset
- the contents of the firmware in the headset can be changed by the user without technical expertise
- Cheaper to manufacture so headset will be cheaper to purchase

Note : From the above answer just try to understand what are the benefits of EEPROM and so you can write for any hardware,

Describe the contents of the ROM in the central computer.

- Stores the bootstrap program (BIOS)
- Stores the start-up instructions for the (any application)
- Stores the kernel of the Operating System

Different Types Of Storage Media

Magnetic Media

- surface coated with magnetic material
- magnetic properties are altered to represent 1s and 0s
- used by hard disks, magnetic tapes, floppy disks

Optical Media

- surface coated with light sensitive material
- read / written by lasers
- CDs use one spiral track
- used by DVD-RAM, CD-R, CD ROM, CD RW, Blu-ray disc

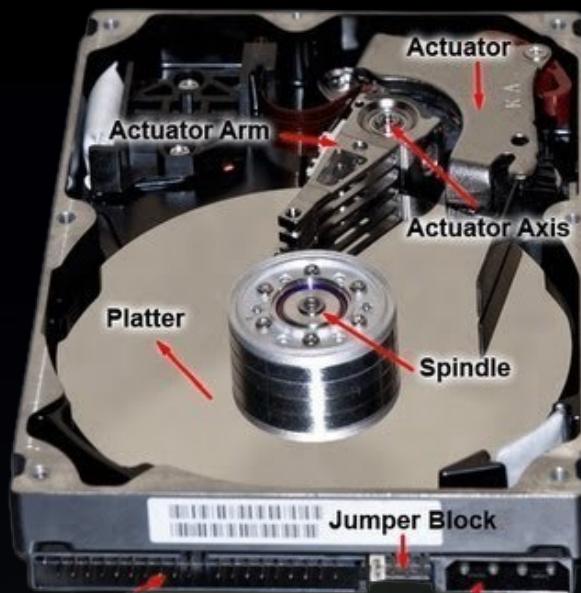
Solid State Media

- uses millions of tiny transistors
- where movement of electrons is controlled within a microchip
- has no moving parts
- used by memory sticks, MP3 player etc.

Describe two reasons why magnetic storage is more appropriate than solid state storage for this computer.

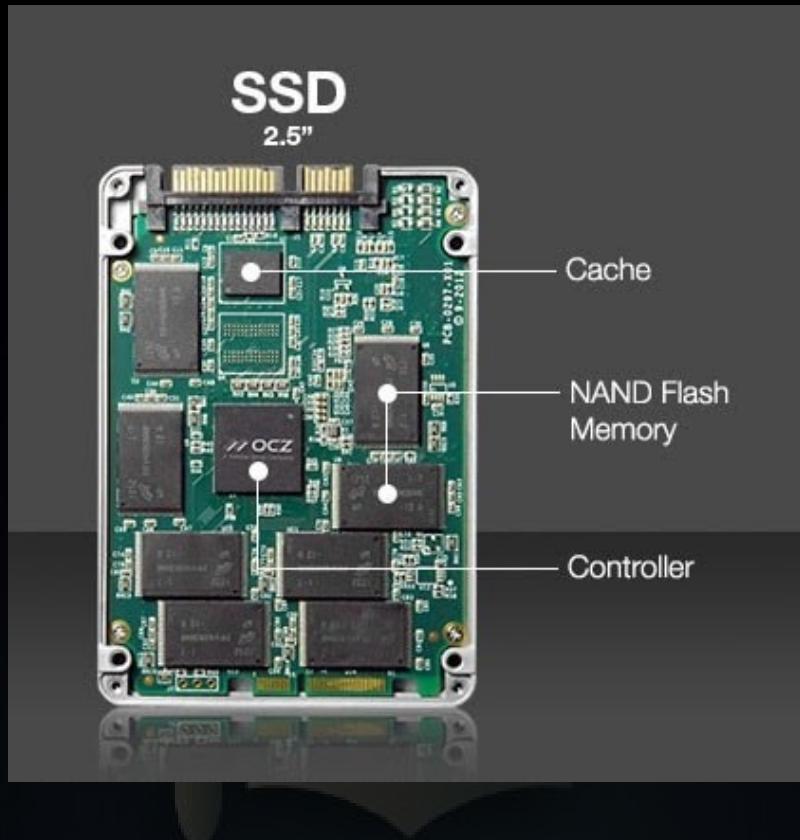
- The computer will have a large number of read/write operations because it is working all the time
- magnetic storage has more longevity
- Magnetic storage costs less per storage unit
- videos are large files and therefore very large storage capacity is required

Basic Internal Operation Of Hard disk



- HDD has one or more platters made of aluminum
- Each surface of the platter is ferrous-oxide which is capable of being magnetised
- The platters are mounted on a central spindle
- The disks are rotated at high speed
- Each surface of the disk has read/write head mounted on an arm positioned just above the surface
- The surface of the platter is divided into concentric track and sector
- One track in one sector is basic unit of storage called block
- The data is encoded as a magnetic pattern for each block.

Basic Internal Operation Of SSD



- No moving parts
- Non volatile
- Uses Nand gates, nor gates // transistors and integrated circuit
- SSD controller manages the components
- uses a grid of column and rows that has two transistors at each intersection
- One transistor is called floating gate
- Second transistor is called control gate
- Memory cells store voltages which can represent either a 0 or 1
- Essentially the movement of electrons is controlled to read/write
- No overwriting data / first erase then add

What is Flash Memory?

- Most are Nand-based Flash memory
- There are no moving parts
- Uses a grid of columns and rows that has two transistors at each intersection
- One transistor is called floating gate
- Second transistor is called control gate
- Memory cells store voltages which can represent either a 0 or 1
- Essentially the movement of electrons is controlled to read/write
- No overwriting data / first erase then add

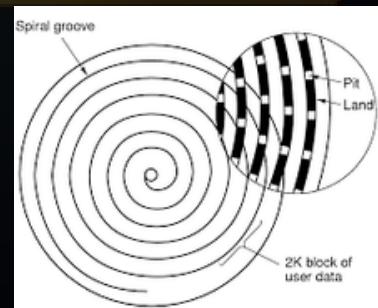
Optical Disc

- Drive motor is used to spin the disc.
- Tracking mechanism moves the laser assembly.
- A lens focuses the laser onto the disc.
- Laser beam is shone onto disc to read/write.



DVD RW

- Uses a single spiral track
- Only allows write or read operation to occur as separate operations
- Requires special packet reading/writing software
- In order to write new data to the disc the existing data must be completely erased
- By time the performance of DVD RW degrades
- Single sided, 4.7 GB capacity
- Rotates at different speed



DVD RAM

- Uses several concentric tracks
- Allows simultaneous read/write operation
- No special read/write software required
- Make use of sector to store data
- Single or double sided; 4.7 GB per side
- Disc rotates at constant speed



Embedded System



General Purpose Register

performs more than one task

Special Purpose Register

performs one specific task

What is meant by embedded system?

- **Microprocessor within a larger system that performs one specific task.**

A car has several features.

- (a) One feature is a lane detection system. This system monitors the lines on either side of the lane. If the car gets too close to one line, the system automatically moves the car away from the line.

Explain why the lane detection system is an example of an embedded system.

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.....
.....

[2]

Benefits And Drawbacks Of Embedded System

Benefits:

- **Cost efficient:** Embedded systems are designed for a specific task which allows cost reduction in manufacturing.
- **Size:** They are typically small in size so can be installed easily.
- **Power Consumption:** Embedded systems are optimized for lower power consumption.

Drawbacks:

- **Limited Resources:** Embedded systems often have limited computing resources which restricts their ability to run complex algorithms.
- **Difficult to upgrade.**
- **Scalability issues:** Embedded systems might not scale well without a complete redesign.

Exam Style Question

2 A video doorbell is attached to the front door of a house. The doorbell uses a motion sensor to detect when a visitor walks in front of the door. When the motion sensor is activated:

- The digital camera in the doorbell starts recording a video.
- A message is transmitted to a smartphone so that the person who lives in the house can watch the video.

The doorbell also has a button that can be pressed. When the button is pressed, a message is transmitted to a smartphone to play the doorbell sound.

The videos are stored on the doorbell's internal secondary storage device and overwritten when the secondary storage device is full.



Identify Characteristics of the doorbell that suggest it is an embedded system ?

- The doorbell only performs the specific tasks of motion detection/video recording/doorbell ringing
- The motion sensor and digital camera are built into the doorbell
- The CPU/memory/storage/software are all dedicated to this task only
- Only a dedicated microprocessor is required due to the limited processing requirements

Hardware

Question 1

5 Kiara has a washing machine and a refrigerator.

- (a) She has an embedded system in her washing machine.

Describe what is meant by an **embedded system**, using the washing machine as an example.

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.....
.....
..... [2]

- (b) The washing machine's embedded system makes use of both Random Access Memory (RAM) and Read Only Memory (ROM).

