

# **INTRODUCTION OF BIOCHEMISTRY**

## **Questions carry two marks:**

1. What are the most abundant biomolecules within cells?
2. Mention the abundant element present in the living organism.
3. Give the contribution/s to Biochemistry of the following eminent scientists.  
a) Wohler b) Miescher c) Buchner d) Pauling e) Sanger f) Watson and Crick g) Fischer  
h) Michaelis and Menten i) Embden, Meyerhoff and Parnas j) Krebs k) Khorana  
f) Avery, MacLeod and McCarty m) Subbarow n) Knoop.
4. "Water is the medium of life." Comment.
5. What is the significance of the following properties of water to living organisms:  
a) High specific heat b) High heat of vapouration c) High dielectric constant d) High tensile strength e) Maximum density at 4°C f) High melting and boiling points.
6. Mention the contribution of Dr. H. G. Khorana to the field of Biochemistry.
7. Mention the contribution of the scientist Knoop in the field of development of Biochemistry.
8. What was Fischer's contribution to Biochemistry?
9. Why is the mitochondrion known as the power house of the cell?

## **Questions carry four marks:**

1. Write a note on the elemental composition of living organisms.
  2. What are a) Major elements b) Minor elements and c) Trace elements, with reference to the composition of living systems. Give four examples of each.
  3. List any four unique properties of water pointing out the biological importance of each.
  4. What two basic properties of water give it its unique characteristics as the medium of life.
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# CARBOHYDRATES

## Questions carry two marks:

1. Write the synthesis of N-acetyl glycosamine and N- acetyl galactoseamine.
2. Write the structure of glucose-D-phosphate and fructose-1, 6-diphosphate. Mention their biological importance.
3. Write the structure of isomaltose, cellobiose and trehalose. How are isomaltose and cellobiose obtained?
4. Based on their functions, how are polysaccharides classified?
5. Name the structural polysaccharides and two storage polysaccharides.
6. Give the structure of fructose-6-phosphate, fructose-1,6-diphosphate , glucose-1-phosphate , ribose-5-phosphate and deoxyribose-5-phosphate.
7. Name the storage polysaccharide present in plant kingdom. Write the structure of disaccharide formed after the partial hydrolysis of this polysaccharide.
8. Write the name and structure of a biologically important sugar phosphate.
9. Write the structure of D-glucuronic acid. What is its importance in metabolism?
10. Name and write the Haworth structures of monosaccharides present in sucrose.
11. Write the structure of N-acetyl neuraminic acid. Mention its biological importance.

## Questions carry Four marks:

1. What are amino sugars? Give the synthesis of D-glycosamine and D-galactosamine. Mention their biological importance.
2. What are sugar acids? Give one example each of aldaric acids and aldouronic acids and aldonic acids. Mention biological importance of  $\alpha$ -D-glyconic and  $\alpha$ -D-glucuronic acids.
3. Name the disaccharides formed by the partial hydrolysis of
  - a. Amylose
  - b. amylopectine
  - c. glycogen
  - d. cellulose.
4. Name the storage polysaccharides present in plants and animals. What are the structural differences between them?
5. Write the partial structure of glycogen. How does it differ from amylopectine of starch in its structure?
6. What are the components of starch? Indicate the structural difference between them.
7. What are oligosaccharides? How a glycosidic bond is formed between the adjacent monosaccharides? What is necessary condition for a disaccharide to be a non-reducing unit?
8. Name and write the Haworth structures of disaccharides obtained by the partial hydrolysis of amylose and amylopectine.
9. Write the partial structure of chitin and inulin. Mention their biological importance.

## LIPIDS

### Questions carry two marks:

1. Give the structure of following: a) palmitic acid b) stearic acid c) oleic acid d) linoleic acid e) arachidonic acid.
2. Define saponification number and iodine number.
3. A fat has a high saponification number and low iodine number. What does this signify?
4. Give the structure of a) 3-Sn-phosphatidyl ethanol amine (cephalin) b) 3-Sn-phosphatidyl choline (lecithin) c) 3-Sn-phosphatidyl serine.
5. Write the structure of amino alcohol present in lecithin.
6. What is significance of saponification number?
7. What is significance of iodine number?
8. Why linoleic acid have a higher iodine number than oleic acid?
9. What are antioxidants?
10. Lipids are insoluble in water, yet their interaction with water is of critical importance biochemically. Comment.
11. Explain critical micellar concentration.
12. What are liposomes? Mention their applications.

