

Q. 1 – Q. 6 carry one mark each.

Q.1 Which of the following amino acids does NOT contribute to fluorescence of a protein?

- (A) Tyrosine (B) Phenylalanine
(C) Cysteine (D) Tryptophan

Q.2 Immunological memory is manifested during

- (A) primary immune responses
(B) non-specific immune responses
(C) innate immune responses
(D) secondary immune responses

Q.3 The main function of the pentose phosphate pathway is to

- (A) supply ribose 5-phosphate and NADPH
(B) supply NADH and ATP
(C) provide a mechanism to use the carbon skeletons of excess amino acids
(D) provide carbon skeletons for oxidation of fatty acids

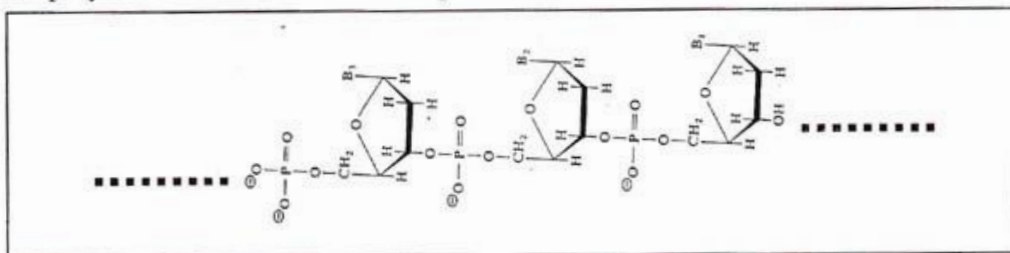
Q.4 Which one of the following CANNOT be considered as a weak interaction?

- (A) van der Waals forces
(B) Peptide bonds
(C) Hydrogen bonds
(D) Ionic interaction

Q.5 Polynucleotide kinase is used

- (A) to add a nitrogenous base at the 5' end of DNA
(B) to add a nitrogenous base at the 3' end of DNA
(C) to add a phosphate at the 5' end of DNA
(D) to add a phosphate at the 3' end of DNA

Q.6 The polymer shown below is a component of



- (A) polysaccharide
(B) polyribonucleotide
(C) polyketide
(D) polydeoxyribonucleotide

Q. 7 – Q. 24 carry two marks each.

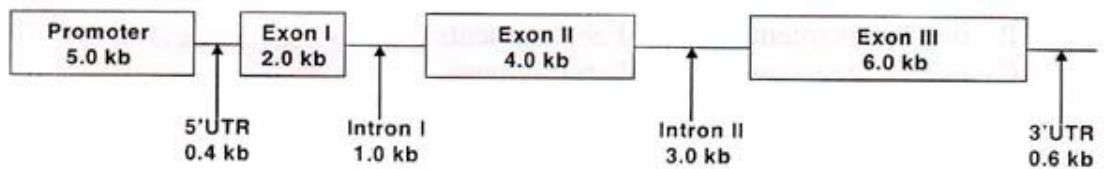
- Q.7 FOS, JUN and MYC are
- (A) proteins expressed on the surface of cancerous cells
 - (B) protein kinases that phosphorylate transcription factors in cancerous cells
 - (C) proteins involved in regulation of expression of genes involved in growth promotion
 - (D) proteins involved in ion transport in cancerous cells
- Q.8 Using microarray technique it was demonstrated that when a mammalian cell line was exposed to a drug, the expression of 10 genes is increased. Which of the following pairs of techniques could be used to validate microarray data?
- (A) Southern blotting and polymerase chain reaction (PCR)
 - (B) Northern blotting and fluorescence *in situ* hybridization
 - (C) Southern blotting and reverse transcriptase (RT)-PCR
 - (D) Northern blotting and RT-PCR
- Q.9 Pepsin hydrolysis of IgG molecule will result in the production of
- (A) one Fc fragment and one F(ab')₂ fragment
 - (B) one Fc fragment and two Fab fragments
 - (C) one Fc fragment and one Fab fragment
 - (D) one F(ab')₂ fragment and one Fab fragment
- Q.10 Select the correct combination to fill in the blanks.
_____ are responsible for the production of antibody against free pathogens and soluble products from pathogens while _____ destroy pathogen and virally infected cells and abnormal cells.
- (A) Cytotoxic T cells and B cells
 - (B) Macrophages and T cells
 - (C) B cells and Helper T cells
 - (D) B cells and Cytotoxic T cells
- Q.11 Select the correct primer pair for the PCR amplification of the following DNA fragment:
- 5'-TTTTTTTTTTGTAAGTCGGTCGTAGGCATTGAACTATGCGGGGGGGGGG-3'
3'-AAAAAAAAAACATTGAGCCAGCATCCGTAAGTTGATACGCCCCCCCCC-5'
- (A) 5'-TTTTTTTTTTT-3' and 5'-GGGGGGGGGGG-3'
 - (B) 5'-AAAAAAAAA-3' and 5'-CCCCCCCCC-3'
 - (C) 5'-TTTTTTTTTTT-3' and 5'-CCCCCCCCC-3'
 - (D) 5'-AAAAAAAAA-3' and 5'-GGGGGGGGGGG-3'