State the purpose of RAM and ROM within the washing machine's embedded system.

RAM

.....
.....
ROM

..... [2]

Question 2

3 Andy likes to play computer games.

- (a) Andy uses several input devices to play the games. These include a keyboard and a microphone.

Describe the principal operation of a microphone.

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..... [3]

Question 3

2 A computer has hardware and software.

(a) The hardware includes different types of memory.

(i) Complete the description of computer memory.

Random Access Memory (RAM) and Read Only Memory (ROM) are both examples of

..... memory.

One item that is stored in RAM is

One item that is stored in ROM is

RAM can be either Static RAM (SRAM) or Dynamic RAM (DRAM).

SRAM uses transistors arranged as

DRAM uses transistors and

[5]

(ii) Explain the difference between Programmable ROM (PROM), Erasable Programmable ROM (EPROM) and Electrically Erasable Programmable ROM (EEPROM).

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..... [3]

(b) A magnetic hard disk is used to store data on the computer.

Describe the principal operations of a magnetic hard disk.

[5]

[5]

Question 4

2 A car has several features.

- (a) One feature is a lane detection system. This system monitors the lines on either side of the lane. If the car gets too close to one line, the system automatically moves the car away from the line.

Explain why the lane detection system is an example of an embedded system.

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.....
.....

[2]

- (b) Two other features:

- record the number of miles travelled in the current journey, from when the engine is turned on to when it is turned off
- record the total number of miles the car has travelled since it was built.

Identify the data that will be stored in the primary **and** secondary storage of the car for these **two** features.

Primary

.....

Secondary

.....

[2]

- (c) The car has a resistive touchscreen for the user to select options.

Tick () **one** box in each row to show whether each statement about a resistive touchscreen is true or false.

Statement	True	False
The screen always has five different layers		
A processor determines the horizontal and vertical coordinates of the point of contact		
The touchscreen will work if any object touches the screen		

[1]

Question 5

9 Many modern televisions are examples of embedded systems.

(a) Explain why these televisions are embedded systems.

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..... [2]

(b) Embedded systems use Electrically Erasable Programmable ROM (EEPROM).

Describe **one** benefit of using EEPROMs in an embedded system.

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..... [2]

Question 6

(c) Embedded systems contain Read Only Memory (ROM) and Random Access Memory (RAM).

Explain the reasons why ROM is used in an embedded system.

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..... [2]

Question 7

- (c) A computer uses a buffer when playing the audio message.

Explain the purpose of a buffer in a computer system using **one other** example.

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..... [3]

Question 8

- (ii) The car alarm is an example of an embedded system.

Describe the characteristics of an embedded system.

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..... [3]

Question 9

- 4 A networked closed-circuit television (CCTV) system in a house uses sensors and cameras to detect the presence of a person. It then tracks the person and records a video of their movements.

Data from the CCTV cameras is transmitted to a central computer.

- (a) This computer has both Read Only Memory (ROM) and Random Access Memory (RAM).

- (i) Describe the contents of the ROM in the central computer.

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[2]

- (ii) The central computer has Dynamic RAM (DRAM).

Identify **two** advantages of using DRAM instead of Static RAM (SRAM).

1

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2

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[2]

- (b) The central computer stores the video files on secondary storage.

Describe **two** reasons why magnetic storage is more appropriate than solid state storage for this computer.

1

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2

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[4]

Question 10

- 3 A mobile telephone is used to record a video.
- (a) The mobile telephone has a touchscreen. There are different types of touchscreen.
- Complete the description of the principal operation of touchscreens.
- A touchscreen has two layers. When the user touches the screen, the layers touch and a is completed.
- A touchscreen has several layers. When the top layer is touched, there is a in the electric current.
- A microprocessor identifies the of the touch.

[5]

Question 11

- 7 (a) Describe the principal operations of a 3D printer.

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.....
..... [3]

- (b) Describe the purpose of a temperature sensor within the 3D printer.

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.....
.....
..... [2]

- (c) A 3D printer contains 1 GB of Dynamic RAM (DRAM) to store print data.

State **two** advantages of the printer having Dynamic RAM instead of Static RAM (SRAM).

1

.....

2

.....

[2]

Question 12

- (b) Give **one** example of an embedded system **and** explain why it is an example of an embedded system.

Example

.....

Explanation

.....

.....

.....

.....

.....

[3]

Question 13

(c) The factory has many different machines with embedded systems.

(i) Identify **two** features of embedded systems.

1

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2

.....

[2]

(ii) Identify **one** drawback of embedded systems.

.....

.....

[1]

Question 14

7 A laptop computer has Static RAM (SRAM).

A virtual reality headset and a laser printer are connected to the laptop.

(a) Explain why Static RAM is used in the laptop instead of Dynamic RAM.

.....

.....

.....

.....

[2]

(b) Identify **two** reasons for using Electrically Erasable Programmable ROM (EEPROM) in a virtual reality headset.

1

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2

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[2]

(c) Describe how the laser printer makes use of a buffer.

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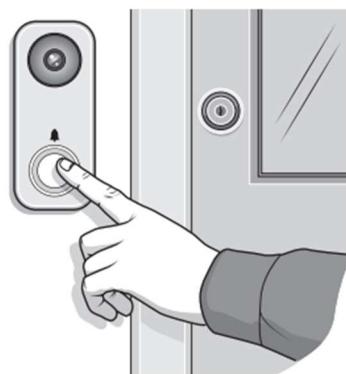
[4]

Question 15

- 2 A video doorbell is attached to the front door of a house. The doorbell uses a motion sensor to detect when a visitor walks in front of the door. When the motion sensor is activated:
- The digital camera in the doorbell starts recording a video.
 - A message is transmitted to a smartphone so that the person who lives in the house can watch the video.

The doorbell also has a button that can be pressed. When the button is pressed, a message is transmitted to a smartphone to play the doorbell sound.

The videos are stored on the doorbell's internal secondary storage device and overwritten when the secondary storage device is full.



- (a) The video doorbell can be considered an example of an embedded system.

Identify **two** characteristics of the doorbell that suggest it is an embedded system.

1

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2

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[2]

- (c) The video doorbell has both primary memory and secondary storage.

- (i) Identify **two** items of data that the video doorbell will store in primary memory.

1

.....

2

.....

[2]

- (ii) The video doorbell has a solid state (flash) secondary storage device.

Complete the table by writing the answer or answers to each statement about the principal operation of solid state (flash) memory.

Statement	Answer
the two types of logic gate that can be used to create solid state devices	1
	2
the number of transistors contained in each cell
the type of gate that can retain electrons without power
the type of gate that allows or stops current from passing through

[4]

- (iii) The video doorbell uses a buffer.

Describe how the video doorbell will use the buffer.

.....
.....
.....
.....

[2]

Question 16

- 2 A computer game is being designed that users will be able to play using a virtual reality (VR) headset.

- (a) Complete the description of the principal operation of a VR headset.

A headset can have one or two that output the image to the user. The headset has speakers that output surround sound to give a realistic experience.

The user's head movements are detected using a sensor.

This sensor is a The data is transmitted to a microprocessor that analyses the data to identify the of movement. Some headsets use that record the user's eye movements for analysis.

[4]

- (b) The computer uses a buffer when transmitting data to the VR headset.

Explain how a buffer is used when data is transmitted between the computer and the VR headset.

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.....

[3]

- (c) The VR headset has Electrically Erasable Programmable Read Only Memory (EEPROM).

Explain the benefits of using EEPROM instead of other types of Read Only Memory (ROM) in the VR headset.

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.....

[3]

Question 17

- (d) The robot includes a touchscreen for the customer to make their payment.

Describe the principal operation of a touchscreen.

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.....

[4]

Question 18

2 Kal teaches Computer Science and uses different devices when teaching his students.

- (a) Tick (\checkmark) one or more boxes on each row to indicate whether each device is an input device, an output device, or both.

Device	Input	Output
LCD monitor		
Microphone		
Keyboard		
Touchscreen		

[2]

- (b) Kal has built a 3D printer to show students how it works.

- (i) The steps 1 to 9 describe the basic internal operation of a 3D printer.

The following five statements are used to complete the sequence of steps.

A	A stepper motor moves the nozzle into position
B	A fan cools the layer
C	The software splits the object into slices
D	The nozzle extrudes the molten plastic
E	The data about the slices is sent to the printer

Write one of the letters A, B, C, D or E in the appropriate step to complete the sequence.

1. The object is designed using Computer Aided Design (CAD) software
2.
3.
4. The solid plastic is melted and transferred to the nozzle
5.
6.
7. The steps 5 to 6 are repeated until the layer is complete
8.
9. The steps 4 to 8 are repeated for each subsequent layer

[4]

- (ii) The 3D printer has both RAM and ROM.

Describe the purpose of RAM and ROM in a 3D printer.

RAM

.....
.....
.....

ROM

.....
.....
.....

[4]

Question 19

- 1 Samira is creating an interactive, multimedia presentation for the entrance to her hotel.

