

Indian Institute of Technology Kharagpur
School of Bioscience
End Sem Class Test (SLOT-II)

Sub: Science of Living Systems**Sub No: BS20001****Full Marks: 20****Session: Autumn, 2017-2018****Date: 08-11-2017****Time: 30 minutes****NAME:****ROLL NO:****DEPT:**

Choose (tick) the (ONE) correct answer OR write in a few words

1. Chemiosmosis during photosynthesis utilizes proton gradient to synthesize ATP. This proton gradient is between
 - a) thylakoid space and stroma
 - b) intermembrane space of chloroplast and stroma
 - c) intermembrane space of chloroplast and cytoplasm
 - d) between stroma of chloroplast and cytoplasm

2. Which of the following is the key intermediate compound that links Glycolysis and Kreb's cycle?
 - a) Pyruvic acid
 - b) ATP
 - c) Acetyl CoA
 - d) NADH

3. During chemi-osmotic phosphorylation in mitochondria, which of the following helps in the generation of ATP?
 - a) ATP synthase
 - b) ATP reductase
 - c) ATP hydrolase
 - d) ATP permease

4. Photosynthesis is an example of anabolic , endergonic process, whereas respiration is an example of catabolic , exergonic process.
 Options: catabolic, anabolic, exergonic, endergonic

5. State TRUE and FALSE from the following statements:
 - A. The thylakoid membranes contain chlorophyll pigments T
 - B. The thylakoid membranes contain the Calvin cycle enzymes F

6. Which of the following will give maximum resolution when used for microscopy?
 - a) Red light
 - b) Blue light
 - c) Green light
 - d) Electron beam

7. Which instrument is more useful to study surface characteristics of a specimen?
 - a) Phase contrast microscope
 - b) Scanning electron microscope
 - c) Transmission electron microscope
 - d) Light microscope

8. *Staphylococcus aureus* and *Escherichia coli* are Gram +ve and Gram –ve bacteria, respectively. With respect to these bacteria, identify where the following will be found.
 - A. Relatively thicker peptidoglycan layer: *Staphylococcus aureus*
 - B. Pink color upon Gram staining: *E. coli*

9. Write down the names of the components that constitute the peptidoglycan layer.

Ans. Sugar backbone (alternating N-acetylglucosamine and N-acetylmuramic acid), Tetrapeptide (alternating L and D amino acids) cross-linked by Pentaglycine.

10. Which of the following helps in processing and transport of proteins?

- a) Ribosome b) Lysosome c) Endoplasmic reticulum d) Mitochondria

11. Fundamentally, prokaryotic cell and eukaryotic cell can be differentiated on the basis of which sub-cellular organelle/structure?

Ans. Nucleus

12. Egg and sperm (cells) both are haploid cells/germ cells/sex cells; muscle and skin (cells) are diploid cells/somatic cells.

13. In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?

- a) G₁ b) S c) G₂ d) M

14. Which of the following cellular structures always disappears during mitosis and meiosis?

- a) Plasma membrane b) Cytoskeleton c) Nuclear envelope d) Mitochondria

15. State TRUE or FALSE:

- A. The amount of nuclear DNA is twice in G₂ as compared to G₁. T
 B. Mitochondria is distributed into the two daughter cells by dividing into large number of small vesicles F

16. A tadpole loses its tail by a genetically controlled program called apoptosis/programmed cell death, to develop into a mature frog.

17. The characteristics of adaptive immunity include

- a) specificity b) memory
 c) distinction between self and foreign d) all of the above

18. Origin and maturation of B cells take place in

- a) Bone marrow b) Thymus c) Spleen d) Lymph node

19. Type-1 diabetes is an example of auto-immune disease.

20. State TRUE or FALSE for the following statements:

- A. Cytotoxic T cell recognizes antigen on the surface of infected cell and then kills the infected cell. T
 B. T cells are generated from our bone marrow and matured in thymus. F

Problem Set: Enzymes and Enzyme Kinetics

1. In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?

- a) Enzyme catalyzed reaction will be faster than uncatalyzed reaction
- b) Enzyme will not bind to substrate
- c) Reaction will not proceed beyond enzyme-substrate complex formation
- d) Enzyme will catalyze product formation but they will remain bound to the enzyme

3. A Methanol poisoning is treated with ethanol which actually slows down the formation of formaldehyde. This is an example of

- a) Competitive inhibition
- b) Uncompetitive inhibition
- c) Allosteric regulation
- d) Non-competitive inhibition

4. Effect of a reversible competitive inhibitor can be nullified by

- a) increasing enzyme concentration
- b) increasing substrate concentration
- c) increasing product concentration
- d) increasing temperature

5. If the reaction $A + B \rightarrow C$ is first order with respect to A and first order with respect to B, then the rate equation for the forward reaction would be

- a) Rate= $k[A]$
- b) Rate= $k[B]$
- c) Rate= $k[A][B]$
- d) Rate= $k_a[A] + k_b[B]$

6. An allosteric inhibitor of an enzyme usually

- a) denatures the enzyme
- b) causes the enzyme to work faster
- c) binds to the active site
- d) changes the conformation of the active site

7. Which of the following statements about Michaelis constant (K_M) of an enzyme is correct?

- a) It is defined as the concentration of substrate required for the reaction to reach maximum velocity
- b) It is defined as the dissociation constant of the enzyme-substrate complex
- c) It is expressed in terms of the reaction velocity
- d) It is a measure of the affinity the enzyme has for its substrate

8. For an efficient enzyme, what relative values of K_M and k_{cat} are correct?

- (a) Low K_M and high k_{cat}
- (b) High K_M and high k_{cat}
- (c) High K_M and low k_{cat}
- (d) Low K_M and low k_{cat}

Problem set 3

1. The amino acid that can form a disulfide linkage is
a. methionine b. cysteine c. histidine d. proline

2. Peptide bond is
a. covalent b. planar, covalent
c. rigid with partial double bond character d. all of the above

3. Arrange the following in the increasing order of protein structure hierarchy:

- A: α -helix
B: amino acid sequence
C: quaternary structure
D: folded structure
a. A, D, C, B b. A, D, B, C
c. B, A, D, C d. B, A, C, D

4. Formation of peptide bond is a
a. ligation reaction b. oxidation reaction
c. hydrolysis reaction d. condensation reaction

5. How are secondary structures stabilized in proteins?
a. Through ionic bonds between oppositely charged amino acid side chains
b. Through covalent bonds joining different parts of the peptide backbone
c. Through hydrogen bonds between different amino acid side chains
d. Through hydrogen bonds joining different parts of the peptide backbone

6. Which of the following CAN NOT be close (adjacent) in primary structure
a. two α -helices c. parallel β -strands
b. anti-parallel β -strands d. an α -helix and a β -strand

7. What is a protein domain?
(A) The α -helical or β -pleated sheet portion of a protein (B) A multi-subunit protein complex
(C) Part of a protein folded into a self-contained 3D structure (D) An unfolded part of a protein

8. Theoretically, a vast number of different proteins can be assembled from 20 different amino acids.
How many polypeptide chains are possible that are 10 amino acids long?

9. Glycine and alanine contain _____ and _____ chiral center(s) respectively

10. _____ interactions are the major driving force for folding of a globular protein.

11. Hydrogen bonds in α -helices are

- (A) more numerous than Van der Waals interactions (B) not present at Phe residues
(C) analogous to the steps in a spiral staircase (D) roughly parallel to the helix axis

12. You have purified a multi-subunit extracellular protein that has several interchain disulfide bonds. Which of the following chemicals would you add to your purified protein mixture if you wanted to eliminate the disulfide bonds?

Problem set: Host Defense

1. Indicate whether each of the following descriptions better applies to an adaptive (A) or innate (I) immune response.
 - (i) It is found in invertebrate and vertebrate animals as well as in plants
 - (ii) It has a long-lasting memory
 - (iii) It is highly specific to the particular invading pathogen
 - (iv) Both, macrophage and dendritic cells play important role in this process

2. State TRUE or FALSE for the following statements:
 - A) Cytotoxic T cell recognizes antigen on the surface of infected cell and then kill the infected cell
 - B) B cell can also recognize antigen and produces antibody
 - C) Our immune system can distinguish between self and foreign and mount response to only foreign while preserving self
 - D) Blood cells are generated from our bone marrow

3. State TRUE or FALSE for the following statements:
 - A) Origin and maturation of B cells take place in bone marrow
 - B) Origin and maturation of T cells take place in Thymus

4. A plasma cell secretes
 - A) Antibody of a single specificity
 - B) Antibody of multiple specificity
 - C) The antigen it recognizes
 - D) Antimicrobial peptides

5. Type-1 diabetes is an example of _____ disease.

6. The characteristics of adaptive immunity include

- A) Specificity
- B) Memory
- C) Distinction between self and foreign
- D) All of the above

7. Majority of antigens are

- A) Carbohydrates
- B) Lipids
- C) Proteins
- D) None of the above

8. Primary function of MHC (major histocompatibility complex) molecules is:

- A) immunological memory
- B) generation of antibody
- C) antigen presentation
- D) immunological surveillance in innate pathway

Indian Institute of Technology Kharagpur
School of Bioscience
End Sem Class Test (SLOT-1)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2017-2018

Date: 08-11-2017

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

Ans. Fluorescence microscopy

7. Gram staining differentiates bacteria based on

 - a) thickness of the peptidoglycan layer in cell wall
 - b) presence of cellulose in cell wall
 - c) certain proteins in the lipid bilayer membrane of bacteria
 - d) D-amino acids in cell wall

8. What component/constituent of the bacterial cell wall gets affected by the lysozyme enzyme present in the tears of our eyes?

Ans. Lysosome

9. Which one of the following eukaryotic cell structures does not contain DNA?

 - a) Endoplasmic reticulum b) Nucleus c) Mitochondria d) Chloroplast

10. Bacterial cell wall is composed of
 a) sugars and amino acids
 b) sugars and lipids
 c) amino acids and lipids
 d) amino acids and nucleic acids
11. In eukaryotic cells, which sub-cellular organelle is associated with the protein synthesis machineries?
- Ans. Rough Endoplasmic Reticulum (rER)**
12. There are two different types of cell division. In higher living organisms, the body cells (somatic cells) proliferate by mitotic division, and the sex cells (gametes) are produced by meiotic division.
13. In which of the following cell division stages chromosomes will be visible as separate entities?
 a) Interphase b) Prophase c) Metaphase d) Telophase
14. Which of the following is FALSE in case of asymmetric mitotic division?
 a) The two progeny cells acquire different fates because they inherit different genetic material
 b) Two progeny cells inherit unequal cytoplasmic materials (RNA/Proteins)
 c) Asymmetric division is the key mechanism for retaining self-renewing ability in stem cells
 d) Two progeny cells are unequal in shape and size
15. Give an example of each:
 A. Haploid Organism: **Bacteria**
 B. Diploid Organism: **Human**
 C. Haploid cell: **Gamete/Sex cells (sperm/ovum)**
 D. Diploid Cell: **Any somatic cell (skin cell, liver cell, white blood cell, neuron etc)**
16. Which molecule moves from inner layer to outer layer of fatty acids of cellular plasma membrane during the process of programmed cell death?
 a) Phosphatidylserine b) Phosphatidylcholine c) Cholesterol d) NADPH
17. Primary lymphoid organs include
 a) Thymus, bone marrow and spleen
 b) Thymus, bone marrow, lymph nodes and spleen
 c) Thymus and spleen
 d) Thymus and bone marrow
18. Majority of antigens are
 a) carbohydrates b) lipids c) proteins d) nucleic acids
19. A plasma cell secretes
 a) antibody of a single specificity b) antibody of multiple specificity
 c) the antigen it recognizes d) antimicrobial peptides
20. In order to initiate an adaptive immune response, antigenic peptide must be presented to T cells. Which cell presents this antigen to T cells?
 a) Red blood cell b) Dendritic cell c) Helper T cell d) Cytotoxic T cell

Indian Institute of Technology Kharagpur**School of Bioscience****Class Test (SLOT-II)****Sub: Science of Living Systems****Sub No: BS20001****Full Marks: 20****Session: Spring, 2018-19****Date: 15-04-2019****Time: 30 minutes****NAME:****ROLLNO:****DEPT:****Choose (tick) the (ONE) correct answer OR write in a few words**

1. For the enzyme-catalyzed reaction $E + S \rightleftharpoons ES \rightarrow E + P$, what is the value of K_M if $[S] = 10 \text{ mM}$ and the corresponding velocity is half of V_{\max} ?

- a) 10
- b) 20
- c) 30
- d) 40

2. A Methanol poisoning is treated with ethanol which actually slows down the formation of formaldehyde. This is an example of

- a) Competitive inhibition
- b) Uncompetitive inhibition
- c) Allosteric regulation
- d) Non-competitive inhibition

3. Effect of a reversible competitive inhibitor can be nullified by

- a) increasing enzyme concentration
- b) increasing substrate concentration
- c) increasing product concentration
- d) increasing temperature

4. An allosteric inhibitor of an enzyme usually

- a) denatures the enzyme
- b) causes the enzyme to work faster
- c) binds to the active site
- d) changes the conformation of the active site

5. For an efficient enzyme, what relative values of K_M and k_{cat} are correct?

- (a) Low K_M and high k_{cat}
- (b) High K_M and high k_{cat}
- (c) High K_M and low k_{cat}
- (d) Low K_M and low k_{cat}

6. Which of the following is not present in bacteria:

- (a) ribosome
- (b) nucleic acid
- (c) endoplasmic reticulum
- (d) cytoplasm

7. Place the following in order of size, from the smallest to the largest

- (a) Protofilament

- (b) Microtubule
- (c) α -tubulin
- (d) Tubulin dimer

8. Bacterial cell wall is composed of

- a) sugars and amino acids
- b) sugars and lipids
- c) amino acids and lipids
- d) amino acids and nucleic acids

9. Which one of the following eukaryotic cell structures does not contain DNA?

- a) Endoplasmic reticulum
- b) Nucleus
- c) Mitochondria
- d) Chloroplast

10. Which of the following will give maximum resolution?

- a) Red light
- b) Blue light
- c) Green light
- d) Electron beam

11. DNA replication occurs in

- a) S Phase
- b) G Phase
- c) M Phase
- d) G₀ Phase

12. Number of mitotic divisions required to produce 128 cells from single cell is

- a) 7
- b) 8
- c) 16
- d) 32

13. In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNAs?

- a) G₁
- b) S
- c) G₂
- d) M

14. An organism has 52 chromosomes, i.e., 2n=52, which includes a pair of sex chromosomes. What will be the combination of chromosomes in its ovum?

- a) 51 + X
- b) 50 + 2X
- c) 26 + X
- d) 25 + X

15. Which of the following is FALSE in case of asymmetric mitotic division?

- a) The two progeny cells acquire different fates because they inherit different genetic material
- b) Two progeny cells inherit unequal cytoplasmic materials (RNA/Proteins)
- c) Asymmetric division is the key mechanism for retaining self-renewing ability in stem cells
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- a) Antibody of a single specificity
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17. The characteristics of adaptive immunity include

- a) Specificity
- b) Memory
- c) Distinction between self and foreign
- d) All of the above

18. Primary lymphoid organs include

- a) Thymus, bone marrow and spleen
- b) Thymus, bone marrow, lymph nodes and spleen
- c) Thymus and spleen
- d) Thymus and bone marrow

19. In order to initiate an adaptive immune response, antigenic peptide must be presented to T cells. Which cell presents this antigen to T cells?

- a) Red blood cell
- b) Dendritic cell
- c) Helper T cell
- d) Cytotoxic T cell

20. Which of the following is NOT true for adaptive immune response?

- a) Highly specific towards individual pathogens
- b) Distinction between self and foreign
- c) Response time is same towards multiple exposures of same pathogen
- d) Retention of memory of infection

Indian Institute of Technology Kharagpur
School of Bioscience
End Sem Class Test (SLOT-1)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Spring, 2017-18

Date: 04-04-2018

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

- In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?
 - Enzyme catalyzed reaction will be faster than uncatalyzed reaction
 - Enzyme will not bind to substrate
 - Reaction will not proceed beyond enzyme-substrate complex formation**
 - Enzyme will catalyze product formation but they will remain bound to the enzyme
 - The transition state of an enzyme catalyzed reaction
 - has lower energy than that of the uncatalyzed reaction**
 - has lower energy than the reaction substrate
 - has higher energy than that of the uncatalyzed reaction
 - has lower energy than that of the product(s)
 - Effect of a reversible competitive inhibitor can be nullified by increasing
 - pH
 - temperature
 - product concentration
 - substrate concentration**
 - For the enzyme-catalyzed reaction $E + S \rightleftharpoons ES \rightleftharpoons E + P$, what is the value of K_M if $[S] = 10\text{mM}$ and the initial velocity is half of V_{max} ?
 - 10**
 - 20
 - 30
 - 40
 - If the reaction $A + B \rightleftharpoons C$ is first order with respect to A and first order with respect to B, then the rate equation for the forward reaction would be
 - $\text{Rate} = k[A]$
 - $\text{Rate} = k[B]$
 - Rate = $k[A][B]$**
 - $\text{Rate} = kA[a] + kB[B]$
 - Which of the following is found in Prokaryotes?
 - Histone protein
 - Ribosome**
 - Mitochondria
 - Nuclear membrane
 - In a defective cell, division is stopped at metaphase stage. You want to investigate whether it is due to defective microtubule arrangement or their defective binding to kinetochore. Which of the following techniques will you use?
 - Bright field microscopy
 - Transmission Electron Microscopy
 - Scanning Electron microscopy
 - Fluorescence microscopy**
 - In the polymerization *in vitro* of actin filaments and microtubules from their subunits, what does the “lag phase” correspond to?
 - Nucleation**
 - Reaching steady state
 - Nucleotide exchange
 - ATP or GTP hydrolysis

9. Bacterial cell wall is composed of
a) sugars and amino acids b) sugars and lipids
c) amino acids and lipids d) amino acids and nucleic acids

10. Which of the following drugs is toxic for our cells?
a) Cytochalasin B, which caps the plus end of actin filaments and prevents actin polymerization
b) Phalloidin, which binds along actin filaments and stabilizes them
c) Colchicine, which caps microtubule ends and leads to their depolymerization
d) All of the above

11. Meiotic cell division is observed in _____ cells whereas Mitotic cell division is observed in _____ cells of our body.

