Question Paper

Exam Date & Time: 11-Jul-2023 (10:00 AM - 01:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

Cell and Molecular Biology [PBT-BP808ET -S1]

Marks: 75 **Duration: 180 mins.**

I Multiple Choice Questions (MCQs)

Answer all the questions. Section Duration: 30 mins

1) What is the function of telomeres in cell division? (1)

- To regulate the length of the G1 phase
- To protect the ends of the chromosomes from degradation
- To ensure all chromosomes are properly aligned before the cell proceeds to anaphase
- To regulate the activity of CDKs

2) Which of the following microscopic techniques enables the observation of internal structures without the need for staining? (1)

- Bright field microscopy
- Dark Field microscopy
- Phase contrast microscopy
- fluorescence microscopy

3) What is the role of the promoter region in the regulation of gene expression? (1)

- Recruit DNA polymerase and transcription factors to DNA
- Recruit RNA polymerase and transcription factors to DNA
- Recruit Ribosomes and translation factors to DNA
- Recruit Ribosomes and translation factors to RNA

4) Which amino acid contains an amide side chain among all the naturally occurring amino acids? (1)

- Aspartate
- Tyrosine
- Methionine
- Asparagine

5) How many peptide bonds does a tetrapeptide have? (1)

- Three
- Four
- Five
- Six

6) An amino acid monomer at neutral pH will be found in what form? (1)

- Negatively charged

Positively charged
Uncharged
Zwitterion

7) The pKa values for the α-carboxy group and α-amino group of serine are 2.2 and 9.2 respectively. Calculate the isoelectric pH (pI) of serine. (1)

2.2
9.2
7.0
5.7

8) What is the nature of exchange resin in Cation-exchange chromatography? (1)

Negatively charged
Positively charged
Uncharged
Neutral

9) During the denaturation of protein, which of the following structure is not denatured? (1)

Primary
Secondary
Tertiary
Quaternary

10) What is the purpose of the forward scatter detector in a flow cytometer? (1)

To detect the fluorescence emitted by cells
To measure the size and shape of cells
To analyze the chemical properties of cells
To separate cells based on their surface markers

11) What happens if a cell fails the G2 checkpoint in the cell cycle? (1)

It will continue on to mitosis
It will enter a state of dormancy
It will undergo apoptosis
It will go back to the S phase for further DNA repair

12) Which process allows for the exchange of genetic material between homologous chromosomes during meiosis? (1)

Synapsis
Crossing over
Independent assortment
Somatic recombination

13) What is the purpose of the flow cell in a flow cytometer? (1)

To separate cells based on their size and shape
To analyze the chemical properties of cells
To generate a uniform flow of cells through the laser beam
To capture and immobilize cells for further analysis

14) How do checkpoint proteins such as p53 help prevent the development of cancer? (1)

It promotes the growth of healthy cells by activating cyclins.
It inhibits the growth of unhealthy cells by blocking cyclins.
It repairs damaged DNA before the cell enters mitosis.
It induces apoptosis in cells with severe DNA damage or mutations.

15) The G1 checkpoint ensures which of the following? (1)

DNA replication is complete
DNA is free from damage
Sister chromatids are properly aligned
The cell has enough energy to enter S phase

16) What is the function of tumor suppressor genes in the cell cycle? (1)

To promote cell division
To prevent cell division
To regulate apoptosis
To regulate DNA replication

17) Which of the following is an example of a tumor suppressor gene? (1)

p53
myc
ras
bcl-2

18) Cyclins contain a "destruction box" near their amino terminus in the sequence, which targets them for (1)

Nucleus
Mitochondria
Vacuoles
Proteosome

19) Ligand binding to G-protein coupled receptors (1)

activates phospholipase C-γ
causes dissociation of Gα-GDP from the receptor followed by exchange of GTP for GDP
stimulates Gα-GDP to exchange GDP for GTP, before dissociating from the receptor
always causes elevation of intracellular [Ca2+]

20) Name the family of ligand-regulated transcription factors that are activated by steroid hormones. (1)

Adhesion Receptors
Nuclear Receptors
GPCRs
Voltage-gated-ion channels

II Long Answers

Answer all the questions.

1) Describe the process of mitosis and mention its biological significance. What are its major differences from meiosis. (10)

2) Write a note on (10)
i. Non-overlapping and overlapping code (2 Marks)

ii. Reading frame (2 Marks)
iii. Degeneracy of the genetic code (2 Marks)
iv. Wobble base (2 Marks)
v. Codon and anti-codon pairing (2 Marks)

III Short Answers

Answer all the questions.

1)	Identify the functions of following cell components and mention whether they are found in prokaryotes, eukaryotes or in both. a. Cell wall b. Ribosome c. Mitochondria d. Plasmids e. Histones	(5)
2)	Write a note about the Meselson and Stahl experimental proof for semiconservative replication.	(5)
3)	i. Define Ampholyte and Iso-electric point. 2 marks ii. Write a note on the classification of amino acids based on nutritional requirements. 3 marks	(5)
4)	Write a brief note on different methods for fractionating proteins using column chromatography.	(5)
5)	Describe the production of transgenic animals through pronuclear injection technique. What are the factors affecting the success rate?	(5)
6)	Discuss epinephrine and its signal transduction mechanism via the β-adrenergic pathway.	(5)
7)	Write about the regulation of passage from the G1 to S phase by phosphorylation of retinoblastoma protein (pRb).	(5)

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