- (a) The presentation will be on a device that has a resistive touchscreen for user input.

Complete the following paragraph about the basic operation of a resistive touchscreen.

The resistive touchscreen has two layers with between the layers. When a finger touches the screen, the moves to touch the ; this creates a point of contact.

The and position of this point is calculated.

[4]

Question 20

- 2 Billy has a laser printer.
- (a) Complete the following description of the basic internal operation of a laser printer.
- The printer uses a and a rotating
to draw the contents of the page on the photosensitive drum as
charge. The is attracted to this charge.

[4]

- (b) The laser printer has both RAM and ROM.

Describe the purpose of RAM and ROM in the **laser printer**.

RAM

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.....
.....

ROM

.....
.....
.....

[4]

Question 21

4 Shazia is creating a computer program that will be released to the public. The program includes a video.

(a) Shazia uses a microphone to record a sound track for the video.

(i) Describe the internal operation of a microphone.

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.....

[3]

(ii) The script for the sound track is printed using a laser printer.

Describe the internal operation of a laser printer.

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[3]

(c) Shazia's computer has Dynamic RAM (DRAM) and Static RAM (SRAM).

Explain the differences between Dynamic RAM and Static RAM.

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[4]

Question 22

- 2 Aaron uses a desktop computer to do school work.
- (a) Aaron has a mouse and keyboard that he can use as input devices and a monitor as an output device.
- (i) Identify **two** additional input devices Aaron could use with his desktop computer.
- 1
- 2
- [2]
- (ii) Identify **two** additional output devices Aaron could use with his desktop computer.
- 1
- 2
- [2]
- (iii) Aaron needs to store a large number of applications and data on his computer. He needs at least 50GB of secondary storage space.

Identify **one** internal secondary storage device for Aaron's computer.

.....
..... [1]

Question 23

- 6 Dominic uses a tablet computer to complete work. He records videos of his work to send to his colleagues to watch at a later date.

- (a) The tablet computer has input and output devices.

- (i) The table lists four devices built into the tablet.

Tick (\checkmark) one or more boxes for each device to identify whether it is an input device, an output device or both.

Device	Input	Output
Touchscreen		
Webcam		
Microphone		
Fingerprint scanner		

[2]

- (ii) An external speaker is plugged into the tablet computer.

The sequence of steps 1 to 7 describes the internal operation of the speaker.

The statements A, B, C, D and E are used to complete the sequence.

Letter	Statement
A	Changes in the audio signal cause the direction of the electrical current to change. This determines the polarity of the electromagnet.
B	The vibration creates sound waves.
C	An electric current is sent to the speaker.
D	The electromagnet is repelled by, or attracted to the permanent magnet.
E	The electric current passes through the coil.

Write one of the letters A to E in each appropriate row to complete the sequence.

1

2

3 The current in the coil creates an electromagnetic field.

4

5

(b) The tablet computer's secondary storage is solid state (flash) memory.

(i) Give one reason why the tablet computer needs secondary storage.

[1]

(ii) Describe solid state memory.

[3]

(c) The tablet computer has RAM and ROM memory.

State the purpose of RAM and ROM memory in the computer.

RAM

ROM

[2]

Question 24

- 1 In a supermarket, a self-checkout machine allows customers to scan the barcodes of products and then pay for their shopping. These are an alternative to the traditional cashier-staffed checkout.



(a) The self-checkout machine has a touchscreen.

(i) Identify **two** other input devices that self-checkout machines have.

1

2

[2]

(ii) Identify **two** other output devices that self-checkout machines have.

1

2

[2]

- (iii) The touchscreen uses capacitive technology.

The sequence of steps 1 to 6 describes the internal operation of the touchscreen.

The statements **A**, **B**, **C** and **D** are used to complete the sequence.

A	Charge is drawn to the point of contact.
B	The screen has a layer that stores an electrical charge.
C	There is a change in the electrostatic field.
D	The coordinates are sent to the touchscreen driver.

Write **one** of the letters **A** to **D** in each appropriate row to complete the sequence.

1

2 When the user touches the screen

3

4

5 The coordinates of the point of contact can be calculated.

6

[2]

- (b) The self-checkout machines have primary storage.

- (i) Give **two** reasons why the self-checkout machine needs primary storage.

1

.....

2

.....

[2]

(b) The self-checkout machines have primary storage.

(i) Give two reasons why the self-checkout machine needs primary storage.

1

2

[2]

(ii) The self-checkout machines use Static RAM (SRAM) for their cache.

The following table has statements about SRAM or Dynamic RAM (DRAM).

Tick (\checkmark) one box in each row to identify whether the statement is about SRAM or DRAM.

Statement	SRAM	DRAM
More expensive to make		
Requires refreshing (recharging)		
Made from flip-flops		

[2]

Question 25

7 A student plays computer games on a games console.

- (a) Identify **two** input devices and **one** output device used in a games console.

Input device 1

Input device 2

Output device

[3]

- (b) The games console has random access memory (RAM) and read only memory (ROM).

- (i) State **two** differences between RAM and ROM.

Difference 1

.....

Difference 2

.....

[2]

- (ii) Give **one** use for RAM in the games console.

.....

[1]

- (iii) Give **one** use for ROM in the games console.

.....

[1]

Question 26

- 7 A zoo has a computer system for the visitors to access multimedia content about the zoo and its animals.

- (a) The users interact with the computer system through touchscreens.

Describe the internal operation of a touchscreen.

-14-

- (b) (i) Give one output device, other than a touchscreen, that may be part of this computer system.

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- (ii) Give two input devices, other than a touchscreen, that may be part of this computer system. State how each device will be used by the visitors.

Device 1

Use

Device 2

Use

14

- (c) Give the most appropriate secondary storage device for this computer system.

Describe two reasons for your choice.

Device

Reason 1

Reason 2

[5]

- (d) This computer system has Random Access Memory (RAM) and Read Only Memory (ROM).

State what will be stored in RAM and ROM for this computer system.

RAM

ROM

[2]

Question 27

- 1 A student is creating a short video and needs to record music to play in the background.

- (a) The student uses a microphone to capture the music.

Explain how the microphone captures the music.

[3]

Question 28

- (c) There are two types of RAM: dynamic RAM (DRAM) and static RAM (SRAM).

The following table shows **five** statements about DRAM and SRAM.

Tick () **one** box in each row to indicate whether the statement applies to DRAM or SRAM.

Statement	DRAM	SRAM
Does not need to be refreshed as the circuit holds the data while the power supply is on		
Mainly used in cache memory of processors where speed is important		
Has less complex circuitry		
Requires higher power consumption under low levels of access, which is significant when used in battery-powered devices		
Requires data to be refreshed occasionally so it retains the data		

[5]

Question 29

- 2 (a) (i) The following sequence of steps (1 to 7) describe how a single page is printed on a laser printer.

The statements A, B, C and D are used to complete the sequence.

A	The paper passes through a fuser, which heats up the paper. The toner melts and forms a permanent image on the paper.
B	The electrical charge is removed from the drum and the excess toner is collected.
C	The image is converted on the drum into an electrostatic charge.
D	The oppositely-charged paper picks up the toner particles from the drum. After picking up the toner, the paper is discharged to stop it clinging to the drum.

Complete the sequence by writing one of the letters A, B, C or D on the appropriate row.

1. A laser beam and a rotating mirror are used to draw an image of the page on the photosensitive drum.
2.
3. Electrostatic charge attracts toner.
4. The charged paper is rolled against the drum.
5.
6.
7.

[3]

- (ii) A computer user has a laser printer to print letters and documents. The user also prints digital photographs taken using a digital camera.

State the most suitable type of printer for printing the photographs.

[1]

- (b) The user is considering the purchase of a new laptop computer. She has read many product reviews and knows that there are different types of internal secondary storage available.

List two options for internal secondary storage.

Option 1

Option 2

Describe one advantage of one of the options.

Advantage of choosing option 1 / 2 (circle)

[3]

Question 30

5 A Personal Computer (PC) has a number of input and output devices.

(a) (i) Name **three** components of a speaker.

[3]

(ii) Explain the basic internal operation of a speaker.

[4]

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(b) (i) The user is considering the purchase of a removable device for secondary storage.

Name **one** suitable device.

(ii) Describe two possible uses for this device on a home Personal Computer (PC).

[2]

Question 31

(b) Explain the basic internal operation of a hard disk drive.

-14

Question 32

- 5 A Personal Computer (PC) has a number of input and output devices.

- (a) (i) Name three components of a speaker.

3

[3]

- (ii) Explain the basic internal operation of a speaker.

[4]

.14

- (b) (i) The user is considering the purchase of a removable device for secondary storage.

Name one suitable device.

.11

- (ii) Describe two possible uses for this device on a home Personal Computer (PC).

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Question 33

2 (a) State **two** differences between Static RAM (SRAM) and Dynamic RAM (DRAM).

1

.....