12. In which of the following cell cycle stages chromosomes are visible as distinctly separate entities?
a) S phase b) G1 phase c) M phase d) G2 phase

13. State TRUE or FALSE for the following statements:
A. Nucleus contains only DNA, but not RNA and proteins
B. *E. coli* chromosome is circular while human chromosomes are linear
C. Stem cell is not present in adult human being
D. **Neuronal cells divide the least in human body**

14. An organism has 52 chromosomes, i.e., $2n=52$, which includes a pair of sex chromosomes. What will be the combination of chromosomes in its ovum?
a) $51 + X$ b) $50 + 2X$ c) $26 + X$ d) **$25 + X$**

15. A cell divides every one minute. At this rate of division it can fill a 100 ml of beaker in 1 hour. How much time does it take to fill a 200 ml of beaker?
a) 2 hrs b) 1 hr c) **61 min** d) 59 min

16. State TRUE or FALSE from the following statements:
a) Cytotoxic T cell recognizes antigen on the surface of infected cell and then kill the infected cell. T
b) T cells are generated from our bone marrow and matured in thymus. T

17. Majority of antigens are
a) carbohydrates b) lipids c) **proteins** d) nucleic acids

18. A plasma cell secretes
a) antibody of a single specificity b) antibody of multiple specificity
c) the antigen it recognizes d) antimicrobial peptides

19. Type-1 diabetes is an example of _____ autoimmune _____ disease

20. In order to initiate an adaptive immune response, antigenic peptide must be presented to T cells. Which cell presents this antigen to T cells?
a) Red blood cell b) **Dendritic cell** c) Helper T cell d) Cytotoxic T cell

Indian Institute of Technology Kharagpur
School of Bioscience
End Sem Class Test (SLOT-II)

Sub: Science of Living Systems**Sub No: BS20001****Full Marks: 20****Session: Spring, 2017-18****Date: 04-04-2018****Time: 30 minutes****NAME:****ROLLNO:****DEPT:**

Choose (tick) the (ONE) correct answer OR write in a few words

1. Which of the following statements about Michaelis constant (K_M) of an enzyme is correct?
It is defined as the concentration of substrate required for the reaction to reach maximum velocity
 - a) It is defined as the dissociation constant of the enzyme-substrate complex
 - b) It is expressed in terms of the reaction velocity
 - c) **It is a measure of the affinity the enzyme has for its substrate**

2. In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?
 - a) Enzyme catalyzed reaction will be faster than uncatalyzed reaction
 - b) Enzyme will not bind to substrate
 - c) **Reaction will not proceed beyond enzyme-substrate complex formation**
 - d) Enzyme will catalyze product formation but they will remain bound to the enzyme

- tion of the active site

3. A Methanol poisoning is treated with ethanol which actually slows down the formation of formaldehyde.
This is an example of

a) Competitive inhibition	b) Uncompetitive inhibition
c) Allosteric regulation	d) Non-competitive inhibition

4. For an enzyme catalyzed reaction, when $[S]=K_M$, the velocity of an enzyme catalyzed reaction would be

a) $0.1*V_{max}$	b) $0.2* V_{max}$	c) $0.3* V_{max}$	d) $0.5* V_{max}$
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5. Which of the following microscopes is most suited to study surface characteristics of a specimen?

a) Phase contrast microscope	b) Scanning electron microscope
c) Transmission electron microscope	d) Light microscope

6. During *in vitro* polymerization of actin filaments or microtubules from their subunits, what does the “lag phase” correspond to?

a) Nucleation	b) Reaching steady state
c) Nucleotide exchange	d) ATP or GTP hydrolysis

7. Rough endoplasmic reticulum (rER) gets its roughness from

a) convoluted membrane	b) ribosomes attached to its outer surface
c) transmembrane proteins protruding outside the surface	d) vesicles attached to its surface

8. Which of the following helps in processing and transport of proteins?
a) Ribosome b) Lysosome c) **Endoplasmic reticulum** d) Mitochondria
9. Which of the following structures can be found in a Prokaryotic cell?
a) **Nucleoid** b) Nucleolus c) Nuclear matrix d) Nuclear envelope
10. How many mitotic divisions are required to produce 128 cells from a single cell?
a) 7 b) 8 c) 16 d) 32
11. Meiotic cell division is reductional, i.e., chromosome number becomes half at the end of two division cycles. Absence of which of the following events between Meiosis I and Meiosis II is responsible for that?
a) **Replication** b) Transcription c) Translation d) Splicing
12. In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?
a) G₁ b) S c) G₂ d) **M**
13. Which of the following cellular structures always disappears during mitosis and meiosis?
a) Plasma membrane b) Cytoskeleton c) **Nuclear envelope** d) Mitochondria
14. State TRUE or FALSE:
A. The amount of nuclear DNA is twice in G₂ as compared to G₁. T
B. Mitochondria is distributed into the two daughter cells by dividing into large number of small vesicles.
F
15. Which of the following enzyme is present in our tear and helps in innate immune response against bacterial pathogen?
a) Penicillin b) **Lysozyme** c) Trypsin d) Lipase
16. Which of the following is NOT true for adaptive immune response?
a) Highly specific towards individual pathogens
b) Distinction between self and foreign
c) **Response time is same towards multiple exposures of same pathogen**
d) Retention of memory of infection
17. Origin and maturation of B cells take place in
a) Spleen b) Thymus c) **Bone marrow** d) Lymph node
18. Rheumatoid Arthritis is an example of _____ **autoimmune** _____ disease.
19. Which of the following cell types links between innate and adaptive arms of immune system?
a) T lymphocyte b) B lymphocyte c) Red blood cell d) **Dendritic cell**

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Spring, 2017-18

Date: 14-02-2018

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

1. During DNA replication, helicase enzyme unwinds the double stranded DNA to produce localized single stranded DNA. In a PCR reaction, we use an alternative mechanism for DNA unwinding. What is that?

- (A) A special buffer with high salt concentration (B) High temperature
 (C) A special DNA polymerase that can denature DNA (D) Very low pH

2. In gel electrophoresis different sized DNA migrate at different rate. Which of the following statements is FALSE?

- (A) DNA is positively charged and hence migrates towards the negative terminal in the applied electric field gradient
 (B) Different DNA molecules separate according to mass
 (C) Smaller molecules migrate faster
 (D) DNA is visualized in the gel by staining with ethidium bromide, which fluoresces under UV light

3. Griffith's experiment proving DNA as the genetic material was based on the principle of

- (A) Termination (B) Transformation (C) Transcription (D) Translation

4. The accepted theory for DNA replication is

- (A) conservative theory (B) dispersive theory (C) semi-conservative theory (D) evolutionary theory

5. Write True/False against each statement:

- (A) If the GC content of a single stranded DNA is 60%, the AT content of its complementary strand will be 60%.
 (B) If we replace the DNA polymerase of our body with Taq polymerase, it can work just fine. F

6. In classic Sanger DNA sequencing technique, four types of ddNTPs are used along with the normal dNTPs. Which of the following is the correct combination?

- (A) All four ddNTPs and four dNTPs in same reaction tube
 (B) Each tube with one type of ddNTP and one type of dNTP (e.g., ddATP + dATP in tube 1, ddGTP + dGTP in tube 2 and so on)
 (C) Each tube will have one type of dNTP and all four types of ddNTP
 (D) Each tube will have one type of ddNTP and all four types of dNTP

7. Following is the protein coding part of the DNA sequence of a hypothetical gene:

5' ATG GCC CAA TAC TGG TGC ACG ACG TGC GAA GTC TGC ATA TTT **TAA** 3'

What will happen to the protein product of the gene if you mutate (change) the 10th codon from GAA into TAA?

- (A) Protein length will be unaffected (B) Protein will be shorter in length
 (C) Amino acid composition will be changed (D) No protein will be synthesized

8. Estimate the length of the protein coded by the following DNA sequence. Start and stop codons are in bold letters; introns are underlined.

5' GCACATATGGCGATACGAAGGGACGCGGTTGAGGCCGTTGT**TTAAGGTTGT** 3'

- (A) 10 (B) 11 (C) 13 (D) 14

9. Theoretically, a vast number of different proteins can be assembled from 20 different amino acids. How many polypeptide chains are possible that are 10 amino acids long?

- (A) 20×10 (B) 20^{10} (C) 10^{20} (D) $20^{10} \times 10^{20}$

10. In lac operon, if you remove the lac operator (the repressor binding site) what will be the effect on the metabolic state of the bacteria?

- (A) Lactose metabolizing enzymes will be produced irrespective of the presence or absence of lactose
(B) Glucose metabolism will be hampered
(C) Lactose will never be metabolized because the enzymes will never be synthesized
(D) RNA Polymerase will not be able to bind the promoter

11. Anticodon is present in

- (A) mRNA (B) tRNA (C) rRNA (D) amino acid

12. Tetracycline is an antibiotic that kills bacteria by

- (A) lysing the bacterial cell wall
(B) interfering with bacterial transcription by binding to RNA polymerase
(C) blocking bacterial translation by binding to 30S ribosome
(D) blocking bacterial DNA replication by binding to DNA polymerase

13. During transcription, RNA polymerase reads the template DNA strand in:

- (A) 3'- 5' direction (B) 5'- 3' direction (C) in both directions (D) does not require a DNA template

14. Write True/False against the following statements:

- (A) The σ subunit is not a permanent component of the RNA polymerase from *E. coli*. **T**
(B) Ribosomal RNA (rRNA) is used as a template for protein synthesis. **F**

15. Which of the following can be an example of tertiary structure of a protein?

- (A) A multi-subunit protein (B) An α -helix (C) A β -pleated sheet (D) A globular domain

16. How are secondary structures stabilized in proteins?

- (A) Through ionic bonds between oppositely charged amino acid side chains
 - (B) Through covalent bonds joining different parts of the peptide backbone
 - (C) Through hydrogen bonds between different amino acid side chains
 - (D) Through hydrogen bonds joining different parts of the peptide backbone

17. What is a protein domain?

- (A) The α -helical or β -pleated sheet portion of a protein (B) A multi-subunit protein complex
(C) Part of a protein folded into a self-contained 3D structure (D) An unfolded part of a protein

18. Hydrogen bonds in α -helices are

- (A) more numerous than Van der Waals interactions (B) not present at Phe residues
(C) analogous to the steps in a spiral staircase (D) roughly parallel to the helix axis

19. In a folded protein, the nonpolar (hydrophobic) amino acids tend to be

20. Peptidyl transferase enzyme

- (A) is rRNA (B) forms peptide bonds (C) component of ribosome (D) all of the above

Indian Institute of Technology Kharagpur

School of Bioscience

Class Test (SLOT-II)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Spring, 2017-18

Date: 14-02-2018

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

1. Why is RNA primer required during DNA replication?

- (A) RNA is less stable than DNA, hence easy to remove
 (C) DNA polymerase needs an existing 3' -OH group
- (B) RNA has extra -OH group at 2' position
(D) RNA polymerase can work without a template

2. RNA is chemically less stable than DNA, because of

- (A) the uracil base instead of the thymine
(C) the extra carbon atom
 (B) the presence of the 2'-OH group
(D) All of the above

3. Griffith's experiment paved the way to establish that

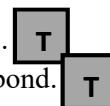
- (A) DNA is the genetic material
(C) proteins and DNA both are genetic material
(B) The ratio of Adenine to thymine was always the same
(D) Phage DNA was similar to bacterial DNA

4. Which of the following enzyme adds complementary bases during replication?

- (A) Helicase (B) Synthetase (C) Replicase (D) Polymerase

5. Write True/False against each statement:

- (A) During DNA replication, half of the DNA is synthesized as Okazaki fragments.
 (B) The linkage between sugar and nitrogenous base in DNA is called Glycosidic bond.



6. In Sanger DNA sequencing technique, ddNTP (analog of dNTP) is used that can terminate DNA synthesis when they get incorporated. How does that happen?

- (A) ddNTPs are bulky molecules
(C) ddNTPs are positively charged
 (B) In ddNTPs 3'-OH group is changed to -H group
(D) ddNTPs have ribose sugar instead of deoxyribose

7. Following is the protein coding part of the DNA sequence of a hypothetical gene:

5' ATG GCC CAA TAC TGG TGC ACG ACG TGC GGT GTC TGC ATA TTT TAA 3'

What will happen to the protein product of the gene if you mutate (change) the start codon from ATG into TTG?

- (A) Protein length will be unaffected
(C) Amino acid composition will be changed
 (B) Protein will be shorter in length
(D) No protein will be synthesized

8. A 900 nucleotide long Eukaryotic nascent mRNA has a 30 nucleotide long intron. But the mature mRNA available for translation is found to be 1100 nucleotide long. What may have caused the increased length of the mature mRNA?

- (A) Splicing (B) 5' capping (C) Poly-A tailing (D) Reverse transcription

9. In an alien species, there are only 2 types of nucleotides (instead of 4 types in humans) but codons are 4 nucleotide long. If each type of codon specifies one unique amino acid, how many possible amino acids can be coded. Also consider that they have only one stop codon.

- (A) 7 (B) 15 (C) 31 (D) 63

10. A mutation in the lac-repressor gene removes the allolactose binding site of the lac-repressor protein. What will be the effect on the activity of the lac operon system?

- (A) Lactose metabolizing enzymes will be produced irrespective of the presence or absence of lactose
(B) Glucose metabolism will be blocked

- (C) Lactose will not be metabolized because the enzymes will not be synthesized
(D) RNA Polymerase will not be able to bind the promoter

Note: Q10. Full marks will be given for any of the answers (C or D)

11. Which type of RNA carries the amino acids during translation?
(A) mRNA (B) tRNA (C) rRNA (D) None of these
12. What is the nature of the interaction between tRNAs and mRNAs?
(A) Covalent bond (B) Hydrophobic interaction (C) Hydrogen bond (D) Electrostatic interaction
13. The function of the sigma factor of RNA polymerase is to ensure that
(A) transcription begins at the proper point (B) transcription ends at the proper point
(C) translation begins at the proper point (D) translation ends at the proper point
14. Write True/False against the following statements:
(A) Poly-A tailing of mRNA is a template-independent synthesis. T
(B) Transcription and translation occurs in the same cellular compartment in both Eukaryotes and Prokaryotes. F
15. Which of the following best describes 'quaternary structure' of a protein?
(A) The arrangement of two or more polypeptide subunits into a single functional complex
(B) The folding of the polypeptide backbone in three-dimensional space
(C) The interaction of amino acid side chains
(D) The sequence of amino acids in a polypeptide chain
16. Which type of bonding is responsible for secondary structure of proteins?
(A) Disulphide bonds between cysteine residues
(B) Hydrogen bonding between the C=O and N-H groups
(C) Peptide bonds between amino acids
(D) Bonds between charged side chains of amino acids
17. Which of the following pairs of amino acids might contribute to protein conformation by forming electrostatic interactions? (Hints: Nonpolar: Glycine, Phenylalanine and Tyrosine; Positively charged: Lysine and Arginine; Negatively charged: Glutamate and Aspartate)
(A) Glycine and aspartate (B) Glutamate and lysine
(C) Phenylalanine and tyrosine (D) Lysine and arginine
18. You have purified a multi-subunit extracellular protein that has several interchain disulfide bonds. Which of the following chemicals would you add to your purified protein mixture if you wanted to eliminate the disulfide bonds?
(A) NaCl, a salt (B) SDS, an ionic detergent
(C) H₂O₂, an oxidizing reagent (D) DTT, a reducing agent
19. Which of the following provides the necessary information to specify the three-dimensional structure of a protein?
(A) The protein's peptide bonds (B) The protein's interactions with other polypeptides
(C) The protein's amino acid sequence (D) The protein's interaction with molecular chaperones
20. In a helical wheel plot what is the angular distance between two amino acids?
(A) 90° (B) 100° (C) 150° (D) 360°

Indian Institute of Technology Kharagpur
School of Bioscience

Class Test SET A

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2018-2019

Date: 02/11/2018

Time: 30 minutes

Choose (tick) the (ONE) correct answer

1. In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?
 - a) Enzyme catalyzed reaction will be faster than uncatalyzed reaction
 - b) Enzyme will not bind to substrate
 - c) Reaction will not proceed beyond enzyme-substrate complex formation**
 - d) Enzyme will catalyze product formation but they will remain bound to the enzyme

2. For the enzyme-catalyzed reaction $E + S \rightleftharpoons ES \rightleftharpoons E + P$, what is the value of K_M if $[S] = 10\text{mM}$ and the corresponding initial velocity is half of V_{max} ?
 - a) 10**
 - b) 20
 - c) 30
 - d) 40

3. Which of the following statements about Michaelis constant (K_M) of an enzyme is correct?
 - a) It is defined as the concentration of substrate required for the reaction to reach maximum velocity
 - b) It is defined as the dissociation constant of the enzyme-substrate complex
 - c) It is expressed in terms of the reaction velocity
 - d) It is a measure of the affinity the enzyme has for its substrate**

4. An allosteric inhibitor of an enzyme usually
 - a) denatures the enzyme
 - b) causes the enzyme to work faster
 - c) binds to the active site
 - d) changes the conformation of the active site**

5. A Methanol poisoning is treated with ethanol which actually slows down the formation of formaldehyde. This is an example of
 - a) Competitive inhibition**
 - b) Uncompetitive inhibition
 - c) Allosteric regulation
 - d) Non-competitive inhibition

6. Which one of the following eukaryotic cell structures does not contain DNA?
 - a) Endoplasmic reticulum**

- b) Nucleus
- c) Mitochondria
- d) Chloroplast

7. Bacterial cell wall is composed of oh

- a) sugars and lipids
- b) sugars and amino acids**
- c) amino acids and lipids
- d) amino acids and nucleic acids

8. In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?

- a) G₁
- b) S
- c) G₂
- d) M**

9. During *in vitro* polymerization of actin filaments or microtubules from their subunits, what does the “lag phase” correspond to?

