

J : Biochemistry

Q.1 – 10 carry one mark each

- Q.1 Which amino acid residue is most likely to be found in the interior of a water soluble globular protein?
- (A) Ser (B) Arg
(C) Val (D) Asp
- Q.2 Of the peptide sequences given below, which one is the digestive enzyme trypsin most likely to cleave?
- (A) -----Val-Lys-Pro-Met----- (B) -----Arg-Val-Phe-Tyr-----
(C) -----Trp-Asp-Gln-Pro----- (D) -----Glu-Gly-Trp-Gly-----
- Q.3 Which pair of amino acids will have the highest absorbance at 280 nm? (Assume equimolar concentrations)
- (A) Thr & His (B) Phe & Pro
(C) Trp & Tyr (D) Phe & His
- Q.4 Which one of the following statements about protein secondary structure is correct?
- (A) An α -helix is primarily stabilized by ionic interactions between the side chains of the amino acids
(B) β -sheets exist only in antiparallel form
(C) β -turns often contain proline
(D) An α -helix can be composed of more than one polypeptide chain
- Q.5 The enzymes where catalysis involves transfer of electrons are named as
- (A) Isomerases (B) Transferases
(C) Oxidoreductases (D) Lyases
- Q.6 Vitamin D is derived from which of the following precursors by the action of UV light?
- (A) 7-Dehydrocholesterol (B) Lanosterol
(C) Glycocholate (D) Squalene epoxide
- Q.7 The molecular defect in familial hypercholesterolemia is due to the lack of functional
- (A) VLDL receptor (B) IDL receptor
(C) LDL receptor (D) HDL receptor
- Q.8 Alcaptonuria is an inborn error in metabolism, transmitted as a single recessive Mendelian trait where the enzyme that is absent is
- (A) Phenylalanine hydroxylase (B) Ornithine decarboxylase
(C) Adenosine deaminase (D) Homogentisate oxidase

- Q.9 The prokaryotic RNA polymerase holoenzyme has the subunit structure
- (A) $\alpha_2\beta\beta'\sigma$ (B) $\alpha_2\beta_2\sigma$
 (C) $\alpha_2\beta_2$ (D) $\alpha_2\beta\beta'$
- Q.10 Given below are four enzymatic reactions involved in glycolysis. In which of the following steps is ATP generated?
- (A) 2-Phosphoglycerate to Phosphoenol pyruvate
 (B) Glucose-6-phosphate to Fructose-6-phosphate
 (C) Phosphoenol pyruvate to Pyruvate
 (D) Glyceraldehyde-3-phosphate to 1,3-bisphosphoglycerate

Q.11 – 30 carry two marks each

- Q.11 The correct decreasing order of permeability through a lipid bilayer of the molecules/ions Isoleucine, Tyrosine, O_2 and Na^+ is
- (A) $O_2 > Na^+ > Isoleucine > Tyrosine$ (B) $O_2 > Isoleucine > Tyrosine > Na^+$
 (C) $Isoleucine > Tyrosine > O_2 > Na^+$ (D) $Isoleucine > Tyrosine > Na^+ > O_2$
- Q.12 For the reaction
- $$\text{Fructose-6-phosphate} + P_i \rightleftharpoons \text{Fructose 1,6-bisphosphate} + H_2O$$
- the equilibrium constant at pH 7 and 300 K is 10^{-3} . The standard free energy change (in kcal per mole) for the reaction is approximately equal to: ($R = 2 \text{ cal deg}^{-1} \text{ mol}^{-1}$)
- (A) +4.1 (B) -4.1 (C) +2.2 (D) -2.2
- Q.13 Of the four statements given below only one is correct. Pick the correct one
- (A) Progesterone is synthesized in the corpus luteum and it prepares the uterine lining for egg implantation and maintenance of pregnancy
 (B) Progesterone is synthesized in the ovary and is responsible for female secondary sex characters
 (C) Progesterone is synthesized in the adrenal cortex and promotes gluconeogenesis and glycogen formation
 (D) Progesterone is synthesized in testis and is responsible for male secondary sex characters
- Q.14 Which one of the following statements about lipoproteins is true?
- (A) Molecular mass of lipoproteins is directly proportional to their density
 (B) The percent protein content in lipoproteins increases with molecular mass
 (C) Density of a lipoprotein decreases with increase in protein content
 (D) Molecular mass of lipoproteins is inversely proportional to their density