2

..... [2]

Question 34

- 3 When an application program requests a file stored on a hard disk, the computer system reads the file. Use the statement labels A to H to complete the sequence of steps that describe how this happens.

Label	Statement
A	When the hard disk drive has read the file, it generates an interrupt.
B	While the file continues, the head reads successive clusters of sectors from the disk and writes data into the disk buffer.
C	The head reads the first cluster of sectors from disk and writes data into the disk buffer.
D	The head moves to the correct track.
E	The operating system transfers the contents of the disk buffer to the application program's data memory.
F	In the relevant directory file, the operating system looks up the track and sector where the file begins.
G	Application program passes file read request to the operating system.
H	The hard disk drive waits for the correct sector to arrive under the head.

1. The application program executes a statement to read a file.
2.
3. The operating system begins to spin the hard disk, if it is not currently spinning.
4.
5.
6.
7.
8.
9.
10.

[8]

Question 35

- 6 (a) Describe **two** differences between RAM and ROM.

1

.....
2

[2]

- (b) State **three** differences between Dynamic RAM (DRAM) and Static RAM (SRAM).

1

.....
2

.....
3

[3]

Question 36

- 4 (a) There are two types of RAM: dynamic RAM (DRAM) and static RAM (SRAM).

Five statements about DRAM and SRAM are shown below.

Draw a line to link each statement to the appropriate type of RAM.

Statement	Type of RAM
requires data to be refreshed periodically in order to retain the data	
has more complex circuitry	DRAM
does not need to be refreshed as the circuit holds the data as long as the power supply is on	
requires higher power consumption which is significant when used in battery-powered devices	SRAM
used predominantly in cache memory of processors where speed is important	

[5]

(b) Describe three differences between RAM and ROM.

.....
.....
.....
.....
.....
.....

[3]

(c) DVD-RAM and flash memory are two examples of storage devices.

Describe **two** differences in how they operate.

.....
.....
.....
.....
.....

[2]

Answer

Answer 1

5(a)	<p>1 mark per bullet point to max 2</p> <ul style="list-style-type: none">• Definition: Microprocessor/microcontroller within a larger system // microprocessor/microcontroller that performs one specific task• Example: e.g. Embedded system in washing machine only controls the programs for the washing cycle // it is part of the washing machine but does not perform any other function within it	2
5(b)	<p>1 mark for RAM, 1 mark for ROM</p> <p>RAM:</p> <ul style="list-style-type: none">• Store the choices/wash program the user has entered // stores the data read from the sensors // stores the time left in the program // by example <p>ROM:</p> <ul style="list-style-type: none">• Store the start-up instructions (for the washing cycles)	2

Answer 2

3(a)	<p>1 mark for each bullet point to max 3</p> <ul style="list-style-type: none">• The microphone has a diaphragm / ribbon• The incoming sound waves cause vibrations of the diaphragm• ... causing a coil to move past a magnet // causing a magnet to move past a coil (dynamic microphone) // changing the capacitance (condenser microphone) // deforms the crystal (crystal microphone)• An electrical signal is produced	3
------	--	----------

Answer 3

2(a)(i)	<p>1 mark for each correct term.</p> <p>Random Access Memory (RAM) and Read Only Memory (ROM) are both examples of primary memory.</p> <p>One item that is stored in RAM is currently running software/data/part of OS.</p> <p>One item that is stored in ROM is the start-up/boot-up instructions/BIOS.</p> <p>RAM can be either Static RAM (SRAM) or Dynamic RAM (DRAM).</p> <p>SRAM uses transistors arranged as flip-flops/latches.</p> <p>DRAM uses transistors and capacitors.</p>	5
2(a)(ii)	<p>1 mark per bullet point to max 3</p> <ul style="list-style-type: none"> • PROM can be set once, EPROM and EEPROM can be overwritten multiple times. • EPROM needs to be removed from device EEPROM can be erased in situ. • EPROM and can be erased using UV light, EEPROM can be erased using voltage // is flash storage . • EPROM must be entirely erased before rewriting, EEPROM does not have to be entirely erased before rewriting. 	3
2(b)	<p>1 mark per bullet point to max 5</p> <ul style="list-style-type: none"> • The hard disk has (one or more) platter/plate/disk • Each surface of the platter/disk is (ferrous oxide which is) capable of being magnetised • The platters/disks are mounted on a (central) spindle • The entire mechanism is contained inside a sealed (aluminium) box. • The disks are rotated (at high-speed) • (Each surface of the disk) has a read/write head mounted on an arm (positioned just above the surface) • Electronic circuits control the movement of the arm (and hence the heads) • The surface of the platter/disk is divided into <u>concentric</u> tracks / circles • The surface of the platter/disk is divided into sectors • One track in one sector is the basic unit of storage called a block • The data is encoded as a magnetic pattern for each block • When writing to disk, a variation in the current in the head produces a variation in magnetic field on the disk • When reading from disk, a variation in magnetic field produces a variation in current through the head 	5

Answer 4

2(a)	<p>1 mark per point to max 2</p> <ul style="list-style-type: none"> The lane detection system is built into / integrated into the car The lane detection system only performs one task The lane detection system is not easily changed/updated by the car owner 	2												
2(b)	<p>1 mark for primary</p> <ul style="list-style-type: none"> e.g. Miles travelled in the current journey, before the engine is turned off <p>1 mark for secondary</p> <ul style="list-style-type: none"> e.g. Total miles travelled since the car was built // miles for most recent journey after engine switched off 	2												
2(c)	<p>1 mark for all correct ticks</p> <table border="1"> <thead> <tr> <th>Statement</th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td>The screen always has five different layers</td> <td></td> <td>✓</td> </tr> <tr> <td>A processor determines the horizontal and vertical coordinates of the point of contact</td> <td>✓</td> <td></td> </tr> <tr> <td>The touchscreen will work if any object touches the screen</td> <td>✓</td> <td></td> </tr> </tbody> </table>	Statement	True	False	The screen always has five different layers		✓	A processor determines the horizontal and vertical coordinates of the point of contact	✓		The touchscreen will work if any object touches the screen	✓		1
Statement	True	False												
The screen always has five different layers		✓												
A processor determines the horizontal and vertical coordinates of the point of contact	✓													
The touchscreen will work if any object touches the screen	✓													

Answer 5

9(a)	<p>1 mark for each bullet point (max 2):</p> <ul style="list-style-type: none"> the embedded system is built into / integrated into the TV combination of hardware and software designed for a specific function The system is not easily changed/updated by the TV owner 	2
9(b)	<p>1 mark for each benefit and 1 mark for corresponding expansion (max 2).</p> <p>For example:</p> <ul style="list-style-type: none"> no additional equipment is needed to change ... enables firmware updates by non-technical users can be erased and reprogrammed several times ... so firmware can be updated ... can erase a particular byte or the whole EEPROM possible to reprogram / update ... without removing it from the device 	2

Answer 6

3(c)	<p>1 mark for each bullet point:</p> <ul style="list-style-type: none">• to store data that does not change• data must be stored even when device is without power• to store boot up instructions / system software / firmware / BIOS	2
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Answer 7

1(c)	<p>1 mark for purpose (max 2):</p> <p>Purpose:</p> <ul style="list-style-type: none">• to act as temporary storage // to store (downloaded) data• ... before it is used by the receiving device• ... to allow processes / devices to operate at different speeds // independently of each other <p>1 mark for each example (max 1):</p> <p>Examples:</p> <ul style="list-style-type: none">• printer buffer used when data is transferred from a computer to a printer• video buffer when streaming videos• keyboard buffer when performing data entry	3
------	--	---

Answer 8

10(b)(ii)	<p>1 mark for each bullet point (max 3):</p> <ul style="list-style-type: none">• the embedded system is built into / integrated (into the car alarm)• combination of hardware and software designed for a specific function• must have a processor, memory and input / output• The system is not easily changed/updated by the car owner	3
-----------	---	---

Answer 9

4(a)(i)	1 mark each to max 2 <ul style="list-style-type: none">• Stores the bootstrap program // start-up instructions for the central computer // BIOS• Stores the start-up instructions for the CCTV system/cameras // firmware for CCTV• Stores the kernel of the Operating System // stores parts of the Operating System	2
4(a)(ii)	1 mark each to max 2 <ul style="list-style-type: none">• Costs less per unit• Higher storage density• Simple design – uses fewer transistors	2
4(b)	1 mark for reason, 1mark for application/justification <ul style="list-style-type: none">• The computer will have a large number of read/write operations because it is working all the time• ... magnetic storage has more longevity• Magnetic storage costs less per storage unit• ... videos are large files and therefore very large storage capacity is required	4

Answer 10

3(a)	<p>1 mark for each term</p> <ul style="list-style-type: none">• Resistive• Circuit• Capacitive• Change• Coordinates <p>A resistive touchscreen has two layers. When the user touches the screen, the layers touch and a circuit is completed.</p> <p>A capacitive touchscreen has several layers. When the top layer is touched there is a change/increase/decrease in the electric current. A microprocessor identifies the coordinates of the touch.</p>	5
------	--	---

