

**M.Sc I. Biochemistry Semester I Paper I Biomolecules
Question Bank**

Unit I: Proteins

Q.1) Choose the correct alternative

(each carry 1 marks)

- In proteins, amino acids are joined to each other by
a. Hydrogen bond b. **Peptide Bond** c. Ionic bond d. Glycosidic bond
- The primary structure of protein represents
a. **Linear sequence of amino acids** b. 3-D structure of protein
c. Helical structure of protein d. Sheets of protein
- Peptide bond is
a. **Rigid with partial double bond character** b. Ionic
c. Hydrogen d. All of the above
- The first protein sequenced by Sanger is
a. Hemoglobin b. Myoglobin c. **Insulin** d. Myosin
- A tripeptide has
a. 3 peptide bonds & 2 amino acids b. 2 peptide bonds & 1 amino acid
c. **2 peptide bonds & 3 amino acids** d. 1 peptide bond & 2 amino acids
- Fibrous proteins consist of polypeptide chains arranged in
a. α -helix b. **β -pleated sheets** c. β -helix d. None of these
- Tertiary structure is maintained by
a. Peptide bond b. Hydrogen bond c. Disulphide bond d. **All of these**
- Hemoglobin is active in its
a. Primary conformation b. Secondary conformation
c. Tertiary conformation d. Quaternary conformation
- Disulphide bonds are between
a. **Cysteine residues that are close together** b. Glycine residues that are close together
c. Proline residues that are close together d. Histidine residues that are close together
- The 3D structure of protein can be determined by
a. Nuclear magnetic resonance b. X-ray crystallography c. Spectroscopy d. **both a and b**
- The span of rotation of dihedral angles is
a. 0° to 90° b. 0° to -180° c. 0° to -180° d. **-180° to 180°**

Q.2) Fill in the blanks

(each carry 1 marks)

- Glycine is the only optically inactive amino acid.
- PAGE is an electrophoretic technique used to separate proteins.
- The C-C bond in amino acids is known as psi.
- The N-C bond in amino acids is known as phi.
- Ramchandran plot is plotted in four number of quadrants.
- Proteins are polymers of amino acids.
- Cysteine is a sulphur containing amino acid.
- The initiation codon in prokaryotes (AUG) codes for N-formyl methionine amino acid.
- A short chain of typically 2 to 50 amino acids is known as peptide.
- Keratin is a fibrous protein found in hair and nails.

Q.3) Answer in one sentence

(each carry 1 marks)

1. Define proteins.

Ans: Nitrogenous organic compounds which are composed of one or more long chains of amino acids.

2. Define amino acids.

Ans: Amino acids are simple organic compounds containing carboxyl (-COOH) and an amino (-NH₂) group.

3. State the two amino acids containing hydroxyl (-OH) group.

Ans: Serine and Threonine

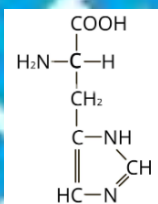
4. State any two derived amino acids.

Ans: Selenocysteine, hydroxyproline, hydroxylysine

5. State any two aromatic amino acids.

Ans: Histidine, Tryptophan

6. Draw the structure of Histidine amino acid.



Ans:

7. Define isoelectric pH of proteins.

Ans: Isoelectric pH is defined as the pH at which the net charge on the molecule is zero.

8. State any 2 methods of protein separation.

Ans: Polyacrylamide gel electrophoresis, Column chromatography

9. Define essential amino acids.

Ans: Essential amino acids are the amino acids that cannot be synthesized fast in the body, therefore, should be taken from the diet.

10. Define dihedral angles.

Ans: The clockwise angle intersecting between planes or half-planes is a dihedral angle.

Q.4) Long answer questions

(each carry 8 marks)

1. Describe the various conformations in proteins.

2. Describe the processes of protein sequencing.

3. Explain Ramchandran plot with illustration.

4. Give the different ways of classification of proteins.

5. Describe different methods of isolation and separation of proteins.

6. Explain the geometry of amino acid chain with illustration.

7. State the different standard amino acids.

8. Illustrate the structures of alpha helix and beta pleated sheets and state its importance in protein function.

9. Explain Globular and fibrous proteins and state their examples.

10. Describe the role of various bonds in protein structure and folding.

Q.5) Short answer questions

(each carry 4 marks)

1. Describe the primary structure of proteins.

2. Describe the secondary structure of proteins.
3. Describe the tertiary structure of proteins.
4. Describe the quaternary structure of proteins.
5. Describe the concept of covalent and weak bonds in proteins.
6. Explain the concept of denaturation in proteins.
7. State the differences between denaturation and renaturation.
8. Describe various techniques of protein isolation.
9. Describe various techniques of protein separation.
10. Draw the structure of insulin.



