



IIT-JAM BIOTECHNOLOGY - BT
TEST : BIOCHEMISTRY

Time : 45 Minutes

Date : 19-03-2017
M.M. : 50

INSTRUCTION:

1. Attempt all the questions.
2. **Section-A** contains **20** Multiple Choice Questions (MCQ). Each question has 4 choices (a), (b), (c) and (d), for its answer, out of which **ONLY ONE** is correct. From **Q.1 to Q.10** carry **1 Mark** and **Q.11 to Q.20** carries **2 Marks** each.
3. **Section-B** contains **5** Multiple Select Questions (MSQ). Each question has 4 choices (a), (b), (c) and (d) for its answer, out of which **ONE or MORE than ONE** is/are correct. From **Q.21 to Q.25** carries **2 Marks** each.
4. **Section-C** contains **5** Numerical Answer Type (NAT) questions. **Q.26 to Q. 30** carries **2 Marks** for each NAT type question.
5. In all sections, questions not attempted will result in zero mark. In **Section-A** (MCQ), wrong answer will result in negative marks. For all **1 mark** questions, **1/3 marks** will be deducted for each wrong answer. For all **2 marks** questions, **2/3 marks** will be deducted for each wrong answer. In **Section-B** (MSQ), there is no negative and no partial marking provisions. There is no negative marking in **Section-C** (NAT) as well.

SECTION - A

Q.1 to Q.10: Carry 1 Mark each.

1. When animal cell are placed in a hypotonic solution such as distilled water, they swell and burst due to
 - a. Diffusion
 - b. Osmosis
 - c. Active transport
 - d. Pinocytosis
2. Polypeptide consists of amino acids linked covalently by peptide bonds. These peptide bonds are formed between atoms
 - a. N & H
 - b. C & O
 - c. C & N
 - d. C & C
3. Aspartame (artificial sweetener) is a/an
 - a. Oligopeptide
 - b. Dipeptide
 - c. Disaccharide
 - d. Dinucleotide
4. The net charge on a protein will be negative when pH is
 - a. At its pI
 - b. Above its pI
 - c. Below its pI
 - d. At neutral pH
5. A water-soluble globular protein is most likely to have the highest proportion of which of the following amino acid residues buried within its core?
 - a. Serine
 - b. Histidine
 - c. Isoleucine
 - d. Glutamate



6. Which of the following pair of amino acids often found in β -turns?
 a. Gly & Ala
 b. Gly & Pro
 c. Pro & Lys
 d. Pro & hydroxy Proline
7. Which of the following combinations of amino acids is likely to form ionic bond between them in proteins?
 a. Arg and Leu
 b. His and Lys
 c. Lys and Glu
 d. Glu and Cys
8. Which one of the following does NOT cleave on the carboxyl side of any Arginine residue in a protein?
 a. Trypsin
 b. Proteinase K
 c. Thrombin
 d. Chymotrypsin
9. Haemoglobin and Myoglobin both have all of the following characteristics except
 a. Consist of subunits designed to provide hydrogen bonds and nonpolar interaction with other subunits
 b. Highly alpha helical
 c. Bind one molecules of heme per globin chain
 d. Bind heme in a hydrophobic pocket
10. During post-translational modification of proteins, which amino acid does not get phosphorylated?
 a. Glutamate
 b. Threonine
 c. Serine
 d. Tyrosine

Q.11 to Q.20: Carries 2 Marks each.

11. Which of the following is not true about Alanine?
 a. At pH 1, overall charge is +1
 b. At pH 1, it will move towards cathode
 c. An equimolar mixture of D and L does not rotate the plane polarised light
 d. Contains branched side chains
12. Which of the following amino acid absorb maximum at 280nm?
 a. Tyrosine
 b. Alanine
 c. Phenylalanine
 d. Tryptophan
13. In an alpha-helix hydrogen bonds are
 a. Within a single chain
 b. Between chains that run side by side
 c. Between polar amino acids and water
 d. Only between amino acids of opposite charge
14. How does haemoglobin carry carbon dioxide generated in tissues back to the lungs?
 a. By coordination with heme
 b. By forming C-terminal carbamate
 c. By forming N-terminal carbamate
 d. By linking to the epsilon-amino group of lysine
15. DNA polymerase contains a lysine residue that is important for binding to DNA. Mutations were found that converted this lysine to either glutamate, Glycine, valine, or arginine. Which mutation would be predicted to the most and least harmful to the ability of the enzyme to bind DNA
- | Most | Least |
|--------------|--------------|
| a. Glycine | Arginine |
| b. Arginine | Glycine |
| c. Glutamate | Valine |
| d. Glutamate | Arginine |

16. The composition of proteins P1 to P4 are shown below:

Protein Composition

P1 Rich in polar residues; poor in apolar residues

P2 Rich in apolar residues; poor in polar residues

P3 Has comparable number of polar and apolar residues

P4 Rich in Glycine and proline

Which of the following options CORRECTLY relates the propensities of these proteins to be folded, aggregated or disordered in an aqueous buffered solution?