Answer 11

7(a)	<p>1 mark for each bullet point (max 3)</p> <p>Generic mark points:</p> <ul style="list-style-type: none"> • Additive manufacturing • Uses a digital 3D model or a Computer Aided Design (CAD) (file) • Builds up the model one layer at a time • ...starting from the bottom • ...using x, y and z co-ordinates • The material is fused / cured together layer by layer <p>Specific mark points:</p> <p>Fused Deposition Modelling (FDM)</p> <ul style="list-style-type: none"> • Material is heated and pushed through nozzle / extruder <p>Stereolithography (SLA)</p> <ul style="list-style-type: none"> • Photosensitive liquid resin is exposed to a UV-laser beam <p>Digital Light Processing (DLP)</p> <ul style="list-style-type: none"> • Uses liquid plastic resin melted with arc lamps <p>Selective Laser Sintering (SLS)</p> <ul style="list-style-type: none"> • Uses a laser to form objects from powdered material 	3
7(b)	<p>1 mark for each bullet point (max 2)</p> <ul style="list-style-type: none"> • To prevent overheating // ensure material is hot enough • ...by identifying the temperature of the object (being printed) • ...by identifying the temperature of the material being used 	2
7(c)	<p>1 mark for each bullet point (max 2)</p> <ul style="list-style-type: none"> • Dynamic RAM has lower cost per unit • A fast access speed is not needed • Higher bit density // more data can be stored per chip 	2

Answer 12

9(b)	<p>One mark for each reason to max 3 to match the example given</p> <ul style="list-style-type: none"> • Dedicated to one task applied to example • Does not require much processing power applied to example • Built into a larger system applied to example • Contains firmware that cannot be easily updated applied to example • The system does not have its own operating system • An embedded system must contain a processor, memory and an I/O capability // Dedicated hardware 	3
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Answer 13

1(c)(i)	1 mark for each feature (max 2) <ul style="list-style-type: none">• Dedicated to a single task // limited number of functions• Built into a larger system // integrated into a larger system• An embedded system must contain a processor, memory and an I/O capability // Dedicated hardware	2
1(c)(ii)	1 mark for each bullet point (max 1) <ul style="list-style-type: none">• Difficult to change / update the firmware by the user // Difficult to upgrade devices to take advantage of new technology• Cannot be easily adapted for another task• Troubleshooting faults/upgrading is a specialist task• Devices are often thrown away rather than repaired as difficult to upgrade or repair	1

Answer 14

7(a)	1 mark for each bullet point (max 2). <ul style="list-style-type: none">• Static RAM has faster access time• ...because it does not need to be refreshed• ...used on the CPU for improvement of CPU cache speed• Static RAM has lower	2
7(b)	1 mark for each bullet point (max 2) <ul style="list-style-type: none">• EEPROM allows frequent / multiple read / write / erase operations• ...which means that the contents of the firmware in the headset can be changed easily• ...without fully erasing the contents of the firmware in the headset first	2
7(c)	1 mark for each bullet point (max 4) <ul style="list-style-type: none">• The print instructions and data are sent by the laptop to a buffer (at laptop speed)• The data is transferred from the buffer to the printer (at printer speed)• ...allowing user to continue using the laptop // and allowing processor to continue processing• ...instead of waiting for relatively slower printer• When the buffer is empty an interrupt is sent to the laptop• ...requesting more data	4

Answer 15

2(a)	<p>1 mark each to max 2:</p> <ul style="list-style-type: none"> The doorbell only performs the specific tasks of motion detection/video recording/doorbell ringing The motion sensor and digital camera are built into the doorbell The CPU/memory/storage/software are all dedicated to this task only Only a dedicated microprocessor is required due to the limited processing requirements 	2										
2(b)	<p>No mark for identification of monitoring or control 1 mark each to max 2 for justification:</p> <p>Monitoring:</p> <ul style="list-style-type: none"> The turning on of the digital camera does not affect the input to the sensor/button The transmission of the data/video does not affect the input to the sensor/button The ringing of the doorbell does not affect the input to the button <p>Control:</p> <ul style="list-style-type: none"> Video doorbell does not only store the values from the motion sensor The data is processed, generating a signal to start the digital camera recording Button pressed/motion detected causes a signal to be sent over a network to the smartphone 	2										
2(c)(i)	<p>1 mark each to max 2:</p> <ul style="list-style-type: none"> Current reading/data from motion sensor Current/recent video Instructions being executed Start-up/BIOS/boot-up instructions 	2										
2(c)(ii)	<p>1 mark for each row:</p> <table border="1"> <thead> <tr> <th>Statement</th> <th>Answer</th> </tr> </thead> <tbody> <tr> <td>The two types of logic gate that can be used to create solid state devices</td> <td>NAND NOR</td> </tr> <tr> <td>The number of transistors contained in each cell</td> <td>2</td> </tr> <tr> <td>The type of gate that can retain electrons without power</td> <td>floating</td> </tr> <tr> <td>The type of gate that allows or stops current from passing through</td> <td>control</td> </tr> </tbody> </table>	Statement	Answer	The two types of logic gate that can be used to create solid state devices	NAND NOR	The number of transistors contained in each cell	2	The type of gate that can retain electrons without power	floating	The type of gate that allows or stops current from passing through	control	4
Statement	Answer											
The two types of logic gate that can be used to create solid state devices	NAND NOR											
The number of transistors contained in each cell	2											
The type of gate that can retain electrons without power	floating											
The type of gate that allows or stops current from passing through	control											

2(c)(iii)	<p>1 mark each to max 2:</p> <ul style="list-style-type: none"> • Captured video is transmitted to buffer • ... video is transmitted from buffer to smartphone • Store recent data in a buffer for the user to rewind • ... instead of storing everything in secondary storage • Store readings from motion sensor • ... until the microprocessor can process them • Store video from digital camera • ... before moving it to secondary storage 	2
-----------	---	---

Answer 16

2(a)	<p>1 mark for each correctly completed statement:</p> <ul style="list-style-type: none"> • (LCD) displays/screens/lenses • gyroscope/accelerometer • direction/speed • digital cameras <p>A headset can have one or two (LCD) displays/screens/lenses that output the image to the user. The headset has speakers that output surround sound to give a realistic experience. The user's head movements are detected using a sensor. This sensor is a gyroscope/accelerometer. The data is transmitted to a microprocessor that analyses the data to identify the direction/speed of movement. Some headsets use digital cameras that record the user's eye movements for analysis.</p>	4
2(b)	<p>1 mark each to max 3:</p> <ul style="list-style-type: none"> • The buffer is used as a temporary store for data going to the headset • Data is transferred into the buffer by the computer • Data is retrieved from the buffer by the headset • When the buffer is empty/full an interrupt is sent to the computer requesting more data/stopping further data being sent • When the headset has enough data/needs more data, an interrupt is sent by the headset to the computer to stop sending data from buffer 	3
2(c)	<p>1 mark each to max 3:</p> <ul style="list-style-type: none"> • EEPROM allows frequent/multiple read/write/erase operations • ... so the headset can take advantage of new features • ... without fully erasing the contents of the firmware in the headset first // can erase a particular byte or the whole EEPROM • ... without removing the chip(s)/firmware from the headset • ... the contents of the firmware in the headset can be changed by the user without technical expertise • Cheaper to manufacture so headset will be cheaper to purchase 	3

Answer 17

7(d)	1 mark each to max 4: <ul style="list-style-type: none">• Resistive: The space between the conductive layers is removed/the layers touch and a circuit is completed• Capacitive: The electrical charge changes where the user pressed• The point of contact is identified• ... from the change in electrical field• The software/microprocessor calculates the coordinates	4
------	--	---

Answer 18

Question	Answer	Marks															
2(a)	<p>1 mark for first three rows, 1 mark for the touchscreen being both.</p> <table border="1"> <thead> <tr> <th>Device</th><th>Input</th><th>Output</th></tr> </thead> <tbody> <tr> <td>LCD Monitor</td><td></td><td>✓</td></tr> <tr> <td>Microphone</td><td>✓</td><td></td></tr> <tr> <td>Keyboard</td><td>✓</td><td></td></tr> <tr> <td>Touchscreen</td><td>✓</td><td>✓</td></tr> </tbody> </table>	Device	Input	Output	LCD Monitor		✓	Microphone	✓		Keyboard	✓		Touchscreen	✓	✓	2
Device	Input	Output															
LCD Monitor		✓															
Microphone	✓																
Keyboard	✓																
Touchscreen	✓	✓															
2(b)(i)	<p>1 mark for 1 correct entry 2 marks for 2 correct entries 3 marks for 3 correct entries 4 marks for 5 correct entries</p> <p>1 The object is designed using Computer Aided Design (CAD) software 2 C (The software splits the object into slices) 3 E (The data about the slices is sent to the printer) 4 The solid plastic is melted and transferred to the nozzle 5 A (A stepper motor moves the nozzle into position) 6 D (The nozzle extrudes the molten plastic) 7 The steps 5 to 6 repeat until the layer is complete 8 B (A fan cools the layer) 9 The steps 4 to 8 are repeated for each subsequent layer</p>	4															