- a) Nucleotide exchange
- b) Reaching steady state
- c) Nucleation**
- d) ATP or GTP hydrolysis

10. In a defective cell, division is stopped at metaphase stage. You want to investigate whether it is due to defective microtubule arrangement or their defective binding to kinetochore. Which of the following techniques will you use?

- a) Bright field microscopy
- b) Transmission Electron Microscopy
- c) Scanning Electron microscopy
- d) Fluorescence microscopy**

11. Which of the following is FALSE in case of asymmetric mitotic division?

- a) The two progeny cells acquire different fates because they inherit different genetic material**
- b) Two progeny cells inherit unequal cytoplasmic materials (RNA/Proteins)
- c) Asymmetric division is the key mechanism for retaining self-renewing ability in stem cells
- d) Two progeny cells are unequal in shape and size

12. Which molecule moves from inner layer to outer layer of fatty acids of cellular plasma membrane during the process of programmed cell death?

- a) Phosphatidylserine**
- b) Phosphatidylcholine
- c) Cholesterol
- d) NADPH

13. Meiosis is reductional cell division, i.e., chromosome number becomes half at the end of two division cycles. Absence of which of the following events between Meiosis I and Meiosis II is responsible for that?

- a) **Replication**
- b) Transcription
- c) Translation
- d) Splicing

14. Which of the following cellular structures always disappears during mitosis and meiosis?

- a) Plasma membrane
- b) Cytoskeleton
- c) **Nuclear envelope**
- d) Mitochondria

15. A cell divides every one minute. At this rate of division, it can fill a 100 ml of beaker in 1 hour. How much time does it take to fill a 200 ml of beaker?

- a) 2 hrs
- b) 1 hr
- c) **61 min**
- d) 59 min

16. A plasma cell secretes

- a) **antibody of a single specificity**
- b) antibody of multiple specificity
- c) the antigen it recognizes
- d) antimicrobial peptides

17. The characteristics of adaptive immunity include

- a) specificity
- b) memory
- c) distinction between self and foreign
- d) **all of the above**

18. Origin and maturation of B cells take place in

- a) **Bone marrow**
- b) Thymus
- c) Spleen
- d) Lymph node

19. Which of the following is NOT true for adaptive immune response?

- a) Highly specific towards individual pathogens
- b) Distinction between self and foreign
- c) **Response time is same towards multiple exposures of same pathogen**
- d) Retention of memory of infection

20. Which of the following cell types is a link between innate and adaptive arms of immune system?

- a) T lymphocyte
- b) B lymphocyte

c) Red blood cell

d) **Dendritic cell**

Indian Institute of Technology Kharagpur
School of Bioscience

Class Test SET B

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2018-2019

Date: 02/11/2018

Time: 30 minutes

Choose (tick) the (ONE) correct answer

1. The transition state of an enzyme catalyzed reaction
 - a) **has lower energy than that of the uncatalyzed reaction**
 - b) has lower energy than the reaction substrate
 - c) has higher energy than that of the uncatalyzed reaction
 - d) has lower energy than that of the product(s)

2. Effect of a reversible competitive inhibitor can be nullified by increasing
 - a) pH
 - b) temperature
 - c) product concentration
 - d) **substrate concentration**

3. If the reaction $A + B \rightarrow C$ is first order with respect to A and first order with respect to B, then the rate equation for the forward reaction would be
 - a) Rate=k[A]
 - b) Rate=k[B]
 - c) **Rate=k[A][B]**
 - d) Rate=ka[A]+kb[B]

4. In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?
 - a) Enzyme catalyzed reaction will be faster than uncatalyzed reaction
 - b) Enzyme will not bind to substrate
 - c) **Reaction will not proceed beyond enzyme-substrate complex formation**
 - d) Enzyme will catalyze product formation but they will remain bound to the enzyme

5. For an enzyme catalyzed reaction, when $[S]=K_M$, the velocity of an enzyme catalyzed reaction would be
 - a) $0.1*V_{max}$
 - b) $0.2* V_{max}$
 - c) $0.3* V_{max}$
 - d) **0.5* V_{max}**

6. Which of the following helps in processing and transport of proteins?
 - a) Ribosome
 - b) Lysosome

c) Endoplasmic reticulum

d) Mitochondria

7. Which of the following microscopes is most suited to study surface characteristics of a specimen?

a) Phase contrast microscope

b) Scanning electron microscope

c) Transmission electron microscope

d) Light microscope

8. Rough endoplasmic reticulum (rER) gets its roughness from

a) convoluted membrane

b) ribosomes attached to its outer surface

c) transmembrane proteins protruding outside the surface

d) vesicles attached to its surface

9. Which of the following structures can be found in a Prokaryotic cell?

a) Nucleoid

b) Nucleolus

c) Nuclear matrix

d) Nuclear envelope

10. Which of the following drugs is toxic for our cells?

a) Cytochalasin B, which caps the plus end of actin filaments and prevents actin polymerization

b) Phalloidin, which binds along actin filaments and stabilizes them

c) Colchicine, which caps microtubule ends and leads to their depolymerization

d) All of the above

11. In which of the following cell division stages chromosomes will be visible as separate entities?

a) Interphase

b) Prophase

c) Metaphase

d) Telophase

12. How many mitotic divisions are required to produce 256 cells from a single cell?

a) 7

b) 8

c) 16

d) 32

13. In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?

a) G₁

b) S

c) G₂

d) M

14. Which of the following statements is TRUE:

a) Nucleus contains only DNA, but not RNA and proteins

- b) *E. coli* chromosome is linear while human chromosomes are circular
- c) Stem cell is not present in adult human being
- d) Neuronal cells divide the least in human body**

15. An organism has 52 chromosomes, i.e., $2n=52$, which includes a pair of sex chromosomes. What will be the combination of chromosomes in its ovum?

- a) $51 + X$
- b) $50 + 2X$
- c) $26 + X$
- d) $25 + X$**

16. Primary lymphoid organs include

- a) Thymus, bone marrow and spleen
- b) Thymus, bone marrow, lymph nodes and spleen
- c) Thymus and spleen
- d) Thymus and bone marrow**

17. In order to initiate an adaptive immune response, antigenic peptide must be presented to T cells. Which cell presents this antigen to T cells?

- a) Red blood cell
- b) Dendritic cell**
- c) Helper T cell
- d) Cytotoxic T cell

18. Type-1 diabetes is an example of _____ disease.

- a) cell division related
- b) immunodeficiency
- c) infectious
- d) autoimmune**

19. Which of the following enzyme is present in our tear and helps in innate immune response against bacterial pathogen?

- a) Penicillin
- b) Lysozyme**
- c) Trypsin
- d) Lipase

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hydroIndian Institute of Technology Kharagpur

School of Bioscience

End Sem Class Test (SLOT-1)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2019-20

Date: 15-11-2019

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose the correct answer

1. In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?
a) Enzyme catalyzed reaction will be faster than uncatalyzed reaction
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a) pH
b) temperature
c) product concentration
d) substrate concentration

3. If the reaction $A + B \rightarrow C$ is first order with respect to A and first order with respect to B, then the rate equation for the forward reaction would be
a) $\text{Rate} = k[A]$
b) $\text{Rate} = k[B]$
c) $\text{Rate} = k[A][B]$
d) $\text{Rate} = kA[a] + kB[B]$

4. Which
d) Nuclear membrane

5. In a defective cell, division is stopped at metaphase stage. You want to inve of the following is found in Prokaryotes?
6. a) Histone protein
b) Ribosome
7. c) Mitochondria
stigate whether it is due to defective microtubule arrangement or their defective binding to kinetochore. Which of the following techniques will you use?
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c) amino acids and lipids
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d) amino acids and nucleic acids

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c) Colchicine, which caps microtubule ends and leads to their depolymerization
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10. In which of the following cell cycle stages chromosomes are visible as distinctly separate entities?
a) S phase
b) G1 phase
c) M phase
d) G2 phase

11. An organism has 52 chromosomes, i.e., $2n=52$, which includes a pair of sex chromosomes. What will be the combination of chromosomes in its ovum?
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 - d) $25 + X$**
12. A cell divides every one minute. At this rate of division, it can fill a 100 ml of beaker in 1 hour. How much time does it take to fill a 200 ml of beaker?
- a) 2 hrs
 - b) 1 hr
 - c) 61 min**
 - d) 59 min
13. Which of the following statements is FALSE?
- a) Cytotoxic T cell recognizes antigen on the surface of infected cell and then kill the infected cell.
 - b) T cells are generated from our bone marrow and matured in thymus
 - c) Dendritic cells can form memory response**
 - d) Innate immune response is faster than adaptive immune response
14. Majority of antigens are
- a) carbohydrates
 - b) lipids
 - c) proteins**
 - d) nucleic acids
15. A plasma cell secretes
- a) antibody of a single specificity**
 - b) antibody of multiple specificity
 - c) the antigen it recognizes
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16. Type-1 diabetes is an example of _____ disease
- a) immunodeficiency
 - b) life-style
 - c) immunosufficiency
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 - d) Cytotoxic T cell
18. Which enzyme is responsible for synthesizing DNA from viral RNA?
- a) DNA dependent DNA polymerase
 - b) DNA dependent RNA polymerase
 - c) RNA dependent DNA polymerase**
 - d) RNA dependent RNA polymerase
19. Which of the following statements is NOT CORRECT for viruses?
- a) They cannot be observed using a light microscope.

- b) Viruses are complexes of nucleic acid and proteins.
c) Viruses can infect bacteria
d) Capsid is composed of lipid molecules
20. Transformation in genetic engineering refers to
a) transfer of plasmid containing gene of interest into a host cell
b) selection of bacterial colony which contain plasmid
c) expression of insert DNA (gene of interest) in host bacterial cell
d) none of the above
21. In order to generate action potential in a neuron, which of the following membrane potentials works as threshold potential?
a) -80 mV
b) -70 mV
c) -55 mV
d) +30 mV
22. Which of the following works as chemically gated ion channel?
a) Nicotinic acetylcholine receptor
b) Voltage gated Na⁺ channel
c) Voltage gated K⁺ channel
d) Na⁺/K⁺ ATPase pump

Indian Institute of Technology Kharagpur
School of Bioscience
End Sem Class Test (SLOT-II)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2019-20

Date: 15-11-2019

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose the correct answer

- Which of the following statements about Michaelis constant (K_M) of an enzyme is correct?
 - It is defined as the concentration of substrate required for the reaction to reach maximum velocity
 - It is defined as the dissociation constant of the enzyme-substrate complex
 - It is expressed in terms of the reaction velocity
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 - Competitive inhibition
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 - Which of the following microscopes is most suited to study surface characteristics of a specimen?
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 - During *in vitro* polymerization of actin filaments or microtubules from their subunits, what does the “lag phase” correspond to?
 - Nucleation
 - Reaching steady state
 - Nucleotide exchange
 - ATP or GTP hydrolysis
 - Which of the following structures can be found in a Prokaryotic cell?
 - Nucleoid
 - Nucleolus
 - Nuclear matrix
 - Nuclear envelope
 - How many mitotic divisions are required to produce 128 cells from a single cell?
 - 7
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 - Meiotic cell division is reductional, i.e., chromosome number becomes half at the end of two division cycles. Absence of which of the following events between Meiosis I and Meiosis II is responsible for that?
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 - Transcription
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 - Splicing
 - In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?
 - G₁
 - S
 - G₂
 - M
 - Which of the following cellular structures always disappears during mitosis and meiosis?
 - Plasma membrane
 - Cytoskeleton
 - Nuclear envelope
 - Mitochondria

11. Cells dying by natural means is known as
a) cytokinesis
b) meiosis
c) necrosis
d) apoptosis
12. Which of the following enzyme is present in our tear and helps in innate immune response against bacterial pathogen?
a) Penicillin **b) Lysozyme** c) Trypsin d) Lipase
13. Which of the following is NOT true for adaptive immune response?
a) Highly specific towards individual pathogens
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Indian Institute of Technology Kharagpur
School of Bioscience
End Sem Class Test (SLOT-1)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Spring, 2017-18

Date: 04-04-2018

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

- In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?
 - Enzyme catalyzed reaction will be faster than uncatalyzed reaction
 - Enzyme will not bind to substrate
 - Reaction will not proceed beyond enzyme-substrate complex formation**
 - Enzyme will catalyze product formation but they will remain bound to the enzyme
 - The transition state of an enzyme catalyzed reaction
 - has lower energy than that of the uncatalyzed reaction**
 - has lower energy than the reaction substrate
 - has higher energy than that of the uncatalyzed reaction
 - has lower energy than that of the product(s)
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 - pH
 - temperature
 - product concentration
 - substrate concentration**
 - For the enzyme-catalyzed reaction $E + S \rightleftharpoons ES \rightleftharpoons E + P$, what is the value of K_M if $[S] = 10\text{mM}$ and the initial velocity is half of V_{max} ?
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 - 40
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 - $\text{Rate} = k[A]$
 - $\text{Rate} = k[B]$
 - Rate = $k[A][B]$**
 - $\text{Rate} = kA[a] + kB[B]$
 - Which of the following is found in Prokaryotes?
 - Histone protein
 - Ribosome**
 - Mitochondria
 - Nuclear membrane
 - In a defective cell, division is stopped at metaphase stage. You want to investigate whether it is due to defective microtubule arrangement or their defective binding to kinetochore. Which of the following techniques will you use?
 - Bright field microscopy
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a) sugars and amino acids b) sugars and lipids
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a) Cytochalasin B, which caps the plus end of actin filaments and prevents actin polymerization
b) Phalloidin, which binds along actin filaments and stabilizes them
c) Colchicine, which caps microtubule ends and leads to their depolymerization
d) All of the above

11. Meiotic cell division is observed in _____ cells whereas Mitotic cell division is observed in _____ cells of our body.