### Questions carry Four marks:

1. How are lipids classified? Give one example under each class.
2. What are essential fatty acids? Write their structures.
3. Write a note on biological importance of triacetyl glycerol.
4. What is oxidative rancidity? Who is this prevented?
5. What is hydrolytic rancidity? How is this prevented?
6. Point out the biological importance of phospho glycerides.
7. With a neat illustration, give a description of the fluid mosaic model of membrane structure.
8. What is chemical composition of cell membrane? Write its function.
9. Write a note on monolayer and bilayer lipid.
10. Discuss the classification of lipoproteins.
11. Discuss the disorders and chemical significance of lipoproteins.
12. What are cholesterol? Discuss their disorders in the biological systems.
- 13.

## PROTEINS

### Questions carry two marks:

1. Explain the reactions of:
  - i. Sanger's reaction.
  - ii. Edman's reaction.
  - iii. Ninhydrin reaction.
2. What is a peptide bond? Explain with an example.

3. What is biuret reaction?
4. What are C and N terminals of a peptide?
5. Name and write the structure of an optically inactive amino acid.
6. Why are all the atoms in the peptide in one plane?
7. Write the name and structure of an amino acid present in protein which does not contain an amino group.
8. Describe a standard test for the deletion of peptide bond in proteins.
9. How does  $\alpha$ -amino acid reacts with
  - i. Ethanol
  - ii. Formaldehyde
  - iii. Carbon dioxide
10. Mention any two colour reactions of amino acids.
11. Mention any three non-protein amino acids and their importance.
12. Mention three biologically important peptides. Give its importance.

**Questions carry Four marks:**

1. How are amino acids classified on the basis of polarity of their side chain?
2. Define 'zwitter ion' with respect to amino acid. Write its structure and show how it can act as an acid and a base.
3. How are proteins classified on the basis of composition and function? Give an example of each class.
4. Define primary, secondary, tertiary and quaternary structures with reference to proteins.
5. Briefly explain  $\alpha$ -helix,  $\beta$ -sheet and triple helix. How are they stabilised? Give an example of a molecule in which these structures are seen.
6. Write a note on the factors stabilizing tertiary structure.
7. What is denaturing of protein? Mention the factors which cause it.
8. What are conjugated proteins? How are they classified? Give an example for each class.
9. Explain Aufinsen's experiment to show denaturation and renaturation of ribonuclease.

**Nucleic acid**

**Questions carry two marks:**

1. Write the structure of the following,
  - a) ATP b)GTP c)CTP d)UTP e)d ATP f)d GTP g)d CTP h)d TTP.
 2. Name the base present in RNA but not in DNA.
2. Write the partial structure of a nucleotide chain.
3. What is Chargaff's rule of base equivalence? Explain.
4. A and G composition (in mole per cent) of one of the strands of DNA double helix is A=27 and G=30. What would be the T and C contents of the complementary strand?
5. Which of the following are base pairs in DNA (T-C, A-T, T-G, T-A, A-C, G-C, G-A, G-T, C-T, C-T).

**Questions carry Four marks:**

1. What is the difference between nucleoside and nucleotide?
2. How do you account for the two strands of DNA to be a) Complementary b) Antiparallel?
3. Write the structural difference between DNA and RNA.
4. Name the different types of RNA. Mention their roles.
5. Give the salient features of Watson – Crick model of DNA.

**Bioenergetics and Biological oxidation**

**Questions carry two marks:**

1. Give various stages of energy transformation in living organisms.
2. Differentiate  $\Delta G^1$  and  $\Delta G^{01}$ .
3. Mention the biochemical standard state.
4. What is energy rich compound? Give an example other than ATP.
5. Define standard Red- Ox potential.
6. Mention the difference between positive and negative Red-Ox potential.
7. What is oxidative phosphorylation? Mention its salient features.
8. Explain the terms with an example oxidation phosphorylation and substrate level phosphorylation.
9. Define P : O ratio
10. Why NADH is capable of generating 3 ATP, while  $FADH_2$  is generates 2 ATP in the ETC.
11. What are exergonic and endergonic rations? Give an example each.