Q.15 Choose the correct common sequence motif of Zn finger proteins from the choices given below. X stands for any amino acid

- (A) X₃-Cys-X_{2,4}-Cys-X_{1,2}-His-X_{3,4}-His-X₄
- (B) X₃-Cys-Cys-X_{2,4}-His-His-X₄
- (C) X₃-Cys-Cys-His-His-X₄
- (D) X₃-Cys-X_{2,4}-His-X_{1,2}-His-X_{3,4}-Cys-X₄

Q.16 Pick the correct statement

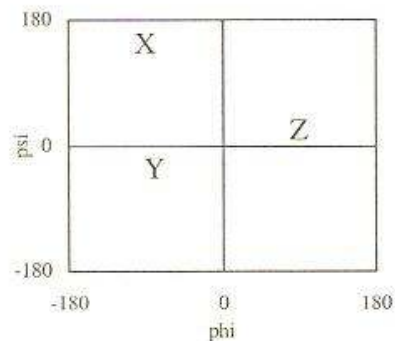
- (A) In O-linked glycosylation, sugars are attached to the protein via O-glycosidic bonds to the carboxyl groups of Asp and Glu
- (B) In O-linked glycosylation, preformed oligosaccharides are attached to the relevant protein
- (C) In O-linked glycosylation, N-acetylgalactosamine is added via O-glycosidic bonds to the OH groups of Ser and Thr after which other sugars are added sequentially
- (D) O-linked glycosylation is inhibited by the passage of the newly synthesized protein through the Golgi complex

Q.17 Which of the following statements is **NOT** true with regard to photosynthesis?

- (A) The dark reactions use NADPH and ATP to drive the synthesis of carbohydrate from CO₂ and H₂O
- (B) The principal photoreceptor, chlorophyll is derived biosynthetically from protoporphyrin IX
- (C) Photosystem II (PS II) generates a strong reductant capable of reducing NADP⁺
- (D) The components involved in the electron transport from H₂O to NADPH are largely organized into three thylakoid membrane-bound particles

Q.18 In the adjoining Ramachandran diagram, which type of secondary structure do the regions marked X, Y and Z represent?

- (A) X : right handed α -helix
Y : left handed α -helix
Z : β -sheet
- (B) X : left handed α -helix
Y : right handed α -helix
Z : β -sheet
- (C) X : β -sheet
Y : right handed α -helix
Z : left handed α -helix
- (D) X : β -sheet
Y : left handed α -helix
Z : right handed α -helix



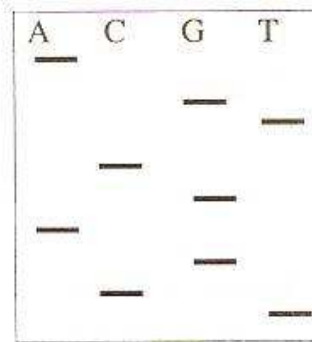
Q.19 The RNase A catalyzed hydrolysis of tRNA follows a two-step process with the intermediate formation of a 2', 3'-cyclic nucleotide. In these steps

- (A) His 12 acts as a general base in the transphosphorylation step abstracting a proton from an RNA 2'-OH group
- (B) His 119 acts as a general base in the transphosphorylation step abstracting a proton from an RNA 2'-OH group
- (C) The 2', 3'-cyclic intermediate is hydrolyzed when His 12 acts as a general base
- (D) His 12 acting as a general acid in the transphosphorylation step promotes bond scission by protonating the leaving group

Q.20 Shown below is the autoradiogram of an electrophoresis gel obtained during the sequencing a single stranded DNA by Sanger's method.

The base sequence of the DNA is

- (A) 3'-AGTCGAGCT-5'
- (B) 5'-TCAGCTCGA-3'
- (C) 3'-TCAGCTCGA-5'
- (D) 5'-AGTCGAGCT-3'



Q.21 In an antigen antibody interaction, in the zone of equivalence, the isolated antigen IgG complex was found to be in the molar ratio of antigen: IgG, 2 : 1. The number of epitope(s) present on the antigen is

- (A) 1
- (B) 2
- (C) 4
- (D) 10

Q.22 Class switching occurs in a B cell to produce IgG from IgM. Which one of the following conclusions is correct?