2(b)(ii)	<p>1 mark per bullet point. Max 3 for RAM, max 2 for ROM</p> <p>RAM</p> <ul style="list-style-type: none"> • Stores currently running parts of the 3D printer software • Stores the data about the layers being printed // contents of buffer • Stores current progress of printing • Stores the data about the printer, e.g. Plastic levels, nozzle position <p>ROM</p> <ul style="list-style-type: none"> • Stores the operating software for the 3D printer // OS for the 3D printer • Stores the boot-up/start-up instructions for the 3D printer 	4
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Answer 19

Question	Answer	Marks
1(a)	<p>1 mark for each correct term</p> <p>The resistive touchscreen has two layers with a gap / an air gap between the layers. When a finger touches the screen, the top layer moves to touch the bottom layer; this creates a point of contact. The horizontal and vertical position of this point is calculated.</p>	4

Answer 20

Question	Answer	Marks
2(a)	<p>1 mark for each appropriate term</p> <p>The printer uses a laser (beam) and a rotating mirror to draw the contents of the page on the photosensitive drum as an electrostatic charge. The toner is attracted to this charge.</p>	4

Question	Answer	Marks
2(b)	<p>1 mark per bullet point. Max 2 for RAM, max 2 for ROM</p> <p>RAM</p> <ul style="list-style-type: none"> • Stores currently running parts of the printer software • Stores the data being printed // contents of buffer • Stores current progress of printing • Stores the data about the printer, e.g. toner levels <p>ROM</p> <ul style="list-style-type: none"> • Stores the printer operating software // OS for the printer • Stores the boot-up/start-up instructions for the printer • Printer fonts stored in ROM 	4

Answer 21

Question	Answer	Marks
4(a)(i)	<p>1 mark per bullet point to max 3</p> <ul style="list-style-type: none"> The microphone has a diaphragm / ribbon (accept equivalent) The incoming sound <u>waves</u> cause vibrations (of the diaphragm) ...causing a coil to move past a magnet (dynamic microphone) // changing the capacitance (condenser microphone) // deforms the crystal (crystal microphone) etc. An electrical signal is produced 	3
4(a)(ii)	<p>1 mark per bullet to max 3</p> <ul style="list-style-type: none"> The revolving drum is initially given an electrical charge A laser beam (bounces off moving mirrors) <u>scans back and forth</u> across the drum ...discharging certain points (i.e. 'drawing' the letters and images to be printed as a pattern of electrical charges) The drum is coated with oppositely charged toner (which only sticks to charged areas) The drum rolls over electro-statically <u>charged</u> paper // Electro-statically <u>charged</u> paper is fed (towards the drum) The 'pattern' on the drum is transferred to the paper The paper is passed through the fuser to seal the image The electrical charge is removed from the drum // the excess toner is collected 	3

Question	Answer	Marks
4(c)	<p>1 mark per bullet to max 4</p> <ul style="list-style-type: none"> • DRAM has to be refreshed / charged and SRAM does not require a refresh • DRAM uses a single transistor and capacitor and SRAM uses more than one transistor • DRAM stores each bit as a charge and in SRAM each bit is stored using a flip-flop/latch • DRAM requires higher power consumption under low levels of access, (which is significant when used in battery-powered devices because it requires more circuitry for refreshing) // SRAM uses less power (no need to refresh) • DRAM less expensive to purchase (requires fewer transistors) // SRAM is more expensive to buy (as it requires more transistors) • DRAM has slower <u>access</u> time/speed (because it needs to be refreshed) // SRAM has faster <u>access</u> times • DRAM can have higher storage/bit/data <u>density</u> // SRAM has lower storage/bit/data <u>density</u> • DRAM used in main memory and SRAM used in cache memory 	4

Answer 22

Question	Answer	Marks
2(a)(i)	<p>1 mark per device to max 2</p> <p>e.g.</p> <ul style="list-style-type: none"> • Trackpad/touchpad • microphone • touchscreen • scanner 	2
2(a)(ii)	<p>1 mark per device to max 2</p> <p>e.g.</p> <ul style="list-style-type: none"> • printer • speakers • touchscreen 	2
2(a)(iii)	Magnetic hard disk drive // solid state drive	1

Answer 23

Question	Answer	Marks															
6(a)(i)	<p>1 mark for touchscreen being both 1 mark for remaining 3 devices</p> <table border="1"> <thead> <tr> <th>Device</th><th>Input</th><th>Output</th></tr> </thead> <tbody> <tr> <td>Touchscreen</td><td>✓</td><td>✓</td></tr> <tr> <td>Webcam</td><td>✓</td><td></td></tr> <tr> <td>Microphone</td><td>✓</td><td></td></tr> <tr> <td>Fingerprint scanner</td><td>✓</td><td></td></tr> </tbody> </table>	Device	Input	Output	Touchscreen	✓	✓	Webcam	✓		Microphone	✓		Fingerprint scanner	✓		2
Device	Input	Output															
Touchscreen	✓	✓															
Webcam	✓																
Microphone	✓																
Fingerprint scanner	✓																
6(a)(ii)	<p>1 mark for any 1 correct letter in the correct position 2 marks for any 2 correct letters in the correct positions 3 marks for any 3 correct letters in the correct positions 4 marks for 5 correct letters in the correct positions</p> <p>C An electric current is sent to the speaker.</p> <p>E The electric current passes through the coil.</p> <p><i>The current in the coil creates an electromagnetic field.</i></p> <p>A Changes in the audio signal cause the direction of the electrical current to change. This determines the polarity of the electromagnet.</p> <p>D The electromagnet is repelled by, or attracted to the permanent magnet.</p> <p><i>The movement of the coil causes the diaphragm to vibrate.</i></p> <p>B The vibration creates sound waves.</p>	4															
6(b)(i)	To store files / software long term	1															
6(b)(ii)	<p>1 mark per bullet point to max 3</p> <ul style="list-style-type: none"> • No moving parts • Solid state memory is non-volatile • Makes use of blocks / arrays of • ... Semiconductors // NAND gates // NOR gates // transistors // integrated circuits • SSD Controller manages the components • Uses a grid of columns and rows that has two transistors at each intersection • One transistor is called a floating gate • The second transistor is called the control gate • Memory cells store voltages which can represent either a 0 or a 1 • Essentially the movement of electrons is controlled to read/write • Not possible to overwrite existing data // it is necessary to first erase the old data then write the new data in the same location 	3															

Question	Answer	Marks
6(c)	<p>1 mark per bullet point to max 2</p> <ul style="list-style-type: none">• RAM stores currently running parts of files / programs / processes / OS• ROM stores boot up instructions / OS kernel // data permanently // store the firmware for the tablet	2

Answer 24

Question	Answer	Marks												
1(a)(i)	<p>1 mark per input device to max 2</p> <p>e.g.</p> <ul style="list-style-type: none"> • Barcode scanner / Infra-red scanner • Pressure sensor • RFID / chip reader • Bank note scanner • Pin / key pad • Magnetic strip reader 	2												
1(a)(ii)	<p>1 mark per output device to max 2</p> <p>e.g.</p> <ul style="list-style-type: none"> • Speaker • Printer • LCD screen 	2												
1(a)(iii)	<p>1 mark for at least two statements in the correct position, 2 marks for all four statements in correct position.</p> <p> 1 B (The screen has a layer that stores an electrical charge) 2 <i>When the user touches the screen</i> 3 A (Charge is drawn to the point of contact) 4 C (There is a change in the electrostatic field) 5 <i>The coordinates of the point of contact can be calculated</i> 6 D (These coordinates are sent to the touchscreen driver) </p>	2												
1(b)(i)	<p>1 mark per bullet point to max 2</p> <ul style="list-style-type: none"> • To store the files needed to boot the system • To store parts of the self- checkout machine operating system • To store the self-checkout machine software • To store the intermediate data / running total for items purchased 	2												
1(b)(ii)	<p>1 mark for at least one correct row, 2 marks for all three correct rows</p> <table border="1"> <thead> <tr> <th>Statement</th> <th>SRAM</th> <th>DRAM</th> </tr> </thead> <tbody> <tr> <td>More expensive to make</td> <td>✓</td> <td></td> </tr> <tr> <td>Requires refreshing (recharging)</td> <td></td> <td>✓</td> </tr> <tr> <td>Made from flip-flops</td> <td>✓</td> <td></td> </tr> </tbody> </table>	Statement	SRAM	DRAM	More expensive to make	✓		Requires refreshing (recharging)		✓	Made from flip-flops	✓		2
Statement	SRAM	DRAM												
More expensive to make	✓													
Requires refreshing (recharging)		✓												
Made from flip-flops	✓													