Ans: 1. Carbohydrates such as glucose provide energy. 2. Provide dietary fiber to the body. 3. Help in Fatty acid metabolism. 4. Act as storage molecules

4. State any two importance of glycolipids.

Ans: 1. Maintain the stability of cell membrane. 2. Facilitate cell recognition. 3. Cell-cell adherence. 4. Act as receptors

5. State any two important lectins.

Ans: Ricin, Abrin, Favin

6. State the two classes of glycoproteins.

Ans: N-linked, O-linked

7. Give two examples of homopolysaccharides.

Ans: Starch, Glycogen, Cellulose

8. State the two components of starch.

Ans: Amylose, Amylopectin

9. State any two uses of lectins in biology

Ans: 1. Protective functions in plants. 2. Immune response against pathogens. 3. Cell-cell interactions

10. State the two classes of glycolipids.

Ans: 1. Glycosphingolipids. 2. Glycoglycerolipids

Q.4) Long answer questions

(each carry 8 marks)

1. Differentiate between glycogen and starch and draw their structures.
2. Describe the importance of glycoproteins and glycolipids in biological systems.
3. Give the different classifications of carbohydrates.
4. Describe isomerism in carbohydrates.
5. Describe Blood group sugar compounds.
6. Describe the characteristics and importance of lectins.
7. Describe the structure and importance of glycogen.
8. Describe the structure and importance of starch.

Q.5) Short answer questions

(each carry 4 marks)

1. Explain the importance of glycoproteins in biological systems.
2. Explain the importance of glycolipids in biological systems.
3. Describe the structure of starch.
4. Describe the functions of glycogen in animals.
5. Describe optical isomerism in carbohydrates.
6. Explain the concept of Chiral carbon using an example of carbohydrates.
7. Describe the types of lectins.
8. Describe the importance of starch in biology.
9. Explain the biological importance of carbohydrates.
10. Describe the dietary importance of carbohydrates in humans.

Ans: 1. Provide energy
impulses

2. Regulate hormones

3. Transmit nerve

2. State any two fatty acids.

Ans: Palmitic acid, Oleic acid, Steric acid

3. State any two important lipids in humans.

Ans: Cholesterol, Triglyceride

4. State the chemical formula of cholesterol.

Ans: The chemical formula of cholesterol $C_{27}H_{46}O$.

5. State any two steroid hormones in humans.

Ans: Estrogen, Progesterone, Testosterone

6. State any two uses of estrogen in human body.

Ans: Regulation of female reproductive tract, development of secondary sexual characters.

7. Define fatty acids.

Ans: Fatty acid is a carboxylic acid consisting of a hydrocarbon chain and a terminal carboxyl group, especially any of those occurring as esters in fats and oils.

8. State the major classes of lipids.

Ans: Simple lipids, Compound lipids, Derived lipids.

9. Give any two examples of steroids.

Ans: Cholesterol, estrogen

10. State the types of fatty acids.

Ans: Saturated fatty acids and unsaturated fatty acids.

Q.4) Long answer questions

(each carry 8 marks)

1. Give the classification of lipids with examples.
2. Explain the structure and functions of cholesterol in body.
3. Explain the chemistry of bile acids and bile salts.
4. Derive the structure of Testosterone from cholesterol.
5. Derive the structure of Estrogen from cholesterol.
6. Derive the structure of Progesterone from cholesterol.
7. Derive the structure of Vitamin D from cholesterol.
8. Explain the structure and functions of Testosterone in the body.
9. Explain the structure and functions of Estrogen in the body.
10. Explain the structure and functions of Progesterone in the body.

Q.5) Short answer questions

(each carry 4 marks)

1. Explain the importance of Lipids in biology.
2. Explain the structure of Cholesterol.
3. Explain the functions of estrogen in the body.
4. Explain the role of progesterone in the body.
5. Discuss the occurrence of lipids in living system.
6. Discuss the role of vitamin D in the body.
7. Draw the structure of Vitamin D.
8. Draw the structure of estrogen.
9. Draw the structure of progesterone.
10. Explain the role of cholesterol in the body.