- (A) Specificity of the IgG and IgM are different from each other
- (B) Specificity of the IgG is the same as IgM
- (C) The molecular weight of the new antibody is the same as the old one
- (D) The valency of the new antibody is the same as the old one

- Q.23 Two types of IgMs are produced by the same B cell, one that is secreted and the other that can bind to the membrane. Which one of the following statements is correct?
- (A) These two antibodies are coded by altogether two different genes
 - (B) The membrane anchor residues are added to the protein by post-translational modification
 - (C) The two different proteins associate, one of which provides the membrane anchor
 - (D) The proteins are produced by alternate splicing of its primary transcript
- Q.24 During DNA replication, short RNA primers are synthesized which are then extended by DNA polymerase. These RNA primers in prokaryotes are removed by the enzyme
- (A) Primase
 - (B) RNase H
 - (C) DNA polymerase I
 - (D) DNA polymerase III
- Q.25 A new antibiotic was discovered which strongly inhibited mRNA precursor transcripts and s_0 RNA transcripts. This antibiotic was predicted to be an inhibitor of
- (A) RNA polymerase I
 - (B) RNA polymerase II
 - (C) RNA polymerase III
 - (D) Helicase
- Q.26 Suppose $[4-^{14}\text{C}]$ oxaloacetate is fed to mitochondria. After one turn of the Citric Acid Cycle, which carbon(s) of succinate would be labelled?
- (A) None
 - (B) Equally distributed between C-1 and C-4
 - (C) Equally distributed between C-2 and C-3
 - (D) C-4
- Q.27 Two restriction enzymes A and B have eight and four base pairs as their recognition sites respectively. The ratio of the number of fragments that they will generate on restriction digestion of a genomic DNA of *E.coli* is approximately
- (A) 4 : 8
 - (B) 8 : 4
 - (C) 1 : 64
 - (D) 1 : 256

Q.28 A solution of tryptophan has an absorbance at 280 nm of 0.54 in a 0.5 cm path length cuvette. Given the absorbance coefficient (ϵ) for tryptophan is $5.4 \times 10^3 \text{ M}^{-1}\text{cm}^{-1}$, the concentration of the solution is

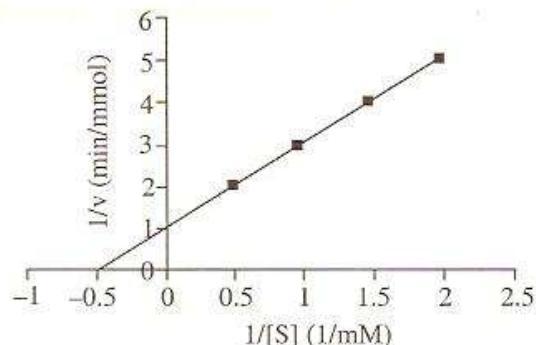
- (A) 0.2 mM (B) 20 μM (C) $1 \times 10^{-3}\text{M}$ (D) 0.1 mM

Q.29 From the data given below, identify the protein pair that would (a) give the least mobility band on a sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE) experiment and (b) elute last on an anion exchange e.g., DEAE column respectively

Protein	pI	Subunit M.W.	Native M.W.
A	9	10,000	20,000
B	8	35,000	35,000
C	6	15,000	90,000
D	5	20,000	80,000
E	3	30,000	30,000

- (A) (a) Protein C (b) Protein A
 (B) (a) Protein A (b) Protein E
 (C) (a) Protein B (b) Protein E
 (D) (a) Protein B (b) Protein A

Q.30 The graph shows a Lineweaver-Burke plot for an enzyme catalyzed reaction



Which of the following statements is correct?

- (A) The V_{\max} is 5 mmol/min and with competitive inhibition V_{\max} remains unchanged
 (B) K_m is 2 mmol/min and with competitive inhibition both K_m and V_{\max} decrease
 (C) K_m is 0.5 mM and with competitive inhibition V_{\max} increases but K_m remains unchanged
 (D) K_m is 2.0 mM and with competitive inhibition K_m increases but V_{\max} remains unchanged