Answer 25

Question	Answer	Marks
7(a)	<p>1 mark for each input device to max 2 e.g.</p> <ul style="list-style-type: none"> • (Handheld) remote controller • Joystick / Games pad / joypad • Accelerometer • Microphone • Suitable sensor <p>1 mark for output e.g.</p> <ul style="list-style-type: none"> • Motor/vibrator in joystick • Speaker • Screen/monitor /TV 	3
7(b)(i)	<p>1 mark for each difference to max 2</p> <ul style="list-style-type: none"> • RAM is volatile and ROM is non-volatile • RAM can change and ROM (usually) can't be changed • ROM is read only, RAM is read/write 	2
7(b)(ii)	<p>1 mark for example e.g.</p> <ul style="list-style-type: none"> • Current game • Currently running processes • Current graphics/sound 	1
7(b)(iii)	<p>1 mark for an example e.g.</p> <ul style="list-style-type: none"> • Start-up instructions / boot program • Kernel of Operating System 	1

Answer 26

Question	Answer	Marks
7(a)	<p>1 mark per bullet to max 4</p> <ul style="list-style-type: none"> • Resistive (screen) consists of two <u>charged</u> plates • Pressure causes the plates to touch • Completing the circuit • Point of contact registered • Coordinates used to calculate the position • Capacitive (screen) made from materials that store electric charge • When touched charge transferred to the finger • Sensors at the (screen) corners detect the change • Point of contact registered • Coordinates used to calculate the position 	4
7(b)(i)	<p>1 mark for suitable device e.g.</p> <ul style="list-style-type: none"> • Speaker • Headphones 	1

Question	Answer	Marks
7(b)(ii)	<p>1 mark for naming input device 1 mark for use in this scenario, for max 2 devices e.g.</p> <ul style="list-style-type: none"> • Microphone <ul style="list-style-type: none"> • ...visitor says commands / search criteria for the computer to respond to • Keyboard <ul style="list-style-type: none"> • ...visitor types key words to look for • Mouse <ul style="list-style-type: none"> • ...visitor controls cursor to navigate / select • Trackpad <ul style="list-style-type: none"> • ...visitor uses finger to control cursor to navigate / select 	4

7(c)	<p>1 mark for device (internal) hard <u>drive</u> / solid state <u>drive</u></p> <p>1 mark per bullet. Max 2 marks for each reason, max two reasons e.g.</p> <p>Hard drive</p> <ul style="list-style-type: none"> • Large capacity... • to store videos / images / sound files with large file sizes • Reasonably fast access speed... • Users will not have to wait for videos to load • Inexpensive per unit storage... • If a large number of needed for different exhibits, the cost can be kept low • Does not need to be moved ... • So moving parts unlikely to be damaged • Slower degradation of data ... • So will last longer / be more reliable under heavy use <p>Solid state</p> <ul style="list-style-type: none"> • Large capacity... • To store videos/images/sound files with large file sizes • Fast access speed... • Users will not have to wait for videos to load • Reliable... • Can be dropped/damaged and will likely still work / no moving parts • Quiet... • No moving parts 	5
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Question	Answer	Marks
7(d)	<p>1 mark for a correct reason for RAM, 1 mark for a correct reason for ROM</p> <p>RAM</p> <ul style="list-style-type: none"> • Currently running data / video / music / images / software <p>ROM</p> <ul style="list-style-type: none"> • Boot up instructions / OS kernel 	2

Answer 27

Question	Answer	Marks
1(a)	1 mark per bullet point to max 3 <ul style="list-style-type: none">• The microphone has a diaphragm• The incoming sound waves cause vibrations• ... causing a coil to move past a magnet (dynamic microphone) // changing the capacitance (condenser microphone)• An electric current is generated / changed	3

Answer 28

6(c)	1 mark per row	5																
	<table border="1"><thead><tr><th>Statement</th><th>DRAM</th><th>SRAM</th></tr></thead><tbody><tr><td>Does not need to be refreshed as the circuit holds the data while the power supply is on</td><td></td><td>✓</td></tr><tr><td>Mainly used in cache memory of processors where speed is important</td><td></td><td>✓</td></tr><tr><td>Has less complex circuitry</td><td>✓</td><td></td></tr><tr><td>Requires higher power consumption under low levels of access, which is significant when used in battery-powered devices</td><td>✓</td><td></td></tr><tr><td>Requires data to be refreshed occasionally so it retains the data</td><td>✓</td><td></td></tr></tbody></table>		Statement	DRAM	SRAM	Does not need to be refreshed as the circuit holds the data while the power supply is on		✓	Mainly used in cache memory of processors where speed is important		✓	Has less complex circuitry	✓		Requires higher power consumption under low levels of access, which is significant when used in battery-powered devices	✓		Requires data to be refreshed occasionally so it retains the data
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Requires data to be refreshed occasionally so it retains the data	✓																	

Answer 29

Question	Answer	Marks															
2(a)(i)	<table border="1"> <tr> <td>1</td><td>A laser beam and a rotating mirror are used to draw an image of the page on the photosensitive drum.</td><td rowspan="7">3</td></tr> <tr> <td>2</td><td>C // The image is converted on the drum into an electrostatic charge.</td></tr> <tr> <td>3</td><td>Electrostatic charge attracts toner.</td></tr> <tr> <td>4</td><td>The charged paper is rolled against the drum.</td></tr> <tr> <td>5</td><td>D // The oppositely-charged paper picks up the toner particles from the drum. After picking up the toner, the paper is discharged to stop it clinging to the drum.</td></tr> <tr> <td>6</td><td>A // The paper passes through a fuser, which heats up the paper. The toner melts and forms a permanent image on the paper.</td></tr> <tr> <td>7</td><td>B // The electrical charge is removed from the drum and the excess toner is collected.</td></tr> </table>	1	A laser beam and a rotating mirror are used to draw an image of the page on the photosensitive drum.	3	2	C // The image is converted on the drum into an electrostatic charge.	3	Electrostatic charge attracts toner.	4	The charged paper is rolled against the drum.	5	D // The oppositely-charged paper picks up the toner particles from the drum. After picking up the toner, the paper is discharged to stop it clinging to the drum.	6	A // The paper passes through a fuser, which heats up the paper. The toner melts and forms a permanent image on the paper.	7	B // The electrical charge is removed from the drum and the excess toner is collected.	
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7	B // The electrical charge is removed from the drum and the excess toner is collected.																
	C in the correct place	1															
	DA,	1															
	AB	1															
2(a)(ii)	Inkjet printer	1															
2(b)	Hard disk drive // HDD Solid state drive // SSD // flash memory One from: <i>Hard disk</i> Inexpensive per unit of storage <u>Larger</u> storage capacity than flash drive	1	3														
	<i>Solid state storage</i>	1															
	No moving parts / noise	1															
	Robust	1															
	Low latency // Fast read/write time	1															

Answer 30

Question	Answer	Marks
5(a)(i)	<p>Three marks from:</p> <ul style="list-style-type: none"> ox Diaphragm / cone ox (Voice) coil of wire ox Spider / Suspension ox (Permanent) Magnet ox Basket ox Dust cap ox Outer frame 	3
5(a)(ii)	<p>Four marks from:</p> <ul style="list-style-type: none"> ox Takes an electrical signal and translates it into physical vibrations to create sound waves ox An electric current in the coil creates an electro-magnetic field ox Changes in the audio signal causes the direction of the electric current to change ox The direction of the current determines the polarity of the electro-magnet // changing the direction of the current changes the direction of the polarity of the electro-magnet ox The electro-magnet is repelled by or attracted to the permanent magnet ox Causing the coil to vibrate ox The movement of the coil causes the cone / diaphragm to vibrate ox That vibration is transmitted to the air in front of the cone / diaphragm as sound waves ox The amount of movement will determine the frequency and amplitude of the sound wave produced 	Max 4
5(b)(i)	<p>One mark from:</p> <ul style="list-style-type: none"> ox External hard disk drive // SSD ox External CD / DVD drive ox Pen drive ox Blu-ray drive 	1
5(b)(ii)	<p>Two marks from:</p> <ul style="list-style-type: none"> ox Additional secondary file storage // storing files ox Backup of files ox Archiving of files ox Transfer files to second computer 	Max 2

Answer 31

6(b)	<p>1 Mark per bullet to max 4</p> <ul style="list-style-type: none">oo The hard disk has one or more platters made of aluminium or glassoo Each surface of the platter/disk is ferrous-oxide which is capable of being magnetisedoo The platters/disks are mounted on a central spindleoo The disks are rotated at high-speedoo Each surface of the disk has a read/write head mounted on an arm positioned just above the surfaceoo Electronic circuits control the movement of the arm and hence the headsoo The surface of the platter/disk is divided into <u>concentric</u> tracks and sectorsoo One track in one sector is the basic unit of storage called a blockoo The data is encoded as a magnetic pattern for each blockoo When writing to disk, a variation in the current in the head produces a variation in magnetic field on the diskoo When reading from disk, a variation in magnetic field produces a variation in current through the head	4
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Answer 32