12. In which of the following cell cycle stages chromosomes are visible as distinctly separate entities?
a) S phase b) G1 phase c) M phase d) G2 phase

13. State TRUE or FALSE for the following statements:
A. Nucleus contains only DNA, but not RNA and proteins
B. *E. coli* chromosome is circular while human chromosomes are linear
C. Stem cell is not present in adult human being
D. **Neuronal cells divide the least in human body**

14. An organism has 52 chromosomes, i.e., $2n=52$, which includes a pair of sex chromosomes. What will be the combination of chromosomes in its ovum?
a) $51 + X$ b) $50 + 2X$ c) $26 + X$ d) **$25 + X$**

15. A cell divides every one minute. At this rate of division it can fill a 100 ml of beaker in 1 hour. How much time does it take to fill a 200 ml of beaker?
a) 2 hrs b) 1 hr c) **61 min** d) 59 min

16. State TRUE or FALSE from the following statements:
a) Cytotoxic T cell recognizes antigen on the surface of infected cell and then kill the infected cell. T
b) T cells are generated from our bone marrow and matured in thymus. T

17. Majority of antigens are
a) carbohydrates b) lipids c) **proteins** d) nucleic acids

18. A plasma cell secretes
a) antibody of a single specificity b) antibody of multiple specificity
c) the antigen it recognizes d) antimicrobial peptides

19. Type-1 diabetes is an example of _____ autoimmune _____ disease

20. In order to initiate an adaptive immune response, antigenic peptide must be presented to T cells. Which cell presents this antigen to T cells?
a) Red blood cell b) **Dendritic cell** c) Helper T cell d) Cytotoxic T cell

Indian Institute of Technology Kharagpur
School of Bioscience
End Sem Class Test (SLOT-II)

Sub: Science of Living Systems**Sub No: BS20001****Full Marks: 20****Session: Spring, 2017-18****Date: 04-04-2018****Time: 30 minutes****NAME:****ROLLNO:****DEPT:**

Choose (tick) the (ONE) correct answer OR write in a few words

1. Which of the following statements about Michaelis constant (K_M) of an enzyme is correct?
It is defined as the concentration of substrate required for the reaction to reach maximum velocity
 - a) It is defined as the dissociation constant of the enzyme-substrate complex
 - b) It is expressed in terms of the reaction velocity
 - c) **It is a measure of the affinity the enzyme has for its substrate**

2. In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?
 - a) Enzyme catalyzed reaction will be faster than uncatalyzed reaction
 - b) Enzyme will not bind to substrate
 - c) **Reaction will not proceed beyond enzyme-substrate complex formation**
 - d) Enzyme will catalyze product formation but they will remain bound to the enzyme

- tion of the active site

3. A Methanol poisoning is treated with ethanol which actually slows down the formation of formaldehyde.
This is an example of

a) Competitive inhibition	b) Uncompetitive inhibition
c) Allosteric regulation	d) Non-competitive inhibition

4. For an enzyme catalyzed reaction, when $[S]=K_M$, the velocity of an enzyme catalyzed reaction would be

a) $0.1*V_{max}$	b) $0.2* V_{max}$	c) $0.3* V_{max}$	d) $0.5* V_{max}$
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5. Which of the following microscopes is most suited to study surface characteristics of a specimen?

a) Phase contrast microscope	b) Scanning electron microscope
c) Transmission electron microscope	d) Light microscope

6. During *in vitro* polymerization of actin filaments or microtubules from their subunits, what does the “lag phase” correspond to?

a) Nucleation	b) Reaching steady state
c) Nucleotide exchange	d) ATP or GTP hydrolysis

7. Rough endoplasmic reticulum (rER) gets its roughness from

a) convoluted membrane	b) ribosomes attached to its outer surface
c) transmembrane proteins protruding outside the surface	d) vesicles attached to its surface

8. Which of the following helps in processing and transport of proteins?
a) Ribosome b) Lysosome c) **Endoplasmic reticulum** d) Mitochondria
9. Which of the following structures can be found in a Prokaryotic cell?
a) **Nucleoid** b) Nucleolus c) Nuclear matrix d) Nuclear envelope
10. How many mitotic divisions are required to produce 128 cells from a single cell?
a) 7 b) 8 c) 16 d) 32
11. Meiotic cell division is reductional, i.e., chromosome number becomes half at the end of two division cycles. Absence of which of the following events between Meiosis I and Meiosis II is responsible for that?
a) **Replication** b) Transcription c) Translation d) Splicing
12. In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?
a) G₁ b) S c) G₂ d) **M**
13. Which of the following cellular structures always disappears during mitosis and meiosis?
a) Plasma membrane b) Cytoskeleton c) **Nuclear envelope** d) Mitochondria
14. State TRUE or FALSE:
A. The amount of nuclear DNA is twice in G₂ as compared to G₁. T
B. Mitochondria is distributed into the two daughter cells by dividing into large number of small vesicles.
F
15. Which of the following enzyme is present in our tear and helps in innate immune response against bacterial pathogen?
a) Penicillin b) **Lysozyme** c) Trypsin d) Lipase
16. Which of the following is NOT true for adaptive immune response?
a) Highly specific towards individual pathogens
b) Distinction between self and foreign
c) Response time is same towards multiple exposures of same pathogen
d) Retention of memory of infection
17. Origin and maturation of B cells take place in
a) Spleen b) Thymus c) **Bone marrow** d) Lymph node
18. Rheumatoid Arthritis is an example of _____ **autoimmune** _____ disease.
19. Which of the following cell types links between innate and adaptive arms of immune system?
a) T lymphocyte b) B lymphocyte c) Red blood cell d) **Dendritic cell**

Indian Institute of Technology Kharagpur

A

School of Bioscience

Class Test (SLOT-A)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2018-2019

Date: 05-09-2018

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

1. Write True/False against each statement:

- (A) If the GC content of a single stranded DNA is 65%, the AT content of its complementary strand will be 65%.
(B) If we replace the DNA polymerase of human cells with Taq polymerase, there will be no adverse effect.

F

2. Ligase enzyme is required during DNA replication for

- (A) sealing the gaps between newly synthesized DNA fragments
 - (B) synthesis of Okazaki fragments
 - (C) stabilizing single stranded DNA
 - (D) sealing the gaps between RNA primers and newly synthesized DNA

3. In gel electrophoresis different sized DNA migrate at different rate. Which of the following statements is FALSE?

- (A) DNA is positively charged, hence migrates towards the negative terminal in the applied electric field gradient
 - (B) Different DNA molecules separate according to mass
 - (C) Smaller molecules migrate faster
 - (D) DNA is visualized in the gel by staining with ethidium bromide, which fluoresces under UV light

4. The overall conclusion of the Griffith's experiment was that

- (A) DNA is the genetic material
 - (B) proteins and DNA both are genetic material
 - (C) the ratio of Adenine to thymine was always the same
 - (D) Phage DNA was similar to bacterial DNA

5. Which of the following enzymes adds complementary bases during replication?

6. Automated DNA sequencing is an improved version of Sanger's method where

- (A) ddNTPs are used for chain termination
 - (B) PCR is used for making sequencing templates
 - (C) Fluorescently labelled dNTPs are used to track DNA fragments
 - (D) Fluorescently labelled ddNTPs are used for chain termination

7. Which part of DNA sequence dictates RNA polymerase where to start transcription?

8. Write True/False against the following statements:

- (A) Poly-A tailing is a template independent synthesis. T

(B) Transcription and translation occurs in same cellular compartment in both Eukaryotes and Prokaryotes. F

9. If the genetic code is constructed following a new rule where 4 consecutive nucleotides are used as codons, instead of triplets. How many different amino acids could such a code specify?

- (A) 256 (B) 32 (C) 64 (D) 32

10. In lac operon, if you remove the lac operator (the repressor binding site) what will be the effect on the metabolic state of the bacteria?

- (A) Lactose metabolizing enzymes will be produced irrespective of the presence or absence of lactose
- (B) Glucose metabolism will be hampered
- (C) Lactose will never be metabolized because the enzymes will never be synthesized
- (D) RNA Polymerase will not be able to bind the promoter

11. During transcription, RNA polymerase reads the template DNA strand in:

- (A) 3'- 5' direction
- (B) 5'- 3' direction
- (C) in both directions
- (D) does not require a DNA template

12. Which of the following is in correct order of sequence as they happen in a cell:

- (A) Transcription, Translation, mRNA Splicing, Protein folding
- (B) Transcription, mRNA Splicing, Translation, Protein folding
- (C) Transcription, Translation, poly-adenylation Protein folding
- (D) Transcription, Translation, 5' capping of mRNA, Protein folding

13. The coding region of a gene is 102 nucleotides long, including both start and stop codons. Which of the following would be the most likely effect of a single nucleotide deletion at position 76 in the coding region?

- (A) There would be no effect on the polypeptide
- (B) The entire amino acid sequence of the polypeptide would change
- (C) There would be changes only in the first 25 amino acids
- (D) There would be changes only after the first 25 amino acids

14. A quaternary structure of a protein signifies

- (A) a highly-supercoiled protein
- (B) multiple α -helices and β -sheets are present in a polypeptide chain
- (C) folded 3D conformation of a multi-domain polypeptide chain
- (D) arrangement of multiple folded polypeptide subunits in a multi-subunit protein complex

15. Which type of bond is formed between two adjacent β -strands?

- (A) Covalent bond
- (B) Hydrophobic interaction
- (C) Hydrogen bond
- (D) Electrostatic interaction

16. In a helical wheel plot what is the angular distance between two amino acids?

- (A) 90°
- (B) 100°
- (C) 150°
- (D) 360°

17. In a folded protein, the nonpolar (hydrophobic) amino acids tend to be

- (A) hidden inside the protein
- (B) exposed on the outside of the protein
- (C) distributed randomly throughout the protein
- (D) cannot be predicted

18. What provides the information necessary to specify the three-dimensional shape of a protein?

- (A) The protein's peptide bonds
- (B) The protein's interactions with other polypeptides
- (C) The protein's interaction with molecular chaperones
- (D) The protein's amino acid sequence

19. Name the amino acid without a chiral carbon atom:

- (A) Cysteine
- (B) Alanine
- (C) Glycine
- (D) Histidine

20. Which of the following is an example of tertiary structure in a protein?

- (A) A multimeric (multi subunit) protein
- (B) An α -helix
- (C) A β -pleated sheet
- (D) A globular domain

Indian Institute of Technology Kharagpur

B

School of Bioscience

Class Test (SLOT-B)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2018-2019

Date: 05-09-2018

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

1. In DNA, hydrogen bonds are formed between

- (A) Sugar and Phosphate
(C) Two polynucleotide chains
- (B) Adenine and Cytosine
(D) Sugar and Nitrogenous bases

2. During DNA replication, Helicase enzyme unwinds the double stranded DNA to produce localized single stranded DNA. In a PCR reaction, we use an alternative mechanism for DNA unwinding, what is that?

- (A) A special buffer with high salt concentration
(C) A special DNA polymerase that can denature DNA
- (B) High temperature
(D) very low pH

3. In Sanger DNA sequencing technique, ddNTP (analogue of dNTP) is used that can terminate DNA synthesis when they get incorporated. How does that happen?

- (A) ddNTPs are bulky molecules
(C) ddNTPs are positively charged
- (B) In ddNTPs 3'OH group is changed to -H group
(D) ddNTPs have ribose sugar instead of deoxyribose

4. The accepted theory for DNA replication is

- (A) conservative theory
(C) semi-conservative theory
- (B) dispersive theory
(D) evolutionary theory

5. RNA is chemically less stable than DNA, because of

- (A) the uracil base instead of the thymine
(C) the extra carbon atom
- (B) the presence of the 2'-OH group
(D) All of the above

6. The function of the sigma factor of RNA polymerase is to

- (A) assure that transcription begins at the proper point
(B) assure that transcription ends at the proper point
(C) assure that translation begins at the proper point
(D) assure that translation ends at the proper point

7. Metal ions such as Mg²⁺, Na⁺ typically interact with the _____ group of DNA.

- (A) sugar (B) nitrogenous base (C) hydroxyl (D) phosphate

8. Following is the protein coding part of the DNA sequence of a hypothetical gene:

5' ATG GCC TAA TAC TGG TGC ACG ACG TGC GGT GTC TGC ATA TTT TAA 3'

Predict what will happen to the protein product of the gene if you mutate (change) the start codon from ATG into TTG.

- (A) Protein length will be unaffected
(B) Protein will be shorter in length
(C) Protein will be produced but its amino acid composition will be changed
(D) No protein will be synthesized

9. Anticodon is present in

- (A) mRNA (B) tRNA (C) rRNA (D) amino acid

10. The lac operon is turned ON

- (A) in the presence of lactose.
- (B) in the presence of glucose.
- (C) in the presence of lactose and presence of glucose.
- (D) in the presence of lactose and absence of glucose.

11 State true or false for the following statements:

- (A) 3' end of nascent Prokaryotic mRNA acquires a poly A tail F
- (B) Splicing removes introns from Eukaryotic transcripts T

12. Erythromycin is an antibiotic that kills bacteria by

- (A) lysing the bacterial cell wall
- (B) interfering with bacterial transcription by binding to RNA polymerase
- (C) blocking bacterial translation by binding to 50S ribosome
- (D) blocking bacterial DNA replication by binding to DNA polymerase

13. Which of the following is a hydrophobic amino acid?

- (A) Valine
- (B) Serine
- (C) Arginine
- (D) Aspartic acid

14. The amino acid that can form a disulfide linkage is

- (A) methionine
- (B) cysteine
- (C) histidine
- (D) proline

15. In a helical wheel plot what is the angular distance between two amino acids?

- (A) 90°
- (B) 100°
- (C) 150°
- (D) 360°

16. Which part of an amino acid gives unique properties to each of the 20 amino acids?

- (A) The amino group
- (B) The carboxyl group
- (C) The side chain
- (D) The peptide backbone

17. Theoretically, a vast number of different proteins can be assembled from 20 different amino acids. How many polypeptide chains are possible that are 10 amino acids long?

- (A) 20×10
- (B) 20^{10}
- (C) 10^{20}
- (D) $20^{10} \times 10^{20}$

18. Choose the enzyme that is not composed of protein:

- (A) RNA polymerase
- (B) DNA polymerase
- (C) DNA ligase
- (D) Peptidyl transferase

19. State True or False for the following statements:

(a) By-product of forming a peptide bond from two amino acids is water. T

(b) Proteins fold with their hydrophobic amino acids in the core and hydrophilic amino acids on the surface. T

20. Arrange the following in the increasing order of protein structure hierarchy:

A: α -helix B: amino acid sequence C: quaternary structure D: folded structure

- (a) A, D, C, B
- (b) A, D, B, C
- (c) B, A, D, C
- (d) B, A, C, D

School of Bioscience
Class Test (SLOT-1)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Spring, 2018-19

Date: 13-02-2019

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

1. During DNA replication, helicase enzyme unwinds the double stranded DNA to produce localized single stranded DNA. In a PCR reaction, we use an alternative mechanism for DNA unwinding. What is that?

- (A) A special buffer with high salt concentration (B) High temperature
(C) A special DNA polymerase that can denature DNA (D) Very low pH

2. In gel electrophoresis different sized DNA migrate at different rate. Which of the following statements is FALSE?

- (A) DNA is positively charged and hence migrates towards the negative terminal in the applied electric field gradient
(B) Different DNA molecules separate according to mass
(C) Smaller molecules migrate faster
(D) DNA is visualized in the gel by staining with ethidium bromide, which fluoresces under UV light

3. Griffith's experiment proving DNA as the genetic material was based on the principle of

- (A) Termination (B) Transformation (C) Transcription (D) Translation

4. The accepted theory for DNA replication is

- (A) conservative theory (B) dispersive theory (C) semi-conservative theory (D) evolutionary theory

5. Write True/False against each statement:

- (A) If the GC content of a single stranded DNA is 60%, the AT content of its complementary strand will be 60%.
(B) If we replace the DNA polymerase of our body with Taq polymerase, it can work just fine. F

6. In classic Sanger DNA sequencing technique, four types of ddNTPs are used along with the normal dNTPs. Which of the following is the correct combination?

- (A) All four ddNTPs and four dNTPs in same reaction tube
(B) Each tube with one type of ddNTP and one type of dNTP (e.g., ddATP + dATP in tube 1, ddGTP + dGTP in tube 2 and so on)
(C) Each tube will have one type of dNTP and all four types of ddNTP
(D) Each tube will have one type of ddNTP and all four types of dNTP

7. Following is the protein coding part of the DNA sequence of a hypothetical gene:

5' ATG GCC CAA TAC TGG TGC ACG ACG TGC GAA GTC TGC ATA TTT **TAA** 3'

What will happen to the protein product of the gene if you mutate (change) the 10th codon from GAA into TAA?

- (A) Protein length will be unaffected (B) Protein will be shorter in length
(C) Amino acid composition will be changed (D) No protein will be synthesized

8. Estimate the length of the protein coded by the following DNA sequence. Start and stop codons are in bold letters; introns are underlined.

5' GCACATATGGCGATACGAAGGGACGCGGTGAGGCCGTTGTTTAAGGTTGT 3'

- (A) 10 (B) 11 (C) 13 (D) 14

9. Theoretically, a vast number of different proteins can be assembled from 20 different amino acids. How many polypeptide chains are possible that are 10 amino acids long?

- (A) 20×10 (B) 20^{10} (C) 10^{20} (D) $20^{10} \times 10^{20}$

10. In lac operon, if you remove the lac operator (the repressor binding site) what will be the effect on the metabolic state of the bacteria?