**Questions carry Four marks:**

1. What is energy coupling in living organisms? Give example.
2. Why is ATP a high energy compound?
3. Biological oxidation of a metabolite takes place in stages. Why?
4. Compare biological oxidation with combustion.
5. Explain the arrangement of electron carriers of the ETC.
6. What are mobile electron carriers? How are they arranged?
7. Explain NHI proteins and their role.
8. Explain the mechanism of oxidation phosphorylation taking chemiosmotic theory.
9. Illustrate diagrammatically the arrangement of the different electron carriers of the mitochondrial electron transport chain. Mention the sites of ATP synthesis.

## Enzymes

### Questions carry two marks:

1. What are enzymes?
2. What is an apoenzyme and holoenzyme?
3. How are enzymes classified?
4. What is an active site of an enzyme?
5. Illustrate the effect of the following on the rate of enzymatic reaction. a) Enzyme concentration, b) substrate concentration, c)  $p^H$  and d) temperature.
6. What is a zymogen?
7. Name an enzyme containing  $Mg^{2+}$ .
8. What are ribozymes?

### Questions carry Four marks:

1. Explain with examples any three classes of enzymes.
2. Explain the suitable examples of the different types of specificity exhibited by enzymes.
3. Write the Michaelis – Menten equation. Define the Michaelis – Menten constant and explain its significance.
4. Differentiate between competitive and non-competitive inhibitors.
5. Describe briefly Koshland's 'Induced fit' theory and Fischer's 'lock and key model of enzyme substrate interaction'.
6. What are allosteric enzymes? Give an example and mention its significance.

## Metabolism

### Questions carry two marks:

1. Describe the role of carnitine in the metabolism of fatty acid.
2. Describe the transamination with an example.
3. TCA cycle is common metabolic pathway. Explain.
4. How is pyruvate converted to acetyl coenzyme A?
5. Name the products of anaerobic glycolysis
6. Name the end product of the nitrogen metabolism in man.
7. Name the electron carriers that participate in the citric acid cycle.
8. Represent by equation, the transportation of fatty acyl CoA from cytosol to matrix of mitochondria.
9. Write the equation of the first substrate level phosphorylation reaction involved in the glycolytic pathway.
10. Mention the changes which lipids undergo at the different stages of metabolism.

11. Mention the chemical present in intermembranous space of mitochondria which transport activated fatty acyl CoA into the matrix.
12. How does pyruvate formed during glycolysis enter the TCA cycle?
13. Describe with example – deamination.
14. What is P.D. complex?
15. Write the extra mitochondrial reaction of  $\beta$  – oxidation of fatty acid.
16. Discuss with example – decarboxylation of an amino acid. What is its importance?
17. Discuss the energetics, when one molecules of glucose if completely oxidised to  $\text{CO}_2$  and  $\text{H}_2\text{O}$ .
18. What is the effect of the presence of oxygen in glycolytic pathway?
19. Name the end product of anaerobic glycolysis in muscle cells. Write the reaction where it is formed.
20. Write the reaction of urea cycle where urea is formed. what is the significance of this cycle?