Unit IV: Nucleic Acids

Q.1) Choose the correct alternative

(each carry 1 mark)

1. According to Chargaff rule, the ratio of Purines to pyrimidines is
a. 0 b. **1** c. 2 d. -2
2. Which of the following is not a pyrimidine?
a. Cytosine b. **Adenine** c. Thymine d. m-diazine
3. Which of the following contains an amino group at carbon 4?
a. **Cytosine** b. Thymine c. Uracil d. None of these
4. A nucleotide consists of
a. **Sugar, Base, Phosphate** b. Sugar, Phosphate c. Paired bases d. Sugar, Base, 3 Phosphate
5. Which of the following can be used to isolate DNA in lab?
a. Cold water b. Cold ethanol c. Cold Isopropanol d. **Both b & c**
6. A ddNTP lacks a hydroxyl group on the following carbon of sugar
a. 5' b. 3' c. 1' d. 6'
7. Which of the following is a chain termination method for DNA sequencing?
a. DNA fingerprinting b. Electrophoresis c. **Sanger sequencing** d. RAPD
8. Sanger sequencing cannot be used for sequencing of the following
a. DNA b. **RNA** c. Both a & b d. None of these
9. The deoxy ribose in DNA lacks a hydroxyl group on the following carbon
a. **2'** b. 3' c. 1' d. 6'
10. Clover leaf model is accepted for the following
a. DNA b. mRNA c. **tRNA** d. rDNA

Q. 2) Fill in the blanks

(each carry 1 mark)

1. The sugar present in DNA is deoxyribose.
2. 6-amino purine is also known as adenine.
3. The sugar present in RNA is ribose.
4. The Watson & Crick model explains DNA as a double stranded molecule.
5. According to Watson & Crick model, purines pair with Pyrimidines.
6. DNA molecule carries net negative charge.
7. DNA sequencing is a method used to determine the sequence of DNA.
8. Sanger sequencing was developed by Fred Sanger.
9. An oligonucleotide that binds to template DNA and acts as starter is primer.
10. ddGTP stands for dideoxy guanine triphosphate.

Q.3) Answer in one sentence

(each carry 1 mark)

1. Define Nucleic acids

Ans: Nucleic acids are biopolymers of high molecular weight with mononucleotides as their repeating units.

2. Define Nucleotide

Ans: Nucleotides are monomers of Nucleic acids made up of Phosphate, sugar and nitrogenous bases.

3. State the two types of nitrogenous bases found in nucleic acids.

Ans: Two types of nitrogenous bases found in nucleic acids are purines and pyrimidines.

4. State the two important nucleic acids.

Ans: The two important nucleic acids are Deoxyribose nucleic acid and Ribonucleic acid.

5. State any two important functions of RNA.

Ans: 1. mRNA carries the genetic code from DNA in form of codons. 2. tRNA carries amino acids to the site of translation.

6. State any two important functions of DNA.

Ans: 1. DNA carry and transmit hereditary information. 2. DNA is essential in synthesis of proteins.

7. State two methods used for the separation of nucleic acids.

Ans: Gel electrophoresis and high-performance liquid chromatography

8. State two methods used for nucleic acid sequencing.

Ans: Sanger sequencing and Maxam-Gilbert sequencing

9. State any two forms of DNA.

Ans: A-form, Z-form

10. State the central dogma of molecular biology.

Ans: DNA replicates to form DNA, DNA transcribes to make RNA, and RNA translates to make protein.

Q.4) Long answer questions

(each carry 8 mark)

1. Describe the importance of nucleic acids in biology.
2. Describe the importance of DNA as genetic material.
3. Draw the general structure of Purine and Pyrimidine bases.
4. Draw and explain the structures of ATP and GTP.
5. Explain Watson and Crick model of DNA.
6. Describe A and Z forms of DNA.
7. Explain the structure of tRNA.
8. Explain the methods of Nucleic acid sequencing.
9. Explain the methods of separation of nucleic acids.
10. Draw the general structure of nucleotide and explain complementary base pairing in nucleic acids.

Q.5) Short answer questions

(each carry 4 marks)

1. Give the experimental evidence that nucleic acids act as the genetic material.
2. Describe the Watson & Crick model of DNA.
3. Draw the structures of Adenine and Guanine.
4. Draw the structures of Cytosine and Thymine.
5. Describe the structure of RNA.
6. Explain Sanger sequencing.
7. Explain the use of electrophoresis in separation of DNA fragments.
8. Explain the method of isolation of DNA from bacteria.
9. Explain Maxam-Gilbert sequencing.
10. State the differences between DNA and RNA.

