QP Code : 50140

(3 Hours) **[Total Marks : 100**

Instructions

Attempt all sections (I, II & III)
Draw a figure whenever necessary

SECTION I

(Multiple choice question)

(40x1=40 Marks)

All questions are compulsory

1. Which of the following is a non-parametric test?
   a) t-test
   b) f-test
   c) ANOVA
   d) χ 2 -test
2. A noncompetitive inhibitor of an enzyme-catalyzed reaction
   a) Increase V_{max} and decrease K_m
   b) Increase K_m nad but does not affect V_{max}
   c) Decrease V_{max} but does not affect K_m
   d) Increase K_m and decrease V_{max}
3. For cell signaling kinase, phosphate groups generally come from
   a) cAMP
   b) ATP
   c) Na_3PO_4
   d) cAMP and ATP
4. Intracellular water is maintained by
   a) Its simple diffusion from extracellular environment
   b) Its entry through dedicated water channel named aquaporin
   c) a ATP driven proton pump that brings extracellular water into the cell
   d) by symport process
5. Which among the following is not a characteristic of gap junction
   a) They allow small ions and molecules to migrate from cell to adjoining cell
   b) They are constituted of a class of membrane associated protein named connexin
   c) They are found only in plants
   d) They are channel like structures connecting the cytoplasms of adjoining cells
6. Which one among the following kinases is different from the other three?
   a) Extracellular signal regulated kinase
   b) PI3 kinase
   c) Protein kinase C
   d) Hexokinase
7. The dark bands in myofibrils are called A-bands, because they
   a) Are anisotropic to polarized light

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b) Contain actin filaments
c) Strongly adhere to the cytoskeleton
d) Were first amongst the myofibrilar structures to be identified

8. What is the name and the number of nerve that transmit information from the basilar and tectorial membranes of the internal ear to the brain?
   a) Olfactory and I cranial nerve
   b) Optic and II cranial nerve
   c) Auditory and VIII cranial nerve
   d) Trigeminal and V nerve
9. In human eyes, light exposure to the retinal photoreceptors
   a) Causes its depolarization
   b) Causes its hyperpolarization
   c) Opens Na^+ channels of the photoreceptor
   d) Opens K^+ channels of the photoreceptors
10. If the molecule has a centre of symmetry, then which of the following is important rule of vibrational spectroscopy
    a) No mode can be both infrared and Raman active
    b) All modes are infrared active but Raman inactive
    c) All modes are both infrared and Raman active
    d) All modes are infrared and Raman inactive
11. In a spectrogram, the stokes and antistokes lines are placed symmetrically about the central peak, which of the following is true?
    a) The magnitude stokes and antistokes frequencies are same
    b) Wavelength of stokes and anti-stokes frequency
    c) Stokes frequency is twice the anti-stokes frequency
    d) Stokes frequency is half the anti-stokes frequency
12. Steric limitations on the bond angles in a polypeptide chain specify that out of three bonds contributed by each amino acid to the backbone of the chain
    a) Cα- C bond can rotate
    b) N- Cα bond cannot rotate
    c) Peptide bond is not planner
    d) Any one of the three bonds can rotate
13. In C-type cytochrome, the heme moiety is bond to the apoprotein by
    a) Covalent bond
    b) Ionic bond
    c) Coordination bond
    d) Van der Waals' interaction
14. Protein transport in mitochondria takes place
    a) Co-translationally
    b) Post – translationally
    c) Through ER –Golgi pathway
    d) Via peroxisomes

15. Which of the statements related to the Ramchandran Plot is not true?
    a) Almost all peptide bonds in proteins are *cis*.
    b) The restriction of ϕ and ψ angles limits structures accessible to unfolded form of proteins
    c) A configuration that has $\phi = 90^0$ and $\psi = -90^0$ is disallowed
    d) Three quarters of possible (ϕ , ψ) combination are excluded by their steric clashes
16. In enzyme catalysed reactions, enzyme molecules are capable of all the following, *except*
    a) altering the equilibrium of the chemical reaction
    b) decreasing the activation energy of the reaction
    c) increasing the rate of reaction
    d) altering the free energy of the reaction.
17. Which of the following pairs of stereoisomers exist in all cellular proteins
    a) L-amino acids and D-ribose
    b) D-amino acids and L-ribose
    c) L-amino acids and L-ribose
    d) D-amino acids and D-ribose
18. In DNA replication, the telomerase RNA plays the role of
    a) a primer
    b) a template
    c) an enzyme
    d) a cofactor
19. Which of the following base pairs plays a major role in the context of secondary structure in RNA?
    a) A : U
    b) G : U
    c) G : C
    d) C : U
20. Which of the following methods can be used to study protein-protein interactions?
    a) Co-immunoprecipitation
    b) Peptide mapping
    c) Radiolabeling
    d) Enzyme linked immunoassay
21. Which of the following enzymes is involved in conversion of molecular oxygen to superoxide?
    a) Superoxide dismutase
    b) Catalase
    c) Cytochrome oxidase
    d) NADPH oxidase
22. In the presence of fixed concentration of competitive inhibitor, which of the following would best characterize an enzyme –catalysed reaction when the concentration of the substrate is increased?
    a) The inhibition does not change
    b) The inhibition decreases
    c) The K_m increases