- P1, P2 and P4 are disordered and P3 is folded
 - P1 and P3 are folded, P2 is aggregated and P4 is disordered
 - P1 and P3 are folded and P2 and P4 are disordered
 - P1 and P4 are disordered, P2 aggregated and P3 is folded
17. An enzyme shows highest activity in the pH range 2.0-3.0. At pH 4.0 and pH 7.0, the enzyme exhibits 50% and 1%, respectively, of its highest activity. Which of the following states of an amino acid residue in the catalytic site is most responsible for its activity profile?
- A protonated Asp
 - A deprotonated Asp
 - A deprotonated Asn
 - A protonated Asn
18. The Isoelectric point of an enzyme is 6. It was observed that at this point there are 5 positively charged and 5 negatively charged side chains of amino acids. When the enzyme solution was titrated with HCL to pH3, it was observed that two ionized aspartate chains got protonated. The net charge at pH 3 would therefore be
- +3
 - +2
 - 3
 - 2
19. The pI of a protein is 6.0. If that protein is dissolved in a buffer of pH 3.0 and subjected to SDS gel electrophoresis
- It will not migrate to either anode or cathode
 - It will migrate to the cathode
 - Partial protein will move towards anode and rest will move towards cathode
 - It will migrate to the anode
20. A mixture of Arginine, Phenylalanine and Histidine was fractionated using cation exchange chromatography at neutral pH. Identify the correct order of elution.
- Arginine, Histidine, Phenylalanine
 - Phenylalanine, Histidine, Arginine
 - Histidine, Phenylalanine, Arginine
 - Arginine, Phenylalanine, Histidine

SECTION – B

Q.21 to Q.25: Carries 2 Marks each.

21. Myoglobin shows a hyperbolic response, while haemoglobin shows a sigmoidal response for oxygen binding. Which of the following statements are TRUE with respect to this observation?
- Haemoglobin binds 2,3-BPG while Myoglobin does not
 - Haemoglobin exists in two different conformational states while Myoglobin does not
 - Haemoglobin is a tetramer while Myoglobin is a monomer
 - Haemoglobin is present in RBCs while Myoglobin is present in the muscle



22. Amino acid is
- Amphoteric in nature
 - Basic structural unit of peptide
 - Can act as an acid (proton donor) or a base (proton acceptor)
 - Exist as Zwitterion in solutions
23. N-terminal amino acids of a polypeptide are estimated by
- Edman reaction
 - Sanger's reagent
 - Formaldehyde test
 - Ninhydrin reaction
24. Which of the following statement/s is/are correct?
- The solubility of protein is lowest at its isoelectric point
 - At low ionic strengths, solubility of a protein increases with increasing salt concentration
 - Tyrosine, tryptophan and phenylalanine have aromatic side chains capable of forming hydrogen bonds
 - Oxygen binding to haemoglobin decreases when pH is increased from 7.2 to 7.6
25. Which of the type/s of interaction/s involved in 3-dimensional structure of proteins
- Hydrogen bonding
 - Ionic interactions
 - Hydrophobic interactions
 - Disulphide linkages

SECTION – C

Q.26 to Q.30: Carries 2 Marks each.

26. Calculate the length of a linear peptide in nm having 200 amino acids, out of them 70% of residues are in α -helix and rest are in β -pleated sheets_____
27. The net charge on the following peptide at pH 7.0 is _____
Val-Asp-Asn-Lys-Ser-Ile
28. The following polypeptide chain was sequentially treated with dithiothreitol, Cyanogen bromide and trypsin.
Phe-Trp-Lys-Tyr-Met-Gly-Ala-Cys-Cys-Pro-Met-Gly-Arg-Phe-Ala-Gly-Trp
The total number of fragments expected at the of complete digestion of the polypeptide are _____
29. An aqueous solution contains two compounds X and Y. This solution gave absorbance values of 1.0 and 0.4 at 220 and 280 nm, in a 1 cm path length cell. Molar absorption coefficients (ϵ) of the compounds X and Y are as shown in the table below. ϵ_{220} ($M^{-1} cm^{-1}$)

	ϵ_{220} ($M^{-1} cm^{-1}$)	ϵ_{280} ($M^{-1} cm^{-1}$)
Compound X	1000	200
Compound Y	800	400

The concentration of Y in the solution is _____ mM.

30. A linear peptide of 500 amino acids have molecular weight approximately_____





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ANSWER KEY

SECTION - A

- | | | | | |
|------------|---------|---------|---------|---------|
| 1. (b) | 2. (c) | 3. (b) | 4. (b) | 5. (c) |
| 6. (b) | 7. (c) | 8. (d) | 9. (a) | 10. (a) |
| 11. (b, d) | 12. (d) | 13. (a) | 14. (c) | 15. (d) |
| 16. (d) | 17. (a) | 18. (b) | 19. (b) | 20. (b) |

SECTION - B

- | | | | |
|---------------|------------------|------------|------------|
| 21. (b, c) | 22. (a, b, c, d) | 23. (a, b) | 24. (a, b) |
| 25. (a, b, d) | | | |

SECTION - C

- | | | | |
|---------------------|---------|---------|---------------|
| 26. (420Å or 42 nm) | 27. (0) | 28. (5) | 29. (8.33 mM) |
| 30. (55kDa) | | | |