- (A) Lactose metabolizing enzymes will be produced irrespective of the presence or absence of lactose
 - (B) Glucose metabolism will be hampered
 - (C) Lactose will never be metabolized because the enzymes will never be synthesized
 - (D) RNA Polymerase will not be able to bind the promoter

11. Anticodon is present in

- (A) mRNA (B) tRNA (C) rRNA (D) amino acid

12. Tetracycline is an antibiotic that kills bacteria by

- (A) lysing the bacterial cell wall
 - (B) interfering with bacterial transcription by binding to RNA polymerase
 - (C)** blocking bacterial translation by binding to 30S ribosome
 - (D) blocking bacterial DNA replication by binding to DNA polymerase

13. During transcription, RNA polymerase reads the template DNA strand in:

- (A) 3'-5' direction (B) 5'-3' direction (C) in both directions (D) does not require a DNA template

14. Write True/False against the following statements:

- (A) The σ subunit is not a permanent component of the RNA polymerase from *E. coli*. **T**
(B) Ribosomal RNA (rRNA) is used as a template for protein synthesis. **F**

15. Which of the following can be an example of tertiary structure of a protein?

- (A) A multi-subunit protein (B) An α -helix (C) A β -pleated sheet (D) A globular domain

16. How are secondary structures stabilized in proteins?

- (A) Through ionic bonds between oppositely charged amino acid side chains
 - (B) Through covalent bonds joining different parts of the peptide backbone
 - (C) Through hydrogen bonds between different amino acid side chains
 - (D)** Through hydrogen bonds joining different parts of the peptide backbone

17. What is a protein domain?

- (A) The α -helical or β -pleated sheet portion of a protein (B) A multi-subunit protein complex
(C) Part of a protein folded into a self-contained 3D structure (D) An unfolded part of a protein

18. Hydrogen bonds in α -helices are

- (A) more numerous than Van der Waals interactions (B) not present at Phe residues
(C) analogous to the steps in a spiral staircase (D) roughly parallel to the helix axis

19. In a folded protein, the nonpolar (hydrophobic) amino acids tend to be

- (A) hidden inside the protein (B) exposed on the outside of the protein
(C) distributed randomly throughout the protein (D) cannot be predicted

20. Peptidyl transferase enzyme

- (A) is rRNA (B) forms peptide bonds (C) component of ribosome (D) all of the above

Indian Institute of Technology Kharagpur

School of Bioscience

Class Test (SLOT-II)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Spring, 2018-19

Date: 13-02-2019

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

1. Why is RNA primer required during DNA replication?

- (A) RNA is less stable than DNA, hence easy to remove
(C) DNA polymerase needs an existing 3' -OH group
- (B) RNA has extra -OH group at 2' position
(D) RNA polymerase can work without a template

2. RNA is chemically less stable than DNA, because of

- (A) the uracil base instead of the thymine
(C) the extra carbon atom
- (B)** the presence of the 2'-OH group
(D) All of the above

3. Griffith's experiment paved the way to establish that

- (A)** DNA is the genetic material
(C) proteins and DNA both are genetic material
- (B) The ratio of Adenine to thymine was always the same
(D) Phage DNA was similar to bacterial DNA

4. Which of the following enzyme adds complementary bases during replication?

- (A) Helicase (B) Synthetase (C) Replicase **(D)** Polymerase

5. Write True/False against each statement:

- (A) During DNA replication, half of the DNA is synthesized as Okazaki fragments.
T
- (B) The linkage between sugar and nitrogenous base in DNA is called Glycosidic bond.
T

6. In Sanger DNA sequencing technique, ddNTP (analog of dNTP) is used that can terminate DNA synthesis when they get incorporated. How does that happen?

- (A) ddNTPs are bulky molecules
(C) ddNTPs are positively charged
- (B)** In ddNTPs 3'-OH group is changed to -H group
(D) ddNTPs have ribose sugar instead of deoxyribose

7. Following is the protein coding part of the DNA sequence of a hypothetical gene:

5' ATG GCC CAA TAC TGG TGC ACG ACG TGC GGT GTC ATA TTT TAA 3'

What will happen to the protein product of the gene if you mutate (change) the start codon from ATG into TTG?

- (A) Protein length will be unaffected
(C) Amino acid composition will be changed
- (B)** Protein will be shorter in length
(D) No protein will be synthesized

8. A 900 nucleotide long Eukaryotic nascent mRNA has a 30 nucleotide long intron. But the mature mRNA available for translation is found to be 1100 nucleotide long. What may have caused the increased length of the mature mRNA?

- (A) Splicing (B) 5' capping **(C)** Poly-A tailing (D) Reverse transcription

9. In an alien species, there are only 2 types of nucleotides (instead of 4 types in humans) but codons are 4 nucleotide long. If each type of codon specifies one unique amino acid, how many possible amino acids can be coded. Also consider that they have only one stop codon.

- (A) 7 **(B)** 15 (C) 31 (D) 63

10. A mutation in the lac-repressor gene removes the allolactose binding site of the lac-repressor protein. What will be the effect on the activity of the lac operon system?

- (A) Lactose metabolizing enzymes will be produced irrespective of the presence or absence of lactose
(B) Glucose metabolism will be blocked

- (C) Lactose will not be metabolized because the enzymes will not be synthesized
(D) RNA Polymerase will not be able to bind the promoter

Note: Q10. Full marks will be given for any of the answers (C or D)

11. Which type of RNA carries the amino acids during translation?
(A) mRNA (B) tRNA (C) rRNA (D) None of these
12. What is the nature of the interaction between tRNAs and mRNAs?
(A) Covalent bond (B) Hydrophobic interaction (C) Hydrogen bond (D) Electrostatic interaction
13. The function of the sigma factor of RNA polymerase is to ensure that
(A) transcription begins at the proper point (B) transcription ends at the proper point
(C) translation begins at the proper point (D) translation ends at the proper point
14. Write True/False against the following statements:
(A) Poly-A tailing of mRNA is a template-independent synthesis. T
(B) Transcription and translation occurs in the same cellular compartment in both Eukaryotes and Prokaryotes. F
15. Which of the following best describes 'quaternary structure' of a protein?
(A) The arrangement of two or more polypeptide subunits into a single functional complex
(B) The folding of the polypeptide backbone in three-dimensional space
(C) The interaction of amino acid side chains
(D) The sequence of amino acids in a polypeptide chain
16. Which type of bonding is responsible for secondary structure of proteins?
(A) Disulphide bonds between cysteine residues
(B) Hydrogen bonding between the C=O and N-H groups
(C) Peptide bonds between amino acids
(D) Bonds between charged side chains of amino acids
17. Which of the following pairs of amino acids might contribute to protein conformation by forming electrostatic interactions? (Hints: Nonpolar: Glycine, Phenylalanine and Tyrosine; Positively charged: Lysine and Arginine; Negatively charged: Glutamate and Aspartate)
(A) Glycine and aspartate (B) Glutamate and lysine
(C) Phenylalanine and tyrosine (D) Lysine and arginine
18. You have purified a multi-subunit extracellular protein that has several interchain disulfide bonds. Which of the following chemicals would you add to your purified protein mixture if you wanted to eliminate the disulfide bonds?
(A) NaCl, a salt (B) SDS, an ionic detergent
(C) H₂O₂, an oxidizing reagent (D) DTT, a reducing agent
19. Which of the following provides the necessary information to specify the three-dimensional structure of a protein?
(A) The protein's peptide bonds (B) The protein's interactions with other polypeptides
(C) The protein's amino acid sequence (D) The protein's interaction with molecular chaperones
20. In a helical wheel plot what is the angular distance between two amino acids?
(A) 90° (B) 100° (C) 150° (D) 360°

Indian Institute of Technology Kharagpur
School of Bioscience
End Sem Class Test (SLOT-1)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2017-2018

Date: 08-11-2017

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

Ans. Fluorescence microscopy

7. Gram staining differentiates bacteria based on

 - a) thickness of the peptidoglycan layer in cell wall
 - b) presence of cellulose in cell wall
 - c) certain proteins in the lipid bilayer membrane of bacteria
 - d) D-amino acids in cell wall

8. What component/constituent of the bacterial cell wall gets affected by the lysozyme enzyme present in the tears of our eyes?

Ans. Lysosome

9. Which one of the following eukaryotic cell structures does not contain DNA?
a) Endoplasmic reticulum b) Nucleus c) Mitochondria d) Chloroplast

10. Bacterial cell wall is composed of
 a) sugars and amino acids
 b) sugars and lipids
 c) amino acids and lipids
 d) amino acids and nucleic acids
11. In eukaryotic cells, which sub-cellular organelle is associated with the protein synthesis machineries?
- Ans. Rough Endoplasmic Reticulum (rER)**
12. There are two different types of cell division. In higher living organisms, the body cells (somatic cells) proliferate by mitotic division, and the sex cells (gametes) are produced by meiotic division.
13. In which of the following cell division stages chromosomes will be visible as separate entities?
 a) Interphase b) Prophase c) Metaphase d) Telophase
14. Which of the following is FALSE in case of asymmetric mitotic division?
 a) The two progeny cells acquire different fates because they inherit different genetic material
 b) Two progeny cells inherit unequal cytoplasmic materials (RNA/Proteins)
 c) Asymmetric division is the key mechanism for retaining self-renewing ability in stem cells
 d) Two progeny cells are unequal in shape and size
15. Give an example of each:
 A. Haploid Organism: **Bacteria**
 B. Diploid Organism: **Human**
 C. Haploid cell: **Gamete/Sex cells (sperm/ovum)**
 D. Diploid Cell: **Any somatic cell (skin cell, liver cell, white blood cell, neuron etc)**
16. Which molecule moves from inner layer to outer layer of fatty acids of cellular plasma membrane during the process of programmed cell death?
 a) Phosphatidylserine b) Phosphatidylcholine c) Cholesterol d) NADPH
17. Primary lymphoid organs include
 a) Thymus, bone marrow and spleen
 b) Thymus, bone marrow, lymph nodes and spleen
 c) Thymus and spleen
 d) Thymus and bone marrow
18. Majority of antigens are
 a) carbohydrates b) lipids c) proteins d) nucleic acids
19. A plasma cell secretes
 a) antibody of a single specificity b) antibody of multiple specificity
 c) the antigen it recognizes d) antimicrobial peptides
20. In order to initiate an adaptive immune response, antigenic peptide must be presented to T cells. Which cell presents this antigen to T cells?
 a) Red blood cell b) Dendritic cell c) Helper T cell d) Cytotoxic T cell

Indian Institute of Technology Kharagpur
School of Bioscience
End Sem Class Test (SLOT-II)

Sub: Science of Living Systems**Sub No: BS20001****Full Marks: 20****Session: Autumn, 2017-2018****Date: 08-11-2017****Time: 30 minutes****NAME:****ROLL NO:****DEPT:**

Choose (tick) the (ONE) correct answer OR write in a few words

1. Chemiosmosis during photosynthesis utilizes proton gradient to synthesize ATP. This proton gradient is between
 - a) thylakoid space and stroma
 - b) intermembrane space of chloroplast and stroma
 - c) intermembrane space of chloroplast and cytoplasm
 - d) between stroma of chloroplast and cytoplasm

2. Which of the following is the key intermediate compound that links Glycolysis and Kreb's cycle?
 - a) Pyruvic acid
 - b) ATP
 - c) Acetyl CoA
 - d) NADH

3. During chemi-osmotic phosphorylation in mitochondria, which of the following helps in the generation of ATP?
 - a) ATP synthase
 - b) ATP reductase
 - c) ATP hydrolase
 - d) ATP permease

4. Photosynthesis is an example of anabolic , endergonic process, whereas respiration is an example of catabolic , exergonic process.
 Options: catabolic, anabolic, exergonic, endergonic

5. State TRUE and FALSE from the following statements:
 - A. The thylakoid membranes contain chlorophyll pigments T
 - B. The thylakoid membranes contain the Calvin cycle enzymes F

6. Which of the following will give maximum resolution when used for microscopy?
 - a) Red light
 - b) Blue light
 - c) Green light
 - d) Electron beam

7. Which instrument is more useful to study surface characteristics of a specimen?
 - a) Phase contrast microscope
 - b) Scanning electron microscope
 - c) Transmission electron microscope
 - d) Light microscope

8. *Staphylococcus aureus* and *Escherichia coli* are Gram +ve and Gram –ve bacteria, respectively. With respect to these bacteria, identify where the following will be found.
 - A. Relatively thicker peptidoglycan layer: *Staphylococcus aureus*
 - B. Pink color upon Gram staining: *E. coli*

9. Write down the names of the components that constitute the peptidoglycan layer.

Ans. Sugar backbone (alternating N-acetylglucosamine and N-acetylmuramic acid), Tetrapeptide (alternating L and D amino acids) cross-linked by Pentaglycine.

10. Which of the following helps in processing and transport of proteins?

- a) Ribosome b) Lysosome c) Endoplasmic reticulum d) Mitochondria

11. Fundamentally, prokaryotic cell and eukaryotic cell can be differentiated on the basis of which sub-cellular organelle/structure?

Ans. Nucleus

12. Egg and sperm (cells) both are haploid cells/germ cells/sex cells; muscle and skin (cells) are diploid cells/somatic cells.

13. In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?

- a) G₁ b) S c) G₂ d) M

14. Which of the following cellular structures always disappears during mitosis and meiosis?

- a) Plasma membrane b) Cytoskeleton c) Nuclear envelope d) Mitochondria

15. State TRUE or FALSE:

- A. The amount of nuclear DNA is twice in G₂ as compared to G₁. T
 B. Mitochondria is distributed into the two daughter cells by dividing into large number of small vesicles F

16. A tadpole loses its tail by a genetically controlled program called apoptosis/programmed cell death, to develop into a mature frog.

17. The characteristics of adaptive immunity include

- a) specificity b) memory
 c) distinction between self and foreign d) all of the above

18. Origin and maturation of B cells take place in

- a) Bone marrow b) Thymus c) Spleen d) Lymph node

19. Type-1 diabetes is an example of auto-immune disease.

20. State TRUE or FALSE for the following statements:

- A. Cytotoxic T cell recognizes antigen on the surface of infected cell and then kills the infected cell. T
 B. T cells are generated from our bone marrow and matured in thymus. F

Indian Institute of Technology Kharagpur
School of Bioscience
End Sem Class Test (SLOT-1)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2019-20

Date: 15-11-2019

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose the correct answer

1. In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?
 - a) Enzyme catalyzed reaction will be faster than uncatalyzed reaction
 - b) Enzyme will not bind to substrate
 - c) Reaction will not proceed beyond enzyme-substrate complex formation
 - d) Enzyme will catalyze product formation but they will remain bound to the enzyme

2. Effect of a reversible competitive inhibitor can be nullified by increasing
 - a) pH
 - b) temperature
 - c) product concentration
 - d) substrate concentrationReversible competitive inhibitor.

3. If the reaction $A + B \rightarrow C$ is first order with respect to A and first order with respect to B, then the rate equation for the forward reaction would be
 - a) Rate=k[A]
 - b) Rate=k[B]
 - c) Rate=k[A][B]
 - d) Rate=kA[a]+kB[B]

4. Which of the following is found in Prokaryotes?
 - a) Histone protein
 - b) Ribosome
 - c) Mitochondria
 - d) Nuclear membraneProkaryotes.

5. In a defective cell, division is stopped at metaphase stage. You want to investigate whether it is due to defective microtubule arrangement or their defective binding to kinetochore. Which of the following techniques will you use?
 - a) Bright field microscopy
 - b) Transmission Electron Microscopy
 - c) Scanning Electron microscopy
 - d) Fluorescence microscopyKinetochore
Microscopy

6. Bacterial cell wall is composed of
 - a) sugars and amino acids
 - b) sugars and lipids
 - c) amino acids and lipids
 - d) amino acids and nucleic acidsBacterial cell wall.

7. Which of the following drugs is toxic for dividing cells?
 - a) Cytochalasin B, which caps the plus end of actin filaments and prevents actin polymerization
 - b) Phalloidin, which binds along actin filaments and stabilizes them
 - c) Colchicine, which caps microtubule ends and leads to their depolymerization
 - d) All of the aboveToxic Drugs for dividing cells

8. In which of the following cell cycle stages chromosomes are visible as distinctly separate entities?
 - a) S phase
 - b) G1 phase
 - c) M phase
 - d) G2 phaseDistinctly separate entities.

Chromosomes in its ovum.

9. An organism has 52 chromosomes, i.e., $2n=52$, which includes a pair of sex chromosomes. What will be the combination of chromosomes in its ovum?
- a) $51 + X$
 - b) $50 + 2X$
 - c) $26 + X$
 - d) $25 + X$

Cell division.

10. A cell divides every one minute. At this rate of division, it can fill a 100 ml of beaker in 1 hour. How much time does it take to fill a 200 ml of beaker?
- a) 2 hrs
 - b) 1 hr
 - c) 61 min
 - d) 59 min

11. Which of the following statements is FALSE?

- a) Cytotoxic T cell recognizes antigen on the surface of infected cell and then kill the infected cell.
- b) T cells are generated from our bone marrow and matured in thymus
- c) Dendritic cells can form memory response
- d) Innate immune response is faster than adaptive immune response

T cell
Dendritic cell.

Innate immune response.

12. Majority of antigens are

- a) carbohydrates
- b) lipids
- c) proteins
- d) nucleic acids

Antigen.

13. A plasma cell secretes

Plasma cell.

- a) antibody of a single specificity
- b) antibody of multiple specificity
- c) the antigen it recognizes
- d) antimicrobial peptides

14. Type-1 diabetes is an example of _____ disease

- a) immunodeficiency
- b) life-style
- c) immunosufficiency
- d) autoimmune

15. In order to initiate an adaptive immune response, antigenic peptide must be presented to T cells. Which cell presents this antigen to T cells?

- a) Red blood cell
- b) Dendritic cell
- c) Helper T cell
- d) Cytotoxic T cell

Antigen to T cells.