### **Questions carry Four marks:**

1. What is glycolysis? Give an oxidation reaction of glycolysis
2. Calculate the no. of ATP molecules produced by the complete oxidation of palmitic acid.
3. Write the equation for the sequence of reaction of the beta oxidation ( $\beta$ -oxidation) of an activated fatty acid molecule.
4. How are amino acid decarboxylated? Name the products of decarboxylation of histidine and glutamic acid.
5. How the pyruvic acid converted in yeast? Give equation.
6. Calculate the no. molecules of ATP liberate when activated lauric acid ( $\text{C}_{12}$ ) is completely oxidised to  $\text{CO}_2$  and  $\text{H}_2\text{O}$ .
7. Sequentially represent the reaction involved with enzymes and coenzymes of the urea cycle during detoxification of ammonia in human beings.
8. Mention any three oxidation reaction involved in the aerobic oxidation of glucose to  $\text{CO}_2$  and  $\text{H}_2\text{O}$ .
9. Draw a diagram showing the reaction of Krebs cycle. Discuss its important.
10. How is  $\beta$  – oxidation of fatty acid linked metabolically with Krebs cycle?
11. Give the structure of the keto acid that is formed by transamination of – (i) alanine and (ii) glutamate.
12. Discuss the energetic of glycolysis.
13. How is ATP produced in citric acid cycle? Write the reaction leading to the production of ATP.
14. Explain the reaction of  $\beta$  – oxidation of fatty acid taking place in cytosol.
15. Describe two oxidation reaction of TCA cycle.
16. Describe two oxidative – decarboxylation reaction of TCA cycle.
17. Write the reaction of TCA cycle catalysed by i) citratesynthesis ii) malatedehydrogenase ii)  $\alpha$  – ketoglutarate – dehydrogenase complex.
18. Describe any two reaction of energy investment of phase of glycolysis.
19. Define following terms i) metabolism ii) catabolism iii) anabolism.
20. Discuss the energetics of glycolysis.
21. Discuss the energetics of TCA cycle. (1+3+3)
22. What is gluconeogenesis? Explain the reaction which is not formed in glucolysis. (2+3)
23. Gluconeogenesis is not reversal of glycolysis. Justify the statement. (4+0)
24. What is gluconeogenesis? Explain the reaction involved in it.

## Molecular biology

### Questions carry two marks:

1. What is the central dogma of molecular biology?
2. What are Okazaki fragments?
3. How many 3' – 5' phosphodiester linkages would be present in a linear polynucleotide containing 20 nucleotide sequences?
4. If a DNA strand contains the base sequence AATCGTAGGC. What will be the base sequence transcribed on to the mRNA?
5. Name the enzyme catalysing the synthesis of DNA and RNA.
6. Explain the terms 'leading strand' and 'lagging strand'.
7. What is genetic code? How many nucleotides are involved in a single codon?
8. Genetic code is universal. Explain.
9. What are codons? What is the relation between codon and anticodon?
10. Name the codons which specify initiation and termination of the synthesis of a polypeptide chain.
11. What is antisense strand?
12. Explain the terms initiation, elongation and termination of the protein synthesis. What are polysomes?
13. Why are nucleic acids called informational molecules?
14. List the proteins required for DNA replication.
15. What is replication fork?
16. Write the note on E.coli RNA polymerase.
17. What are promoters?
18. What is an operon?
19. What is meant by negative control?
20. How does rifampin inhibit transcription?

### Questions carry Four marks:

1. Explain the terms replication, transcription and translation.
2. Outline the semiconservative mode of replication of DNA.
3. What are the functions of mRNA, tRNA and rRNA?
4. What is DNA finger printing? Mention its applications.
5. Explain nucleic acid – protein interaction in chromatin and viral nuclear capsid.
6. List the models of DNA replication.
7. Briefly describe the experimental evidence to prove the semiconservative mode of DNA replication.
8. Write a note on initiation of translation.
9. Describe the reverse transcription of HIV – RNA.
10. What are constitutive and induced enzymes?
11. Describe the organization of Lac operon of E.coli.
12. What are structural and regulatory genes?
13. Explain the regulation of Lac operon of E.coli
14. List the antibiotics that inhibit translation. How do they inhibit?

## BIOCHEMICAL TECHNIQUES

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**Questions carry two marks:**

1. What is chromatography?
2. What is electrophoresis?
3. What is adsorption chromatography?
4. What is Ion exchange chromatography?
5. Explain the general principle of partition chromatography?
6. Explain the general principle of Ion exchange chromatography?
7. Explain briefly the principle of GLC.

**Questions carry four marks:**

1. What is TLC? How is this technique useful in the identification of the given amino-acids?
  2. Explain how the given amino-acid is identified by ascending Chromatography.
  3. Explain how the given amino-acid is identified by descending Chromatography.
  4. Explain how this technique is used in the separation of biochemical compounds.
  5. Give the general principle and applications of TLC.
  6. Explain how a mixture of amino-acid can be separated by thin layer chromatography?
  7. Name the chromatography method that can be adopted for the separation of mixture of volatile materials.
  8. Discuss the principle and applications of paper chromatography.
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