Question	Answer	Marks
5(a)(i)	<p>Three marks from:</p> <ul style="list-style-type: none"> o Diaphragm / cone o (Voice) coil of wire o Spider / Suspension o (Permanent) Magnet o Basket o Dust cap o Outer frame 	3
5(a)(ii)	<p>Four marks from:</p> <ul style="list-style-type: none"> o Takes an electrical signal and translates it into physical vibrations to create sound waves o An electric current in the coil creates an electro-magnetic field o Changes in the audio signal causes the direction of the electric current to change o The direction of the current determines the polarity of the electro-magnet // changing the direction of the current changes the direction of the polarity of the electro-magnet o The electro-magnet is repelled by or attracted to the permanent magnet o Causing the coil to vibrate o The movement of the coil causes the cone / diaphragm to vibrate o That vibration is transmitted to the air in front of the cone / diaphragm as sound waves o The amount of movement will determine the frequency and amplitude of the sound wave produced 	Max 4
5(b)(i)	<p>One mark from:</p> <ul style="list-style-type: none"> o External hard disk drive // SSD o External CD / DVD drive o Pen drive o Blu-ray drive 	1
5(b)(ii)	<p>Two marks from:</p> <ul style="list-style-type: none"> o Additional secondary file storage // storing files o Backup of files o Archiving of files o Transfer files to second computer 	Max 2

Answer 33

2 (a) Any two from:

- DRAM has to be refreshed / charged
// SRAM does not request a refresh
- DRAM uses a single transistor and capacitor
// SRAM uses more than one transistor to form a memory cell
// SRAM has more complex circuitry
- DRAM stores each bit as a charge
// SRAM each bit is stored using a flip-flop / latch
- DRAM uses higher power(because it requires more circuitry for refreshing)
// SRAM uses less power (no need to refresh)
- DRAM less expensive (to purchase / requires fewer transistors)
// SRAM is more expensive (to buy as it requires more transistors)
- DRAM has slower access time / speed (because it needs to be refreshed)
// SRAM has faster access times
- DRAM can have higher storage / bit / data density
// SRAM has lower storage / bit / data density
- DRAM used in main memory
// SRAM used in cache memory

[2]

Answer 34

3 ONE mark for each letter in the correct place.

Then **ONE** mark for any pair of letters in the correct order, but not in the correct place

- 1 The application program executes a statement to read a file.
- 2 G
- 3 The operating system begins to spin the hard disk, if it is not currently spinning.
- 4 F
- 5 D
- 6 H
- 7 C
- 8 B
- 9 A
- 10 E

[8]

Answer 35

6 (a) ONE mark for each difference from the bullet points below.

- RAM loses content when power turned off / volatile memory / temporary memory
ROM does not lose content when power turned off / non-volatile memory / permanent memory
- Data in RAM can be altered / deleted / read from and written to
ROM is read only / cannot be changed / altered / deleted
- RAM stores files / data / operating system currently in use
ROM is used to store BIOS / bootstrap / pre-set instructions

[2]

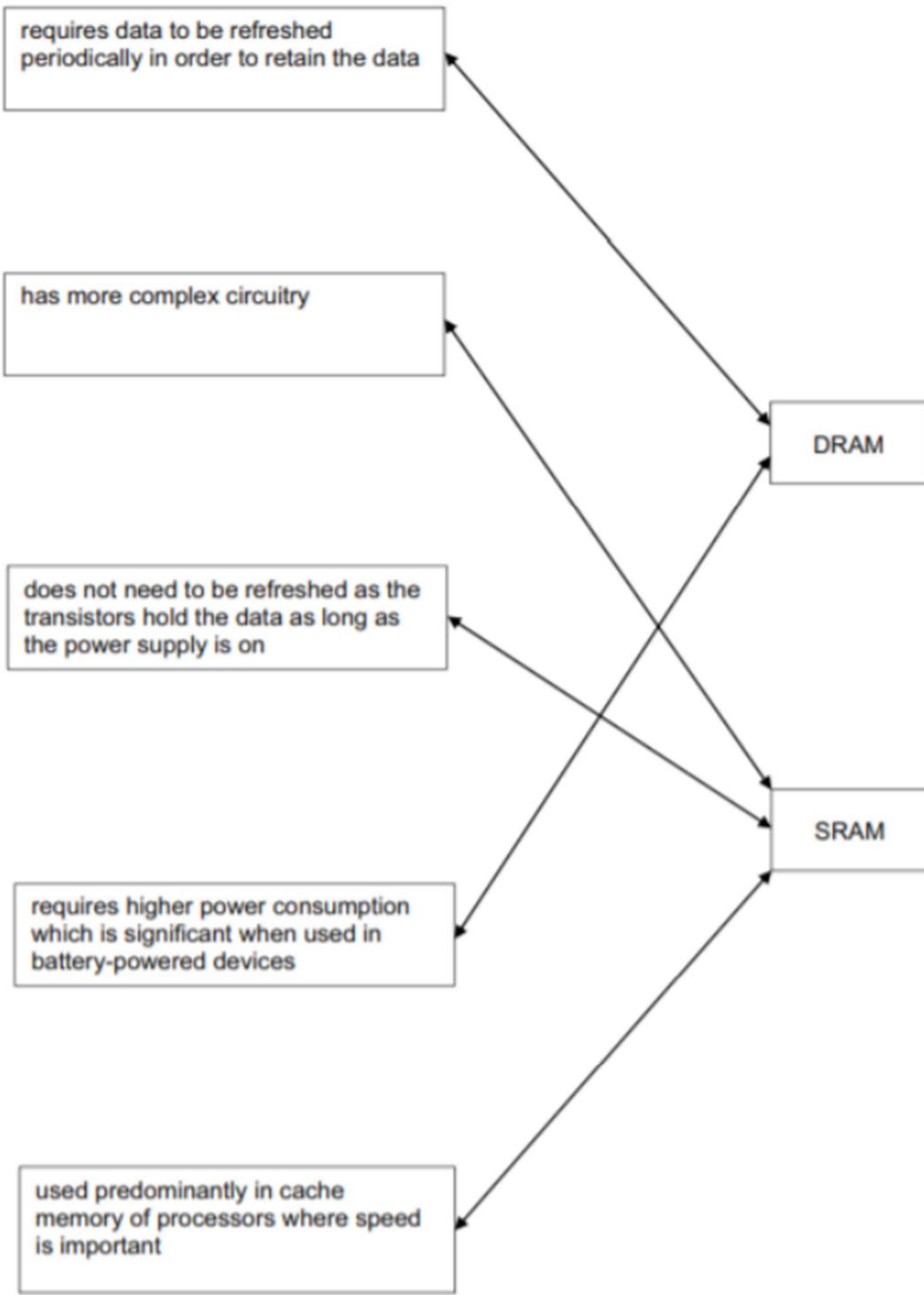
(b) THREE from:

- DRAM has to be refreshed / charged
// SRAM does not request a refresh
- DRAM uses a single transistor and capacitor
// SRAM uses more than one transistor to form a memory cell
// SRAM has more complex circuitry
- DRAM stores each bit as a charge
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- DRAM uses higher power (because it requires more circuitry for refreshing)
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- DRAM less expensive (to purchase / requires fewer transistors)
// SRAM is more expensive (to buy as it requires more transistors)
- DRAM has slower access time / speed (because it needs to be refreshed)
// SRAM has faster access times
- DRAM can have higher storage / bit / data density
// SRAM has lower storage / bit / data density
- DRAM used in main memory
// SRAM used in cache memory

[3]

Answer 36

4 (a)



[5]

(b) maximum of two marks for RAM and maximum of two marks for ROM

RAM

- loses contents when power turned off/volatile memory/temporary memory
- stores files/data/operating system currently in use
- data can be altered/deleted/read from and written to
- memory size is often larger than ROM

ROM

- doesn't lose contents when power turned off/non-volatile memory/permanent memory
- cannot be changed/changed/deleted/read only
- can be used to store BIOS/bootstrap

[3]

(c) one mark for DVD-RAM, one mark for flash memory.

DVD-RAM

- data is stored/written using lasers/optical media
- DVD-RAM uses phase changing recording, in which varying laser intensities cause targeted areas in the phase change recording layer to alternate between an amorphous and a crystalline state.
- uses a rotating disk with concentric tracks
- allows read and write operation to occur simultaneously

flash memory

- most are NAND-based flash memory
- there are no moving parts
- uses a grid of columns and rows that has two transistors at each intersection
- one transistor is called a floating gate
- the second transistor is called the control gate
- memory cells store voltages which can represent either a 0 or a 1
- essentially the movement of electrons is controlled to read/write
- not possible to over-write existing data; it is necessary to first erase the old data then write the new data in the same location

[2]