16. Which enzyme is responsible for synthesizing DNA from viral RNA?

- a) DNA dependent DNA polymerase
- b) DNA dependent RNA polymerase
- c) RNA dependent DNA polymerase
- d) RNA dependent RNA polymerase

Enzyme synthesizing
DNA from viral RNA

17. Which of the following statements is NOT CORRECT for viruses?

- a) They cannot be observed using a light microscope.

Viruses.

- b) Viruses are complexes of nucleic acid and proteins.
c) Viruses can infect bacteria
d) Capsid is composed of lipid molecules
18. Transformation in genetic engineering refers to
a) transfer of plasmid containing gene of interest into a host cell
b) selection of bacterial colony which contain plasmid
c) expression of insert DNA (gene of interest) in host bacterial cell
d) none of the above
19. In order to generate action potential in a neuron, which of the following membrane potentials works as threshold potential?
a) -80 mV
b) -70 mV
c) -55 mV
d) +30 mV
20. Which of the following works as chemically gated ion channel?
a) Nicotinic acetylcholine receptor
b) Voltage gated Na⁺ channel
c) Voltage gated K⁺ channel
d) Na⁺/K⁺ ATPase pump
- Transformation
in Genetic Engineering.*
- Threshold potential.*
- Chemically
gated Ion.*

Indian Institute of Technology Kharagpur

School of Bioscience
End Sem Class Test (SLOT-II)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2019-20

Date: 15-11-2019

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Michaelis constant

Choose the correct answer

1. Which of the following statements about Michaelis constant (K_M) of an enzyme is correct?
a) It is defined as the concentration of substrate required for the reaction to reach maximum velocity
b) It is defined as the dissociation constant of the enzyme-substrate complex
c) It is expressed in terms of the reaction velocity
d) It is a measure of the affinity the enzyme has for its substrate

2. A Methanol poisoning is treated with ethanol which actually slows down the formation of formaldehyde. This is an example of *Treatment*.
a) Competitive inhibition
b) Uncompetitive inhibition
c) Allosteric regulation
d) Non-competitive inhibition

3. For an enzyme catalyzed reaction, when $[S]=K_M$, the velocity of an enzyme catalyzed reaction would be
a) $0.1*V_{max}$
b) $0.2* V_{max}$
c) $0.3* V_{max}$
d) $0.5* V_{max}$

4. Which of the following microscopes is most suited to study surface characteristics of a specimen?
a) Phase contrast microscope
b) Scanning electron microscope
c) Transmission electron microscope
d) Light microscope

5. During *in vitro* polymerization of actin filaments or microtubules from their subunits, what does the “lag phase” correspond to?
a) Nucleation
b) Reaching steady state
c) Nucleotide exchange
d) ATP or GTP hydrolysis

6. Which of the following structures can be found in a Prokaryotic cell?
a) Nucleoid
b) Nucleolus
c) Nuclear matrix
d) Nuclear envelope

7. How many mitotic divisions are required to produce 128 cells from a single cell?
a) 7
b) 8
c) 16
d) 32

8. Meiotic cell division is reductional, i.e., chromosome number becomes half at the end of two division cycles. Absence of which of the following events between Meiosis I and Meiosis II is responsible for that?
a) Replication
b) Transcription
c) Translation
d) Splicing

9. In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?
a) G_1
b) S
c) G_2
d) M

10. Which of the following cellular structures always disappears during mitosis and meiosis?
a) Plasma membrane
b) Cytoskeleton
c) Nuclear envelope
d) Mitochondria

Cellular structures always disappear during mitosis & meiosis.

11. Cells dying by natural means is known as
a) cytokinesis
b) meiosis
c) necrosis
d) apoptosis

Cells dying by natural means.

12. Which of the following enzyme is present in our tear and helps in innate immune response against bacterial pathogen?
a) Penicillin b) Lysozyme c) Trypsin d) Lipase
13. Which of the following is NOT true for adaptive immune response?
a) Highly specific towards individual pathogens
b) Distinction between self and foreign
c) Response time is same towards multiple exposures of same pathogen
d) Retention of memory of infection

14. Origin and maturation of B cells take place in
a) Spleen b) Thymus

Innate & adaptive arms.

- c) Bone marrow d) Lymph node

15. Which of the following cell types links between innate and adaptive arms of immune system?
a) T lymphocyte b) B lymphocyte c) Red blood cell d) Dendritic cell

16. Which enzyme is responsible for synthesizing DNA from viral RNA?

- a) DNA dependent DNA polymerase
b) DNA dependent RNA polymerase
c) RNA dependent DNA polymerase
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DNA from viral RNA.

17. Which of the following statements is NOT CORRECT for viruses?

- a) They cannot be observed using a light microscope.
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d) Capsid is composed of lipid molecules

Viruses.

18. Transformation in genetic engineering refers to

- a) transfer of plasmid containing gene of interest into a host cell
b) selection of bacterial colony which contain plasmid
c) expression of insert DNA (gene of interest) in host bacterial cell
d) none of the above

Transformation in Genetic Engineering.

19. In order to generate action potential in a neuron, which of the following membrane potentials works as threshold potential?

- a) -80 mV
b) -70 mV
c) -55 mV
d) +30 mV

Action Potential in a neuron.

20. Which of the following works as chemically gated ion channel?

- a) Nicotinic acetylcholine receptor

Chemically gated ion channel.

- b) Voltage gated Na⁺ channel
- c) Voltage gated K⁺ channel
- d) Na⁺/K⁺ ATPase pump

Indian Institute of Technology Kharagpur

School of Bioscience

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2019-20

Date: 15-11-2019

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose the correct answer

- Which of the following statements about Michaelis constant (K_M) of an enzyme is correct?
 - It is defined as the concentration of substrate required for the reaction to reach maximum velocity
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 - It is expressed in terms of the reaction velocity
 - It is a measure of the affinity the enzyme has for its substrate
 - A Methanol poisoning is treated with ethanol which actually slows down the formation of formaldehyde. This is an example of
 - Competitive inhibition
 - Uncompetitive inhibition
 - Allosteric regulation
 - Non-competitive inhibition
 - For an enzyme catalyzed reaction, when $[S]=K_M$, the velocity of an enzyme catalyzed reaction would be
 - $0.1*V_{max}$
 - $0.2* V_{max}$
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 - Which of the following microscopes is most suited to study surface characteristics of a specimen?
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 - Replication
 - Transcription
 - Translation
 - Splicing
 - In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?
 - G₁
 - S
 - G₂
 - M
 - Which of the following cellular structures always disappears during mitosis and meiosis?
 - Plasma membrane
 - Cytoskeleton
 - Nuclear envelope
 - Mitochondria

11. Cells dying by natural means is known as
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Indian Institute of Technology Kharagpur

School of Bioscience

Class Test (SLOT-1)

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Spring, 2018-19

Date: 15-04-2019

Time: 30 minutes

NAME:

ROLLNO:

DEPT:

Choose (tick) the (ONE) correct answer OR write in a few words

1. In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?

- a) Enzyme catalyzed reaction will be faster than uncatalyzed reaction
- b) Enzyme will not bind to substrate
- c) Reaction will not proceed beyond enzyme-substrate complex formation
- d) Enzyme will catalyze product formation but they will remain bound to the enzyme

2. If the reaction $A + B \rightarrow C$ is first order with respect to A and first order with respect to B, then the rate equation for the forward reaction would be

- a) Rate=k[A]
- b) Rate=k[B]
- c) Rate=k[A][B]
- d) Rate=ka[A]+kb[B]

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- b) It is defined as the dissociation constant of the enzyme-substrate complex
- c) It is expressed in terms of the reaction velocity
- d) It is a measure of the affinity the enzyme has for its substrate

4. Effect of a reversible competitive inhibitor can be nullified by

- a) increasing enzyme concentration
- b) increasing substrate concentration
- c) increasing product concentration
- d) increasing temperature

5. An allosteric inhibitor of an enzyme usually

- a) denatures the enzyme
- b) causes the enzyme to work faster
- c) binds to the active site
- d) changes the conformation of the active site

6. Antibiotic penicillin acts on bacterial

- a) outer membrane
- b) cell membrane
- c) ribosome
- d) peptidoglycan

Anti biotic penicillin

7. In the polymerization in vitro of actin filaments and microtubules from their subunits, what does the "lag phase" correspond to?

- a) Nucleation
- b) Reaching steady state
- c) Nucleotide exchange
- d) ATP or GTP hydrolysis

8. Which of the following drugs is toxic for our cells?

- a) Cytochalasin B, which caps the plus end of actin filaments and prevents actin polymerization
- b) Phalloidin, which binds along actin filaments and stabilizes them
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- d) All of the above

9. Which of the following will give maximum resolution?

- a) Red light
- b) Blue light
- c) Green light
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10. Which of the following helps in processing and transports of proteins

- a) Ribosome
- b) Lysosome
- c) endoplasmic reticulum
- d) mitochondria

11. A cell divides every one minute. At this rate of division it can fill a 100 ml of beaker in 1 hour. How much time does it take to fill a 200 ml of beaker?

- a) 2 hours
- b) 59 min
- c) 60 min
- d) 61 min

12. In how many cells meiotic division has taken place, if the total number of sperms produced are 64

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

13. Cytokinesis occurs at which phase of cell division cycle?

- a) M
- b) G₁
- c) S
- d) G₂

14. Which of the following cellular structures always disappears during mitosis and meiosis?

- a) Plasma membrane
- b) Cytoskeleton
- c) Nuclear envelope
- d) Mitochondria

15. Which of the following is FALSE in case of asymmetric mitotic division?

- a) The two progeny cells acquire different fates because they inherit different genetic material
- b) Two progeny cells inherit unequal cytoplasmic materials (RNA/Proteins)
- c) Asymmetric division is the key mechanism for retaining self-renewing ability in stem cells

d) Two progeny cells are unequal in shape and size

16. Majority of antigens are

- a) Carbohydrates
- b) Lipids
- c) Proteins
- d) None of the above

17. Primary function of MHC (major histocompatibility complex) molecules is:

- a) immunological memory
- b) generation of antibody
- c) antigen presentation
- d) immunological surveillance in innate pathway

18. Which of the following is NOT true for adaptive immune response?

- a) Highly specific towards individual pathogens
- b) Distinction between self and foreign
- c) Response time is same towards multiple exposures of same pathogen
- d) Retention of memory of infection

19. Origin and maturation of B cells take place in

- a) Bone marrow
- b) Thymus
- c) Spleen
- d) Lymph node

20. In order to initiate an adaptive immune response, antigenic peptide must be presented to T cells. Which cell presents this antigen to T cells?

- a) Red blood cell
- b) Dendritic cell
- c) Helper T cell
- d) Cytotoxic T cell

BS10003_Spring 2021_Test2 (3)

Total marks: 52

1

Name: *

Yash Kale

2

Roll number: *

20EC30059

Part 1 of 2: Select the right answer (17 Questions, 2 marks each)

3

Convalescent plasma therapy uses blood from people who've recovered from an illness to help others recover. Blood plasma from people who have recovered from COVID19 has antibodies against viral proteins. When administered in a new patient, the antibodies will fight the virus. What type of immunity is this?

(2 Points)

- Autoimmunity
- Active immunity
- Innate immunity
- Passive immunity

4

(2 Points)

You are doing a plaque assay from a patient sample to determine viral titer. You made ten-fold serial dilutions of virus stock solution starting from 10^{-1} to 10^{-10} . You have prepared 10 culture plates with cultured host cells in monolayer. Now you added 0.1 ml of each dilution solution to individual plates. After staining of living cells, you observed the following:

- 1) 300-400 partially overlapping plaques in the plate where you've added 10^{-5} dilution;
- 2) 34 plaques in the plate where you've added 10^{-6} dilution.
- 3) 4 plaques in the plate where you've added 10^{-7} dilution.

Calculate the viral titer present in stock solution (patient sample) based on the above result.

- $34 \times 10^6 \text{ PFU/ml}$
- $300 \times 10^6 \text{ PFU/ml}$
- $40 \times 10^7 \text{ PFU/ml}$
- $34 \times 10^7 \text{ PFU/ml}$

5

A student was performing cloning of a giraffe by nuclear transfer method. She made two mistakes: firstly, she took a fertilized ovum; secondly, she forgot to remove the nucleus of the ovum before injecting the nucleus of a somatic cell. What would be the most probable outcome of this experiment? (2 Points)

- The resulting zygote will develop into a normal diploid ($2n$) giraffe
- The zygote will be tetraploid ($4n$), it will result into a gigantic giraffe
- The zygote will be triploid ($3n$), hence would have cell division problems
- The zygote will be tetraploid ($4n$), hence it would not survive due to double genomic content

6

You have purified a multi-subunit extracellular protein that has several interchain disulfide bonds. Which of the following chemicals would you add to your purified protein mixture if you wanted to eliminate the disulfide bonds?

(2 Points)

- SDS, an ionic detergent
- β -mercapto ethanol, a reducing agent
- H_2O_2 , an oxidizing reagent
- NaCl, a salt

7

In alpha helix and beta sheets, the hydrogen bonds are
(2 Points)

- parallel to the helical axis and perpendicular to the beta strands.
- perpendicular to the helical axis and perpendicular to the beta strands.

- perpendicular to the helical axis and parallel to the beta strands.
- parallel to the helical axis and parallel to the beta strands.

8

Theoretically, a vast number of different proteins can be assembled from 20 different amino acids. How many polypeptide chains are possible that are 10 amino acids long?

(2 Points)

- $20^{10} \times 10^{20}$
- 10^{20}
- 20×10
- 20^{10}

9

One undergrad student is repeating Anfinsen's experiment with an enzyme that has TEN cysteine residues and forms FIVE disulfide bonds. What is the total number of possible disulfide bond combinations that can be formed randomly in the denatured protein?

(2 Points)

- 225
- 945
- 105
- 45

Arrange the following options in increasing order of protein structure hierarchy:

- A: alpha-helix
- B: amino acid sequence
- C: quaternary structure
- D: a protein domain

(2 Points)

- A, C, B, D
- B, A, D, C
- A, B, C, D
- B, C, A, D

There is an initial 'eclipse period' followed by a 'burst phase' in the viral growth curve. What do you think is the reason for this?

(2 Points)

- After initial infection the virus disassembles, makes the individual nucleic acids and proteins, and assembles them inside the host resulting in the eclipse period. The assembled particles are released in the burst phase
- Initially the viral particles divide very slowly and hence we cannot detect any significant growth. Later on their number increases exponentially giving the burst phase
- The G1, S and G2 phases result in the initial 'eclipse period' in the viral growth curve. After mitosis the 'burst phase' occurs.
- The eclipse period is when our immune system is efficiently killing the virus particles. When the virus overcomes the immune system, the burst phase occurs.

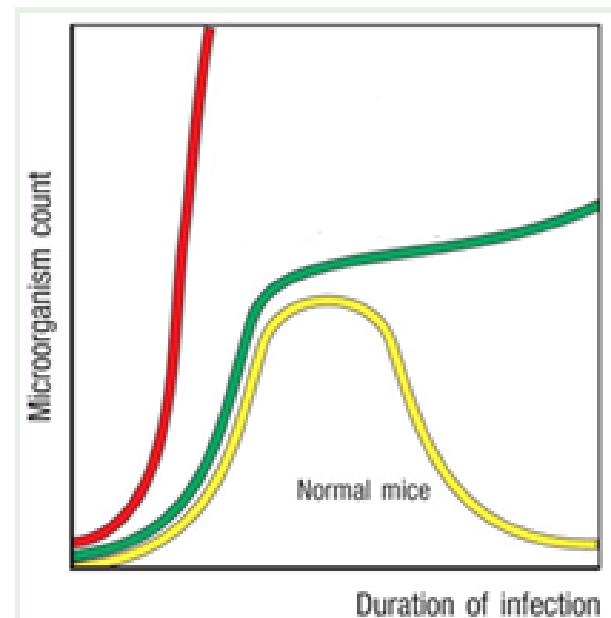
12

While Origin and maturation of B cells take place in _____, origin of T cells take place in bone marrow and get mature in _____.

(2 Points)

- Thymus, bone marrow
- Thymus, lymph nodes
- Bone marrow, thymus
- Bone marrow, lymph nodes

13



Following curves represent the load of pathogen (in y axis) over time (y axis). The curve in yellow represents the result of a healthy mouse. Other two curves represent some kind of defects in the immune system of respective mouse. What could be the defect that delivers these results?

(2 Points)

- Curves in red and green correspond to mouse that possess a strong adaptive immune response and a weak innate immune response respectively
- Curves in red and green correspond to mouse that lack innate immune component and adaptive immune component respectively
- Curves in red and green correspond to mouse that possess weak adaptive immune system

- and strong innate immune system respectively
- Curves in red and green correspond to mouse that lack adaptive immune component and innate immune component respectively

14

In sexually reproducing organisms, which of the following two events, occurring in every generation of diploid organisms, ensure conservation of diploid nature?