- Q.12 The double-reciprocal transformation of the Michaelis-Menten equation, also called the Lineweaver-Burk plot, is given by

$$1/V_0 = K_m/(V_{\max}[S]) + 1/V_{\max}$$

To determine K_m from a double-reciprocal plot, you would

- (A) take the reciprocal of the y-axis intercept
 - (B) take the reciprocal of the x-axis intercept
 - (C) multiply the reciprocal of the x-axis intercept by -1
 - (D) multiply the reciprocal of the y-axis intercept by -1
- Q.13 Which of the following statements is INCORRECT?
- (A) Most of the eukaryotic mRNAs have a 7-methylguanosine cap at their 5' end
 - (B) TATA binding protein is involved in the synthesis of mRNA, tRNA and rRNA
 - (C) Histones have no other function except in chromatin organization
 - (D) Eukaryotic RNA polymerase II consists of more than 4 subunits
- Q.14 The organization of an eukaryotic gene expressed at high levels in liver is diagrammatically represented below:



The size of the mature mRNA generated by the transcription followed by normal splicing of this gene will be (assume that this mRNA is not polyadenylated; 5'UTR and 3'UTR refer to the 5' and 3' untranslated regions, respectively)

- (A) 12.4 kb
 - (B) 13.0 kb
 - (C) 12.0 kb
 - (D) 12.6 kb
- Q.15 Incubation of a cell extract containing all enzymes of glycolysis with $[\gamma\text{-}^{32}\text{P}]\text{ATP}$ and unlabeled inorganic phosphate results in the formation of which of the following labeled compounds (assume that pyruvate kinase is inactivated)?
1. Glucose-6- ^{32}P Phosphate
 2. (3- ^{32}P)-Phosphoglycerate
 3. (1-Phospho-3- ^{32}P Phospho)-Bisphosphoglycerate
 4. (1-Phospho-6- ^{32}P Phospho)-Fructose bisphosphate
- (A) 1 and 3
 - (B) 1, 2 and 3
 - (C) 2 and 4
 - (D) only 4

Q.16 Electrophoresis of a purified protein named X in the presence of sodium dodecyl sulfate and 2-mercaptoethanol, shows a single band of 45 kDa. In gel filtration column chromatography, protein X elutes between alcohol dehydrogenase (160 kDa) and beta-amylase (190 kDa). How many identical subunits is protein X composed of?

- (A) One (B) Two (C) Three (D) Four

Q.17 Identify the correct pairs for the primary functions of the different enzyme classes

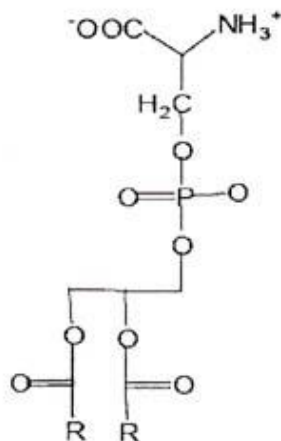
- | | |
|-----------------|--|
| P. Kinases | 1. cleave bonds by elimination |
| Q. Lyases | 2. make large molecules from small molecules |
| R. Synthases | 3. transfer phosphate group to biomolecules |
| S. Phosphatases | 4. remove phosphate group from biomolecules |

- (A) P-4, Q-2, R-3, S-1
 (B) P-3, Q-1, R-2, S-4
 (C) P-4, Q-1, R-2, S-3
 (D) P-3, Q-2, R-1, S-4

Q.18 Which of the following statements about the mitochondrial proton gradient and membrane potential is correct?