d) The V_{max} increases

23. While measuring UV visible absorption spectrum of protein using a 1 mm path length cell, you find that the signal is weak because the concentration of the protein is low. You would overcome this problem by
    a) Increasing viscosity by adding glycerol
    b) Changing the wavelength range
    c) Changing the temperature of sample
    d) Increasing the path length of the sample
24. The shielding effect in NMR is result of
    a) Near-neighbour effects on the NMR active molecule
    b) Solvent interaction with the NMR active molecule
    c) Opposition to the applied field by the induced magnetic field
    d) Spin-spin coupling in the applied magnetic field
25. Of the following protein motifs, three are commonly associated with proteins with specific type of function. Identify the odd one out?
    a) Helix-turn-Helix
    b) Leucine zipper
    c) Zn finger
    d) Seven pass *trans* membrane domain
26. Fluorescence emission of Trp residue in a protein
    a) Is dependent of the environment around the Trp
    b) Undergoes red shift when exposed to an aqueous environment
    c) Undergoes blue shift when exposed to an aqueous environment
    d) Is always observed at 331 nm
27. Protein folding is a spontaneous process primarily because it is driven by
    a) The favourable bonding interactions between amino acids
    b) The tendency of the protein chain to occupy minimum volume
    c) The tendency of the protein to maximize its entropy
    d) The hydrophobic interactions in the protein that allow the solvent maximum entropy
28. The characteristics of X-ray radiation is emitted when
    a) Electrons are accelerated to a fixed energy level
    b) The source of electrons emits a mono-energetic beam
    c) The bombarding electrons knock out electrons from inner shell to the target atom and one of the outer electrons fall into this vacancy
    d) The bombarding electron knock out electrons from the valance shell of an atom
29. All the factors remaining identical , propagation of nerve impulse is
    a) Directly proportional to the diameter of the nerve
    b) Directly proportional to the length of the nerve fibre
    c) Indirectly proportional to the myelination of the nerve fibre
    d) Independent of the diameter of the nerve fibre
30. Heart muscle cannot be tetanized because
    a) It get O_2 from the blood it pump

b) Its refractory period is long
c) It does not contain Ca^{2+}
d) It does not possess Mg^{2+}

31. A fibrous protein can be distinguished from a globular protein of the same mass by
a) SDS-PAGE analysis
b) Emission at 340nm
c) Absorption at 280nm
d) Size exclusion chromatorgrapy

32. A peptide composed entirely of d-amino acids can be distinguished from the composed of entirely l-amino acids by
a) Change in UV absorption maxima
b) Change in fluorescence maxima
c) Difference in the Circular Dichroism spectrum
d) Differential mobility in SDS-PAGE

33. Which of the following hormone does not act by a second messenger
a) Glucagan
b) Epinpherin
c) Follicle stimulating hormone
d) Testosterone

34. The stiffening of muscles in dead animals, called *Rigor mortis* , occurs due to
a) Lack of calcium
b) Deterioration of muscle proteins
c) Lack of ATP which is necessary for the detachment of cross bridges
d) Reduced body temperature

35. When neuron is at resting potential (-70mv) , the net flow of sodium is
a) Into the neuron
b) Out of the neuron
c) Zero because sodium ion do not move across neuron membrane
d) Zero because sodium ions move at an equal rate in both directions

36. What role does O_2 play in aerobic respiration
a) It plays no role
b) It combine with acetyl-CoA at the start of the Krebs cycle
c) It combine with H2O to help the drive formation of ATP
d) It is the final electron accepter at the end of the electron transport

37. The receptor for steroid hormones are found
a) On cell membrane
b) In cytoplasm
c) In mitochondria
d) On Ribosomes

38. Which of the following is not a membrane lipid
a) Cholesterol
b) Phosphoglycerides

c) Cerebroside
d) choline

39. Most of the free fatty acids are transported blood
a) In side the RBC
b) Bound to albumin
c) Combined with glucose
d) Bound to cholesterol

40. Patch clamp is a device use to
a) Measure strength of an electrochemical gradient
b) Study the properties of individual neuro transmitters
c) Infuse different kinds of ions in to axon
d) Study the properties of individual membrane channels

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SECTION II

(short answer questions)

Attempt **any three** (3x10=30 Marks)

1. Explain the terms Entropy, Enthalpy and Free energy. Write briefly on free energy of biological systems giving suitable examples
2. Describe the methodology of 2-D Electrophoresis. How can this technique be used in drug discovery?
3. What is semi conservative replication of DNA? Which landmark experiment was carried out to demonstrate semi conservative replication in prokaryotes.
4. Differentiate between Tunneling Electron Microscope and Atomic force microscope. Write their application in biological systems.
5. Describe organization of membrane components according to Fluid Mosaic model. What information can be obtained by Hydropathy plot in membrane studies.

SECTION III

(Long answer questions)

Attempt any two question (2x15 =30 Marks)

1. Write a detailed account of the structure and polymerization of microtubes, microfilament and inter mediate filaments.
2. Derive the expression of multi-target single hit model of cell survival following exposure to ionizing radiation. Discuss the possible effects of whole body exposure of to 5Gy gamma radiation dose.
3. Write the principles of Infrared and Raman Spectroscopy. Give a comparative account of how these techniques compliments each other in structure determination of biological macro molecules.
4. What is microarry ? what are the different types of microarrays available? Describe their uses giving suitable examples.