(2 Points)

- (i) Fertilization of haploid gametes; (ii) chromosome number duplication in Zygote
- (i) Reducational Meiotic division during gamete formation; (ii) Mitotic division of gametes
- (i) Mitotic division of gametes; (ii) Fertilization of haploid gametes
- (i) Reducational Meiotic division during gamete formation; (ii) Fertilization of haploid gametes

15

If the recognition sequence of the restriction enzyme is GAATTC, then how many covalent bonds will be broken by the enzyme in the following DNA molecule?

5' GCTGTGAATTCAAGT 3'
3' CGACACTTAAGTCA 5'

(2 Points)

- 4
- 0
- 2
- 1

16

You have studied genetic engineering in your 2nd semester at IIT Kharagpur, and you came to know that in order to express a foreign protein in bacteria E. coli, you have to clone the gene of interest in suitable plasmid that should contain a promoter site. This promoter site is required for
(2 Points)

- the production of RNA so that the desired protein can be translated in E. coli.
- keeping E. coli alive in presence of antibiotics.
- maintaining the plasmid in E. coli.
- the self-replication of plasmid.

17

Domestic sheep possesses $2n=54$ chromosomes. You have studied, that Dolly, the first cloned mammals was created through nuclear transfer method. During this process, the nucleus which was used for the creation of Dolly should contain

(2 Points)

- 54 chromosomes
- 108 chromosomes
- 27 chromosomes
- Cannot be predicted

18

Which of the following pairs of amino acids might contribute to protein conformation by forming electrostatic interactions? (Hints: Nonpolar: Glycine, Phenylalanine and Tyrosine; Positively charged: Lysine and Arginine; Negatively charged: Glutamate and Aspartate)

(2 Points)

- Lysine and arginine

- Glutamate and lysine
- Phenylalanine and tyrosine
- Glycine and aspartate

19

Peptide backbone has three torsion angles namely omega, phi and psi. However, Ramachandran map ignores one of these and plots and only two are considered. Which of the following statements gives the CORRECT reasoning for this?

(2 Points)

- One of the torsion angles is part of the peptide plane and in most cases has only one value. Hence, unnecessary to plot.
- A two-dimensional plot can be made using only two variables. Hence one of the angles was ignored.
- It does not matter which two torsion angles are used to create the Ramachandran map.
The same map can be created by choosing any two of the three torsion angles.
- Historically only two torsion angles were discovered at that time. Hence, Ramachandran and his student used only those two torsion angles for the map.

Part 2 of 2: Select the right answer (18 Questions, 1 mark each)

20

Corona virus is described as a 'zoonotic' virus - what does this mean?
(1 Point)

- Such viruses are confined to animals
- They cause pandemics
- They had always been a human virus and cause disease in humans
- They emerged from animals and crossed the species barrier to infect humans

21

Which of the following phase of cell cycle is shortest?
(1 Point)

G2

G1

S

M

22

Mature human muscle cells and nerve cells
(1 Point)

continuously divide to produce new muscle and nerve cells

only express housekeeping genes and don't express any tissue-specific genes

only express tissue-specific genes and don't express any housekeeping genes

normally don't divide as they are differentiated cells

23

The enzyme that is involved in joining of Okazaki fragments during DNA replication is also utilized in recombinant DNA technology in the following step:

(1 Point)

Selection of transformed bacteria in culture

Restriction cleavage of gene of interest

Transformation of bacterial cell with recombinant plasmid

Insert gene of interest into vector

24

In a folded protein, the nonpolar (hydrophobic) amino acids tend to be
(1 Point)

- exposed on the outside of the protein
- cannot be predicted
- hidden inside the protein
- distributed randomly throughout the protein

25

Which of the following amino acids often participate in covalent bond formation through its side chain?
(1 Point)

- Alanine
- Valine
- Cysteine
- Glycine

26

The professional antigen presenting cells of the immune system are:
(1 Point)

- Macrophages and Dendritic cells
- Natural Killer cells and Neutrophils
- Dendritic cells and Natural Killer cells
- Neutrophils and Basophils

27

Which of the following tests could be performed to detect the presence of viral nucleic acid (RNA) in patient body fluid?

(1 Point)

Plaque assay

Antibody test

Antigen test

RT-PCR test

28

Which of the essential cellular machinery is lacking for all of the viruses?

(1 Point)

RNA polymerase

Reverse transcriptase

Ribosome

DNA polymerase

29

Identical twins are

(1 Point)

always of same sex.

the result of embryo splitting at the early stage of pregnancy.

all of these.

the result of fertilization of single egg that splits in two.

30

Which of the following is NOT true for adaptive immune response?
(1 Point)

- Highly specific towards individual pathogens
- Response time is same towards multiple exposures of same pathogen
- Distinction between self and foreign
- Retention of memory of infection

31

A plasma cell secretes
(1 Point)

- antibody of multiple specificity
- antimicrobial peptides
- antibody of a single specificity
- Option 2
- the antigen it recognizes

32

Metastasis is one of the hallmark signatures of Cancer. What does it mean?
(1 Point)

- Formation of blood vessels in tumor
- Accelerated cell division
- Evading (escaping) apoptosis
- Invasion and tumor formation at a new site

33

Which of the following processes leading to genetic exchange between chromosomes giving new combination of genes that are different from either parent?

(1 Point)

- Crossing over
- Mitosis
- Cytokinesis
- Apoptosis

34

RNA polymerase is an example of

(1 Point)

- Quaternary structures of protein.
- Proteins that are available in all of our cells.
- Two of the most complex proteins present in our body.
- Tertiary structures of protein.

35

Which of the following is the most important discovery that has led to the development of recombinant DNA technology (genetic engineering)?

(1 Point)

- All of these.
- Discovery of double helix model by Watson and Crick.
- Discovery of restriction enzymes.
- Discovery of DNA as genetic material.

36

Major function of MHC (major histocompatibility complex) molecules is
(1 Point)

- antigen presentation
- immunological surveillance in innate pathway
- immunological memory
- generation of antibody

37

Sperms are produced by meiotic division of diploid progenitor cells. How many of these diploid cells would be required to generate 4000 sperms?
(1 Point)

- 1000
- 2000
- 4000
- 500

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Indian Institute of Technology Kharagpur
School of Bioscience

Class Test SET A

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2018-2019

Date: 02/11/2018

Time: 30 minutes

Choose (tick) the (ONE) correct answer

1. In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?

- a) Enzyme catalyzed reaction will be faster than uncatalyzed reaction
- b) Enzyme will not bind to substrate
- c) Reaction will not proceed beyond enzyme-substrate complex formation**
- d) Enzyme will catalyze product formation but they will remain bound to the enzyme

2. For the enzyme-catalyzed reaction $E + S \rightleftharpoons ES \rightleftharpoons E + P$, what is the value of K_M if $[S] = 10\text{mM}$ and the corresponding initial velocity is half of V_{max} ?

- a) 10**
- b) 20
- c) 30
- d) 40

3. Which of the following statements about Michaelis constant (K_M) of an enzyme is correct?

- a) It is defined as the concentration of substrate required for the reaction to reach maximum velocity
- b) It is defined as the dissociation constant of the enzyme-substrate complex
- c) It is expressed in terms of the reaction velocity
- d) It is a measure of the affinity the enzyme has for its substrate**

4. An allosteric inhibitor of an enzyme usually

- a) denatures the enzyme
- b) causes the enzyme to work faster
- c) binds to the active site
- d) changes the conformation of the active site**

5. A Methanol poisoning is treated with ethanol which actually slows down the formation of formaldehyde. This is an example of

- a) Competitive inhibition**
- b) Uncompetitive inhibition
- c) Allosteric regulation
- d) Non-competitive inhibition

6. Which one of the following eukaryotic cell structures does not contain DNA?

- a) Endoplasmic reticulum**

- b) Nucleus
 - c) Mitochondria
 - d) Chloroplast
7. Bacterial cell wall is composed of oh
- a) sugars and lipids
 - b) sugars and amino acids**
 - c) amino acids and lipids
 - d) amino acids and nucleic acids
8. In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?
- a) G₁
 - b) S
 - c) G₂
 - d) M**
9. During *in vitro* polymerization of actin filaments or microtubules from their subunits, what does the “lag phase” correspond to?
- a) Nucleotide exchange
 - b) Reaching steady state
 - c) Nucleation**
 - d) ATP or GTP hydrolysis
10. In a defective cell, division is stopped at metaphase stage. You want to investigate whether it is due to defective microtubule arrangement or their defective binding to kinetochore. Which of the following techniques will you use?
- a) Bright field microscopy
 - b) Transmission Electron Microscopy
 - c) Scanning Electron microscopy
 - d) Fluorescence microscopy**
11. Which of the following is FALSE in case of asymmetric mitotic division?
- a) The two progeny cells acquire different fates because they inherit different genetic material**
 - b) Two progeny cells inherit unequal cytoplasmic materials (RNA/Proteins)
 - c) Asymmetric division is the key mechanism for retaining self-renewing ability in stem cells
 - d) Two progeny cells are unequal in shape and size
12. Which molecule moves from inner layer to outer layer of fatty acids of cellular plasma membrane during the process of programmed cell death?
- a) Phosphatidylserine**
 - b) Phosphatidylcholine
 - c) Cholesterol
 - d) NADPH

13. Meiosis is reductional cell division, i.e., chromosome number becomes half at the end of two division cycles. Absence of which of the following events between Meiosis I and Meiosis II is responsible for that?

- a) **Replication**
- b) Transcription
- c) Translation
- d) Splicing

14. Which of the following cellular structures always disappears during mitosis and meiosis?

- a) Plasma membrane
- b) Cytoskeleton
- c) **Nuclear envelope**
- d) Mitochondria

15. A cell divides every one minute. At this rate of division, it can fill a 100 ml of beaker in 1 hour. How much time does it take to fill a 200 ml of beaker?

- a) 2 hrs
- b) 1 hr
- c) **61 min**
- d) 59 min

16. A plasma cell secretes

- a) **antibody of a single specificity**
- b) antibody of multiple specificity
- c) the antigen it recognizes
- d) antimicrobial peptides

17. The characteristics of adaptive immunity include

- a) specificity
- b) memory
- c) distinction between self and foreign
- d) **all of the above**

18. Origin and maturation of B cells take place in

- a) **Bone marrow**
- b) Thymus
- c) Spleen
- d) Lymph node

19. Which of the following is NOT true for adaptive immune response?

- a) Highly specific towards individual pathogens
- b) Distinction between self and foreign
- c) **Response time is same towards multiple exposures of same pathogen**
- d) Retention of memory of infection

20. Which of the following cell types is a link between innate and adaptive arms of immune system?

- a) T lymphocyte

- b) B lymphocyte
- c) Red blood cell
- d) Dendritic cell**

Indian Institute of Technology Kharagpur
School of Bioscience

Class Test SET B

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2018-2019

Date: 02/11/2018

Time: 30 minutes

Choose (tick) the (ONE) correct answer

1. The transition state of an enzyme catalyzed reaction
 - a) **has lower energy than that of the uncatalyzed reaction**
 - b) has lower energy than the reaction substrate
 - c) has higher energy than that of the uncatalyzed reaction
 - d) has lower energy than that of the product(s)

2. Effect of a reversible competitive inhibitor can be nullified by increasing
 - a) pH
 - b) temperature
 - c) product concentration
 - d) **substrate concentration**

3. If the reaction A + B → C is first order with respect to A and first order with respect to B, then the rate equation for the forward reaction would be
 - a) Rate=k[A]
 - b) Rate=k[B]
 - c) **Rate=k[A][B]**
 - d) Rate=ka[A]+kb[B]

4. In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?
 - a) Enzyme catalyzed reaction will be faster than uncatalyzed reaction
 - b) Enzyme will not bind to substrate
 - c) **Reaction will not proceed beyond enzyme-substrate complex formation**
 - d) Enzyme will catalyze product formation but they will remain bound to the enzyme

5. For an enzyme catalyzed reaction, when $[S]=K_M$, the velocity of an enzyme catalyzed reaction would be
 - a) $0.1*V_{max}$
 - b) $0.2* V_{max}$
 - c) $0.3* V_{max}$
 - d) **0.5* V_{max}**

6. Which of the following helps in processing and transport of proteins?
 - a) Ribosome
 - b) Lysosome

c) Endoplasmic reticulum

d) Mitochondria

7. Which of the following microscopes is most suited to study surface characteristics of a specimen?

a) Phase contrast microscope

b) Scanning electron microscope

c) Transmission electron microscope

d) Light microscope

8. Rough endoplasmic reticulum (rER) gets its roughness from

a) convoluted membrane

b) ribosomes attached to its outer surface

c) transmembrane proteins protruding outside the surface

d) vesicles attached to its surface

9. Which of the following structures can be found in a Prokaryotic cell?

a) Nucleoid

b) Nucleolus

c) Nuclear matrix

d) Nuclear envelope

10. Which of the following drugs is toxic for our cells?

a) Cytochalasin B, which caps the plus end of actin filaments and prevents actin polymerization

b) Phalloidin, which binds along actin filaments and stabilizes them

c) Colchicine, which caps microtubule ends and leads to their depolymerization

d) All of the above

11. In which of the following cell division stages chromosomes will be visible as separate entities?

a) Interphase

b) Prophase

c) Metaphase

d) Telophase

12. How many mitotic divisions are required to produce 256 cells from a single cell?

a) 7

b) 8

c) 16

d) 32

13. In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?

a) G₁

b) S

c) G₂

d) M

14. Which of the following statements is TRUE:

a) Nucleus contains only DNA, but not RNA and proteins

- b) *E. coli* chromosome is linear while human chromosomes are circular
- c) Stem cell is not present in adult human being
- d) Neuronal cells divide the least in human body**

15. An organism has 52 chromosomes, i.e., $2n=52$, which includes a pair of sex chromosomes. What will be the combination of chromosomes in its ovum?

- a) $51 + X$
- b) $50 + 2X$
- c) $26 + X$
- d) $25 + X$**

16. Primary lymphoid organs include

- a) Thymus, bone marrow and spleen
- b) Thymus, bone marrow, lymph nodes and spleen
- c) Thymus and spleen
- d) Thymus and bone marrow**

17. In order to initiate an adaptive immune response, antigenic peptide must be presented to T cells.

Which cell presents this antigen to T cells?

- a) Red blood cell
- b) Dendritic cell**
- c) Helper T cell
- d) Cytotoxic T cell

18. Type-1 diabetes is an example of _____ disease.

- a) cell division related
- b) immunodeficiency
- c) infectious
- d) autoimmune**

19. Which of the following enzyme is present in our tear and helps in innate immune response against bacterial pathogen?

- a) Penicillin
- b) Lysozyme**
- c) Trypsin
- d) Lipase

20. A plasma cell secretes

- a) antibody of a single specificity**
- b) antibody of multiple specificity
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Indian Institute of Technology Kharagpur
School of Bioscience

Class Test SET B

Sub: Science of Living Systems

Sub No: BS20001

Full Marks: 20

Session: Autumn, 2018-2019

Date: 02/11/2018

Time: 30 minutes

transition State

Choose (tick) the (ONE) correct answer

1. The transition state of an enzyme catalyzed reaction
 - a) has lower energy than that of the uncatalyzed reaction
 - b) has lower energy than the reaction substrate
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2. Effect of a reversible competitive inhibitor can be nullified by increasing
 - a) pH
 - b) temperature
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 - d) **substrate concentration**

Reversible competitive inhibitor.

3. If the reaction $A + B \rightarrow C$ is first order with respect to A and first order with respect to B, then the rate equation for the forward reaction would be
 - a) Rate=k[A]
 - b) Rate=k[B]
 - c) **Rate=k[A][B]**
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Enzyme catalyzed rxn.

4. In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?
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 - b) $0.2* V_{max}$
 - c) $0.3* V_{max}$
 - d) **0.5* V_{max}**

Velocity of enzyme catalyzed rxn

6. Which of the following helps in processing and transport of proteins?
 - a) Ribosome
 - b) Lysosome

Processing & transport of proteins.

c) Endoplasmic reticulum

d) Mitochondria

microscope.

7. Which of the following microscopes is most suited to study surface characteristics of a specimen?

a) Phase contrast microscope

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c) Transmission electron microscope

d) Light microscope

Surface characteristic.

rER

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b) Nucleolus

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Prokaryotic cell.

Toxic drugs

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Cell division stages.

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Mitotic divisions.

b) 8

c) 16

d) 32

13. In which phase of the cell cycle, chromosomes are inactive, condensed, and not transcribed to messenger RNA?

a) G₁

Phase of cell cycle

b) S

c) G₂

Chromosomes are inactive, condensed.

d) M

& not transcribed.

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- b) $50 + 2X$
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- d) $25 + X$**

Chromosomes in Ovum

16. Primary lymphoid organs include

- a) Thymus, bone marrow and spleen
- b) Thymus, bone marrow, lymph nodes and spleen
- c) Thymus and spleen
- d) Thymus and bone marrow**

Primary lymphoid.

Adaptive immune response

17. In order to initiate an adaptive immune response, antigenic peptide must be presented to T cells.

Which cell presents this antigen to T cells?

- a) Red blood cell
- b) Dendritic cell**
- c) Helper T cell
- d) Cytotoxic T cell

Antigenic Peptide T cells.