- (A) Either of them is sufficient to make ATP from ADP + Pi
 (B) Both are required to make ATP
 (C) Usually cancel one another since the system is at equilibrium
 (D) Neither of them is required for ATP synthesis

Q.19 The molecule shown is:

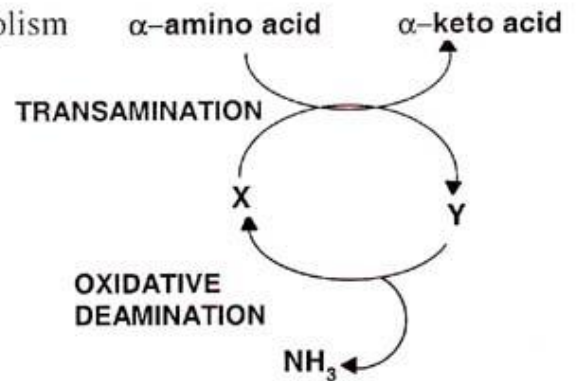


- (A) Phosphatidylserine
 (B) Phosphatidylcholine
 (C) Phosphatidylethanolamine
 (D) Phosphatidylinositol

Q 20 Melting curve of two DNA specimens X and Y at the same pH and ionic strength have T_m values of 85 °C and 80 °C, respectively. This means that

- (A) the AT content of Y is higher than X
- (B) the GC content of Y is higher than X
- (C) the AT content is same in X and Y
- (D) the GC content of X is higher than Y

Q.21 Part of the overall flow in amino acid catabolism is shown in the figure. Identify X and Y



- (A) X: L-Glutamate; Y: α -Ketoglutarate
- (B) X: α -Ketoglutarate; Y: L-Glutamate
- (C) X: α -Ketoglutarate; Y: L-Glutamine
- (D) X: α -Ketoglutarate; Y: D-Glutamate

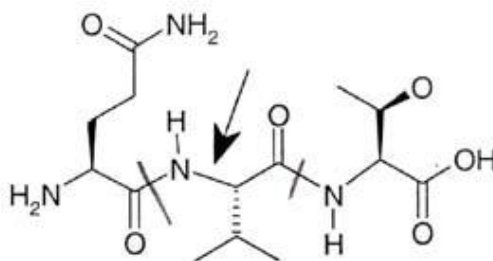
Q.22 Which one of the following statements refers to glycogen, and which one refers to cellulose?

- I. Branched molecule containing β -1,4-glycosidic bond
- II. Straight chain molecule containing β -1,4-glycosidic bond
- III. Branched molecule containing α -1,6-glycosidic bond
- IV. Straight chain molecule containing α -1,6-glycosidic bond

- (A) I = Glycogen; IV = Cellulose
- (B) II = Glycogen; III = Cellulose
- (C) III = Glycogen; II = Cellulose
- (D) IV = Glycogen; I = Cellulose

Common Data Questions

Common Data for Questions 23, 24:



- Q.23 The dihedral angle indicated by an arrow in the tripeptide structure corresponds to the
- (A) psi angle
 - (B) phi angle
 - (C) chi angle
 - (D) omega angle
- Q.24 The amino acid sequence of the above tripeptide is
- (A) Glutamine - valine - threonine
 - (B) Asparagine - valine - serine
 - (C) Glutamine - leucine - threonine
 - (D) Asparagine - valine - threonine

Linked Answer Questions: Q. 25 to Q. 28 carry two marks each.

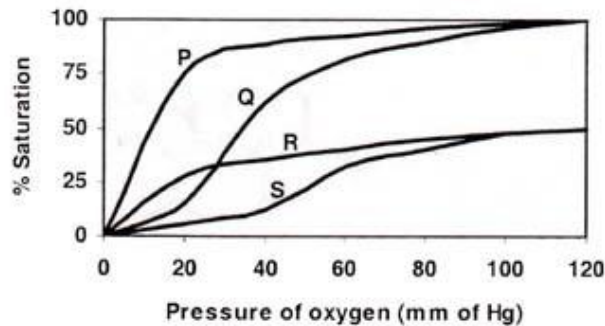
Statement for Linked Answer Questions 25 & 26:

Binding of glucagon to its receptor results in the generation of a specific second messenger.

- Q.25 Which of the following second messengers is generated in this case?
- (A) Calcium
 - (B) cGMP
 - (C) Phosphatidylinositol
 - (D) cAMP
- Q.26 Which of the following enzymes is activated by this second messenger?
- (A) Protein kinase A
 - (B) Protein kinase C
 - (C) Phospholipase C
 - (D) Protein phosphatase 2A

Statement for Linked Answer Questions 27 & 28

The figure shows the oxygen binding curves for hemoglobin (Hb) and myoglobin (Mb).



Q.27 Identify the correct curves for Hb and Mb

- (A) P:Mb; Q:Hb (B) Q:Mb; P:Hb
(C) R:Mb; Q:Hb (D) S:Mb; R:Hb

Q.28 Sick cell anemia arises due to the formation of a hydrophobic patch in one of the proteins shown in the above curves. This is due to the replacement of

- (A) Glu 6 by Val 6 in the β subunit of P
(B) Glu 6 by Val 6 in the β subunit of Q
(C) Glu 6 by Val 6 in the β subunit of R
(D) Glu 6 by Val 6 in the β subunit of S

END OF THE SECTION