Unit V-Porphyrins

Q1. Choose the correct alternative

(each carry 1 mark)

- Example of natural porphyrins includes
 - Haemoglobin
 - Myoglobin
 - Cytochrome
 - All of the above.**
- The most abundant porphyrin in nature is
 - Haemoglobin
 - Chlorophyll
 - Myoglobin
 - Both a and b.**
- The side chains of the porphyrin are
 - Methyl & Vinyl
 - Propionyl & Acetyl
 - Ethene & acetyl
 - Both a and b.**
- The metal ion in the porphyrin ring of the haemoglobin in human is
 - Iron**
 - Magnesium
 - Nickel
 - Cobalt
- The metal ion in the porphyrin ring of the chlorophyll pigments in plants is
 - Iron
 - Magnesium**
 - Nickel
 - Cobalt
- In females, the normal concentration of hemoglobin is
 - 7-10g/dl
 - 15-20g/dl
 - 13-15g/dl**
 - 20-25g/dl
- The protoporphyrin among the following is
 - Chlorophyll A
 - Hemoglobin**
 - Chlorophyll B
 - All of these
- The metalloporphyrin among the following is/are
 - Chlorophyll
 - Hemoglobin
 - Vitamin B12
 - All of these**
- The chains present in hemoglobin are
 - Alpha chains
 - Beta chains
 - Sulphur chains
 - Both a & b**
- The following is/are by products of heme degradation
 - Biliverdin
 - Bilirubin
 - Bile Acids
 - Both a & b**

Q.2) Fill in the blanks

(each carry 1 mark)

- Chlorophyll contains Mg²⁺ as the central metal ion.
- Hemoglobin contains Fe²⁺ as the central metal ion.
- One hemoglobin molecule can carry 4 number of O₂.
- The heme in hemoglobin is the porphyrin part.
- Hemoglobin contains two types of amino acid chains.
- Alpha and beta chains are found in hemoglobin porphyrin.
- Hemoglobin is present on the Red blood cells of human body.
- Phytol tail is present in chlorophyll porphyrin.
- Vitamin B12 is also known as Cyanocobalamin.
- Porphin is made up of four pyrrole rings.

Q.3) Answer in one sentence

(each carry 1 mark)

1. Define porphyrins.

Ans: Porphyrins are defined as biologically active compounds with a macrocyclic structure that consists essentially of a central metal atom and four pyrrole rings joined by four =CH- groups.

2. State any two important porphyrins in biology.

Ans: Hemoglobin and Chlorophyll

3.State any two functions of hemoglobin in the body.

Ans: 1. Transports O₂ in the body. 2. Modulates RBC metabolism. 3. Carries out redox reactions.

4. State the functions of chlorophyll in plants.

Ans: Chlorophyll is the major site of photosynthesis in plants. It absorbs CO₂ from atmosphere and water and minerals from soil.

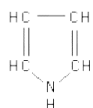
5. Name the porphyrin present in ETC.

Ans: The porphyrin present in ETC is Cytochrome C.

6. State the important functions of porphyrins in biology.

Ans: 1. Oxygen transport 2. Carry out redox reactions

7. Draw the structure of pyrrole ring.



Pyrrole

Abbreviated version of pyrrole

Ans: 8. State the number and names of the chains present in hemoglobin molecule.

Ans: There are 2 alpha and 2 beta chains present in a hemoglobin molecule

9.State any two metalloporphyrins.

Ans: Hemoglobin and Chlorophyll

10. State the names of any two products formed by heme degradation.

Ans: Bilirubin, Biliverdin

Q.4) Long answer questions

(each carry 8 marks)

1. Explain the structure of hemoglobin.
2. Explain the structure of chlorophyll.
3. Explain the structure of Porphin.
4. Define porphyrins and describe the functions of various porphyrins in biology.

Q.5) Short answer questions

(each carry 4 marks)

1. Explain the importance of porphyrins in biology.
2. Describe the classification of porphyrins.
3. Describe the structure of pyrrole.
4. Explain the functions of hemoglobin.
5. Explain the functions of chlorophyll.

Syllabus

Unit I: Protein Classification	Isolation and Separation, assay methods Structures of peptide bond, Ramachandran Plot, Modern approach to peptide synthesis, conformation of proteins, concept of covalent and weak bonds, primary, secondary tertiary and quaternary structure. Denaturation and renaturation of proteins, protein sequencing.	12 periods
Unit II: Carbohydrates	Importance glycoproteins and glycolipids, Blood group sugar compounds, Lectins - specificity, characteristics and uses, Structure of glycogen and starch.	12 periods
Unit III: Lipids	Occurrence, structure of cholesterol (derivation excluding synthesis), Chemistry of bile acids, bile salts, structural derivation of certain steroidal compounds such as testosterone, progesterone, estrogen and vitamin D.	12 periods
Unit IV: Nucleic acids	Classification, isolation, separation assay methods, structure of DNA, RNA and Nucleic acid sequencing	12 periods
Unit V: Porphyrins	Importance of porphyrins in biology, classification, structure of hemoglobin, chlorophyll and porphyrins	12 periods