Antigen to T cells.

18. Type-1 diabetes is an example of autoimmune disease.

- a) cell division related
- b) immunodeficiency
- c) infectious
- d) autoimmune**

Type -1 Diabetes.

19. Which of the following enzyme is present in our tear and helps in innate immune response against bacterial pathogen?

- a) Penicillin
- b) Lysozyme**
- c) Trypsin
- d) Lipase

innate immune response.

bacterial pathogen.

20. A plasma cell secretes

- a) antibody of a single specificity**
- b) antibody of multiple specificity
- c) the antigen it recognizes
- d) antimicrobial peptides

Plasma cell.

Problem set 4 (Viruses and Immune system)

1. State TRUE or FALSE for the following statements:

A) Cytotoxic T cell recognizes antigen on the surface of infected cell and then kill the infected cell 

B) B cell can also recognize antigen and produces antibody  

C) Our immune system can distinguish between self and foreign and mount response to only foreign while preserving self  

D) Blood cells are generated from our bone marrow 



2. State TRUE or FALSE for the following statements:

A) Origin and maturation of B cells take place in bone marrow 

B) Origin and maturation of T cells take place in Thymus 



3. A plasma cell secretes



 A) Antibody of a single specificity

B) Antibody of multiple specificity

C) The antigen it recognizes

D) Antimicrobial peptides

4. The characteristics of adaptive immunity include



A) Specificity

B) Memory

C) Distinction between self and foreign

 D) All of the above

5. Majority of antigens are



A) Carbohydrates

B) Lipids

 C) Proteins

D) None of the above

Virus infected cell viral antigens to Cytotoxic T cells.

6. What is the immediate outcome after a virus-infected cell presents viral antigens to Cytotoxic T cells?

- . The Cytotoxic T cell releases antibody which kills the virus
- A. The Cytotoxic T cell kills the virus infected cell
- B. The Cytotoxic T cell activates Macrophages
- C. The Cytotoxic T cell engulfs (phagocytose) the virus infected cell

Natural Passive immunity.

7. Which of the following is an example of Natural Passive immunity?

- . When an foetus receives mother's antibodies during pregnancy through placental transfer
- A. When antibodies are administered into the patient after a snake bite
- B. When a person becomes infected by a disease, the body builds immunity against the disease
- C. A person can build a resistance to a disease after vaccination

8. Which of the following tests could be performed to detect the presence of viral nucleic acid in patient body fluid?

Viral Nucleic acid.

- a) Plaque assay
- b) Antigen test
- c) Antibody test
- d) RT-PCR test

HIV & immune deficiency.

9. How HIV infection leads to the "immune deficiency"?

- a) HIV infects innate immune cells like macrophage and dendritic cells, hence interferes with the innate immunity.
- b) HIV infects B cells, hence directly affect antibody production.
- c) HIV infects CD4 T cells, hence impact the adaptive immune system
- d) HIV infects cytotoxic T cells, hence interferes with the final clearing of infected cells.

10. In a plaque assay performed to determine the titer of influenza virus, 25 plaques were developed for the set corresponding to 10^5 dilution. Considering that 0.1 ml of virus inoculum was used for the plaque assay what should be final titer of the virus?

- a) 25×10^5 pfu/ml
- b) 2.5×10^7 pfu/ml
- c) 2.5×10^8 pfu/ml
- d) 25×10^7 pfu/ml

Titer of the virus.

BS10003_Spring 2021_Test2

Total marks: 52

...

Points: **52/52**

1

Name: *

Kuldeep Bijarniya

2

Roll number: *

20MI10027

Part 1 of 2: Select the right answer (17 Questions, 2 marks each)

Immunity.

Convalescent plasma therapy uses blood from people who've recovered from an illness to help others recover. Blood plasma from people who have recovered from COVID19 has antibodies against viral proteins. When administered in a new patient, the antibodies will fight the virus. What type of immunity is this?

(2/2 Points)

- Active immunity
- Autoimmunity
- Passive immunity ✓
- Innate immunity

4

(2/2 Points)

You are doing a plaque assay from a patient sample to determine viral titer. You made ten-fold serial dilutions of virus stock solution starting from 10^{-1} to 10^{-10} . You have prepared 10 culture plates cultured host cells in monolayer. Now you added 0.1 ml of each solution to individual plates. After staining of living cells, you count the following:

- 1) 300-400 partially overlapping plaques in the plate where you added 10^{-5} dilution;
- 2) 34 plaques in the plate where you've added 10^{-6} dilution;
- 3) 4 plaques in the plate where you've added 10^{-7} dilution.

Calculate the viral titer present in stock solution (patient sample) from the above result.

Viral Titer

- $300 \times 10^6 PFU/ml$
- $34 \times 10^7 PFU/ml$ ✓
- $34 \times 10^6 PFU/ml$
- $40 \times 10^7 PFU/ml$

Cloning.

A student was performing cloning of a giraffe by nuclear transfer method. She made two mistakes: firstly, she took a fertilized ovum; secondly, she forgot to remove the nucleus of the ovum before injecting the nucleus of a somatic cell. What would be the most probable outcome of this experiment?

(2/2 Points)

- The resulting zygote will develop into a normal diploid ($2n$) giraffe
- The zygote will be tetraploid ($4n$), it will result into a gigantic giraffe
- The zygote will be triploid ($3n$), hence would have cell division problems
- The zygote will be tetraploid ($4n$), hence it would not survive due to double genomic content ✓

6 Multi Subunit Extracellular protein.

You have purified a multi-subunit extracellular protein that has several interchain disulfide bonds. Which of the following chemicals would you add to your purified protein mixture if you wanted to eliminate the disulfide bonds?

(2/2 Points)

- β -mercapto ethanol, a reducing agent ✓
- SDS, an ionic detergent .
- H_2O_2 , an oxidizing reagent
- NaCl, a salt

α helix & β sheets

7

In alpha helix and beta sheets, the hydrogen bonds are
(2/2 Points)

Hydrogen Bonds.

- perpendicular to the helical axis and perpendicular to the beta strands.
- parallel to the helical axis and parallel to the beta strands.
- parallel to the helical axis and perpendicular to the beta strands. ✓
- perpendicular to the helical axis and parallel to the beta strands.

8

Polypeptide chains.

Theoretically, a vast number of different proteins can be assembled from 20 different amino acids. How many polypeptide chains are possible that are 10 amino acids long?

(2/2 Points)

- 10^{20}
- $20^{10} \times 10^{20}$
- 20^{10} ✓
- 20×10

9

Anfinsen's Exp.

One undergrad student is repeating Anfinsen's experiment with an enzyme that has TEN cysteine residues and forms FIVE disulfide bonds. What is the total number of possible disulfide bond combinations that can be formed randomly in the denatured protein?

(2/2 Points)

Disulfide Bond.

225 945 ✓ 105 45

10

Protein Structure hierarchy.

Arrange the following options in increasing order of protein structure hierarchy:

- A: alpha-helix
- B: amino acid sequence
- C: quaternary structure
- D: a protein domain

(2/2 Points)

 B, C, A, D B, A, D, C ✓ A, B, C, D A, C, B, D

11

Eclipse period. Burst phase

viral growth curve.

There is an initial 'eclipse period' followed by a 'burst phase' in the viral growth curve. What do you think is the reason for this?

(2/2 Points)

The G1, S and G2 phases result in the initial 'eclipse period' in the viral growth curve. After mitosis the 'burst phase' occurs.

After initial infection the virus disassembles, makes the individual nucleic acids and proteins, and assembles them inside the host resulting in the eclipse period. The assembled particles are released in the burst phase ✓

Initially the viral particles divide very slowly and hence we cannot detect any significant growth
 Later on their number increases exponentially giving the burst phase

- The eclipse period is when our immune system is efficiently killing the virus particles. When the virus overcomes the immune system, the burst phase occurs.

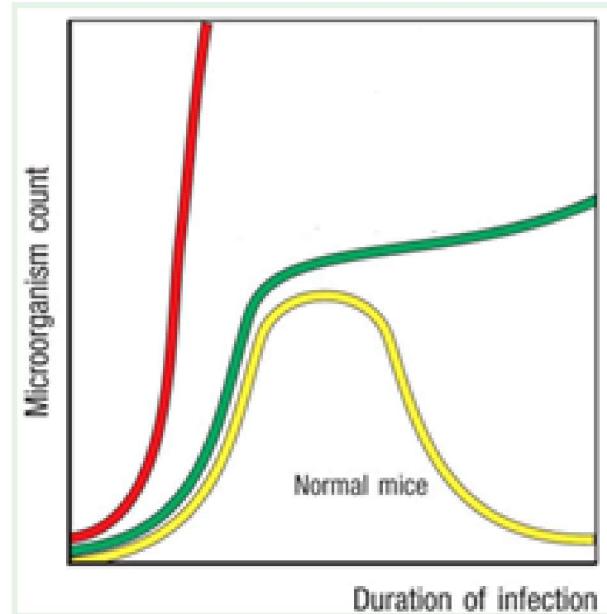
Origin & maturation of B cells.

While Origin and maturation of B cells take place in _____, origin of T cells take place in bone marrow and get mature in _____.
(2/2 Points)

- Bone marrow, lymph nodes
- Thymus, lymph nodes
- Bone marrow, thymus ✓
- Thymus, bone marrow

13

Load of Pathogen



Following curves represent the load of pathogen (in y axis) over time (y axis). The curve in yellow represents the result of a healthy mouse. Other two curves represent some kind of defects in the immune system of respective mouse. What could be the defect that delivers these results?
(2/2 Points)

- Curves in red and green correspond to mouse that lack adaptive immune component and innate immune component respectively
- Curves in red and green correspond to mouse that possess weak adaptive immune system and strong innate immune system respectively
- Curves in red and green correspond to mouse that possess a strong adaptive immune response and a weak innate immune response respectively
- Curves in red and green correspond to mouse that lack innate immune component and adaptive immune component respectively ✓

Sexually reproducing organisms.

14

In sexually reproducing organisms, which of the following two events, occurring in every generation of diploid organisms, ensure conservation of diploid nature?
(2/2 Points)

- (i) Fertilization of haploid gametes; (ii) chromosome number duplication in Zygote
- (i) Reducational Meiotic division during gamete formation; (ii) Mitotic division of gametes
- (i) Mitotic division of gametes; (ii) Fertilization of haploid gametes
- (i) Reducational Meiotic division during gamete formation; (ii) Fertilization of haploid gametes ✓

Recognition sequence of restriction enzyme.

15

If the recognition sequence of the restriction enzyme is GAATTC, then how many covalent bonds will be broken by the enzyme in the following DNA molecule?

5' GCTGTGAATTCACT 3'
3' CGACACTTAAGTCA 5' □□
(2/2 Points)

Covalent bonds

- 1
- 0

2 ✓ 4

16 Promoter site Genetic Engineering.

You have studied genetic engineering in your 2nd semester at IIT Kharagpur, and you came to know that in order to express a foreign protein in bacteria E. coli, you have to clone the gene of interest in suitable plasmid that should contain a promoter site. This promoter site is required for
(2/2 Points)

- keeping E. coli alive in presence of antibiotics.
- the production of RNA so that the desired protein can be translated in E. coli. ✓
- maintaining the plasmid in E. coli.
- the self-replication of plasmid.

17 Cloning

Domestic sheep possesses $2n=54$ chromosomes. You have studied, that Dolly, the first cloned mammals was created through nuclear transfer method. During this process, the nucleus which was used for the creation of Dolly should contain

(2/2 Points)

- Cannot be predicted
- 54 chromosomes ✓
- 27 chromosomes
- 108 chromosomes

18 Protein Conformation.

Which of the following pairs of amino acids might contribute to protein conformation by forming electrostatic interactions? (Hints: Nonpolar: Glycine, Phenylalanine and Tyrosine; Positively charged: Lysine and Arginine; Negatively charged: Glutamate and Aspartate)

(2/2 Points)

- Glycine and aspartate
- Phenylalanine and tyrosine
- Lysine and arginine
- Glutamate and lysine ✓

19 Peptide Backbone

Peptide backbone has three torsion angles namely omega, phi and psi. However, Ramachandran map ignores one of these and plots and only two are considered. Which of the following statements gives the CORRECT reasoning for this?

(2/2 Points)

- One of the torsion angles is part of the peptide plane and in most cases has only one value ✓
Hence, unnecessary to plot.
- It does not matter which two torsion angles are used to create the Ramachandran map. The same map can be created by choosing any two of the three torsion angles.
- Historically only two torsion angles were discovered at that time. Hence, Ramachandran and his student used only those two torsion angles for the map.
- A two-dimensional plot can be made using only two variables. Hence one of the angles was ignored.

Part 2 of 2: Select the right answer (18 Questions, 1 mark each)

20

Corona virus.

Corona virus is described as a 'zoonotic' virus - what does this mean?
(1/1 Point)

- They emerged from animals and crossed the species barrier to infect humans ✓
- They had always been a human virus and cause disease in humans
- They cause pandemics
- Such viruses are confined to animals

21

Phase of cell cycle is shortest.

Which of the following phase of cell cycle is shortest?
(1/1 Point)

- G1
- S
- M ✓
- G2

22

Mature Human muscle & nerve cells.

Mature human muscle cells and nerve cells
(1/1 Point)

- normally don't divide as they are differentiated cells ✓
- only express tissue-specific genes and don't express any housekeeping genes

- only express housekeeping genes and don't express any tissue-specific genes
- continuously divide to produce new muscle and nerve cells

23

Enzyme Okazaki Fragments.

The enzyme that is involved in joining of Okazaki fragments during DNA replication is also utilized in recombinant DNA technology in the following step:
(1/1 Point)

- Transformation of bacterial cell with recombinant plasmid
- Restriction cleavage of gene of interest
- Selection of transformed bacteria in culture
- Insert gene of interest into vector ✓

24

Folded protein. Non Polar amino acids.

In a folded protein, the nonpolar (hydrophobic) amino acids tend to be
(1/1 Point)

- distributed randomly throughout the protein
- cannot be predicted
- hidden inside the protein ✓
- exposed on the outside of the protein

25

Amino acids participate in covalent Bond side chain.

Which of the following amino acids often participate in covalent bond formation through its side chain?
(1/1 Point)

- Valine
- Glycine
- Alanine
- Cysteine ✓

26

Professional antigen.

The professional antigen presenting cells of the immune system are:
(1/1 Point)

- Neutrophils and Basophils
- Macrophages and Dendritic cells ✓
- Natural Killer cells and Neutrophils
- Dendritic cells and Natural Killer cells

27

Which of the following tests could be performed to detect the presence of viral nucleic acid (RNA) in patient body fluid?
(1/1 Point)

- Antigen test
- RT-PCR test ✓
- Antibody test
- Plaque assay

Viral nucleic acid (RNA)
in patient body fluid.

28

Cellular machinery

Which of the essential cellular machinery is lacking for all of the viruses?
(1/1 Point)

RNA polymerase

DNA polymerase

Reverse transcriptase

Ribosome ✓

29

Identical twins.

Identical twins are
(1/1 Point)

always of same sex.

all of these. ✓

the result of embryo splitting at the early stage of pregnancy.

the result of fertilization of single egg that splits in two.

30

Adaptive immune response

Which of the following is NOT true for adaptive immune response?
(1/1 Point)

Retention of memory of infection

Highly specific towards individual pathogens

Response time is same towards multiple exposures of same pathogen ✓

- Distinction between self and foreign

31

Plasma cell.

A plasma cell secretes

(1/1 Point)

- antibody of multiple specificity
- antimicrobial peptides
- Option 2
- antibody of a single specificity ✓
- the antigen it recognizes

32

Metastasis.

Metastasis is one of the hallmark signatures of Cancer. What does it mean?

(1/1 Point)

- Invasion and tumor formation at a new site ✓
- Accelerated cell division
- Formation of blood vessels in tumor
- Evading (escaping) apoptosis

33

Genetic exchange between chromosomes.

Which of the following processes leading to genetic exchange between chromosomes giving new combination of genes that are different from either parent?

(1/1 Point)

- Mitosis
- Apoptosis
- Crossing over ✓
- Cytokinesis

34

RNA polymerase

RNA polymerase is an example of
(1/1 Point)

- Quaternary structures of protein. ✓
- Two of the most complex proteins present in our body.
- Proteins that are available in all of our cells.
- Tertiary structures of protein.

35

Recombinant DNA technology.

Which of the following is the most important discovery that has led to the development of recombinant DNA technology (genetic engineering)?
(1/1 Point)

- Discovery of restriction enzymes. ✓
- All of these.
- Discovery of double helix model by Watson and Crick.
- Discovery of DNA as genetic material.

36

MHC (major histocompatibility complex)

Major function of MHC (major histocompatibility complex) molecules is
(1/1 Point)

- generation of antibody
- immunological memory
- antigen presentation ✓
- immunological surveillance in innate pathway

37

Sperms Diploid cells.

Sperms are produced by meiotic division of diploid progenitor cells. How many of these diploid cells would be required to generate 4000 sperms?

(1/1 Point)

- 4000
- 2000
- 500
- 1000 ✓

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