

# Question Paper

Exam Date & Time: 15-May-2023 (10:00 AM - 01:00 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

Cell and Molecular Biology [PBT-BP808ET -S3]

Marks: 75

Duration: 180 mins.

### I Multiple Choice Questions (MCQs)

Answer all the questions.

Section Duration: 30 mins

- 1) Which of the following is a characteristic of prokaryotic cells? (1)
- [They have a nucleus](#)
  - [They have a cell wall made of cellulose](#)
  - [They do not have membrane-bound organelles](#)
  - [They have linear chromosomes](#)
- 2) What type of transport occurs across the cell membrane when molecules move from an area of higher concentration to an area of lower concentration without the use of energy? (1)
- [Passive transport](#)
  - [Active transport](#)
  - [Facilitated transport](#)
  - [Endocytosis](#)
- 3) RNA is involved in a wide range of cellular processes, identify the type of RNA involved in pre-mRNA splicing. (1)
- [miRNA](#)
  - [siRNA](#)
  - [snRNA](#)
  - [snoRNA](#)
- 4) An example of aromatic amino acid is (1)
- [Aspartate](#)
  - [Tyrosine](#)
  - [Methionine](#)
  - [Asparagine](#)
- 5) Which amino acid can absorb UV light? (1)
- [Alanine](#)
  - [Valine](#)
  - [Tryptophan](#)
  - [Histidine](#)
- 6) The pKa values for the  $\alpha$ -carboxy group and  $\alpha$ -amino group of tryptophan are 2.4 and 9.4 respectively. Calculate the isoelectric pH (pI) of tryptophan. (1)

- [2.4](#)
- [5.8](#)
- [7.0](#)
- [9.4](#)

7) What is the nature of proteins that are exchanged with charged resin in Anion-exchange chromatography? (1)

- [Negatively charged](#)
- [Positively charged](#)
- [Uncharged](#)
- [Sodium Polystyrene](#)

8) The net charge on a protein is zero at (1)

- [Acidic pH](#)
- [Basic pH](#)
- [Isoelectric point](#)
- [All the above](#)

9) Which of the following structure is not common in all proteins? (1)

- [Primary structure](#)
- [Secondary structure](#)
- [Tertiary structure](#)
- [Quaternary structure](#)

10) What is the purpose of the sheath fluid in a flow cytometer? (1)

- [To dilute the sample and prevent cell clumping](#)
- [To generate a uniform flow of cells through the laser beam](#)
- [To quench the fluorescence emitted by cells](#)
- [To preserve the viability of cells during analysis](#)

11) What is the purpose of the side 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](#)

12) Which of the following events occurs during prophase I of meiosis? (1)

- [Separation of sister chromatids](#)
- [Separation of homologous chromosomes](#)
- [Alignment of chromosomes at the equator of the cell](#)
- [Formation of spindle fibers](#)

13) During which stage of meiosis does DNA replication occur? (1)

- [Prophase I](#)
- [Metaphase I](#)
- [Anaphase I](#)
- [Interphase II](#)

14) Which of the following is **not** a limitation of the pronuclear injection method for creating transgenic animals? (1)

- [Low efficiency of gene insertion](#)
- [Limited control over the site of gene insertion](#)
- [Risk of genetic mosaicism](#)
- [Inability to create homozygous transgenic animals](#)

15) Which of the following is **not** a checkpoint in the cell cycle during mitosis? (1)

- [G1 checkpoint](#)
- [G2 checkpoint](#)
- [Metaphase checkpoint](#)
- [Telophase checkpoint](#)

16) What is the function of cyclins in the cell cycle? (1)

- [To activate CDKs](#)
- [To prevent DNA damage](#)
- [To induce apoptosis](#)
- [To inhibit cell division](#)

17) During which phase of mitosis does the nuclear envelope break down? (1)

- [Prophase](#)
- [Metaphase](#)
- [Anaphase](#)
- [Telophase](#)

18) The steroid hormone receptor complex binds to (1)

- [HREs in DNA](#)
- [HREs in mRNA](#)
- [HREs in proteins](#)
- [HREs in carbohydrates](#)

19) Which of the following is not the mechanism for oscillations of CDKs? (1)

- [Dephosphorylation of the CDK](#)
- [controlled degradation of the cyclin subunit](#)
- [periodic synthesis of CDKs and cyclins](#)
- [cyclin-dependent protein kinase](#)

20) Which of the following hormone inhibits the adenylyl cyclase enzyme? (1)

- [Epinephrine](#)
- [Glucagon](#)
- [Somatostatin](#)
- [Adrenocorticotrophic hormone](#)

## II Long Answers

**Answer all the questions.**

Long Answers

2 Q x 10 marks = 20 marks

- 1) Describe the different stages of meiosis and explain its biological significance. (10)
- 2) Explain the process of transcription and translation in prokaryotes. (10)

### III Short Answers

**Answer all the questions.**

Short Answers

7 Q x 5 marks = 35 marks

- 1) What are the major lipids found in cell membrane? What is the function of cholesterol in cell membrane? (5)
- 2) Briefly describe microRNAs and small Interfering RNAs. (5)
- 3) Write a note on Ramachandran's plot and explain its importance. (5)
- 4) Write about the classification of Amino acids based on the R group. (5)
- 5) Describe the principle and application of homologous recombination and explain the process of positive negative screening. (5)
- 6) Draw a neatly labeled diagram and briefly explain steroid receptors and receptor enzymes. (5)
- 7) List the names of six general types of signal transducers and write about the key features of the molecular mechanism of signal transduction. (5)

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