④   Your Roll No. 2022

Sr. No. of Question Paper : 1121   A

Unique Paper Code   : 32491201

Name of the Paper   : Proteins

Name of the Course   : **B.Sc. (H) Biochemistry**

Semester   : II

Duration : 3 Hours   Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. There are **8** questions.

3. Attempt any **five** questions. **All** questions carry equal marks.

4. Question no. **1** is compulsory.

1. (a) Justify the following statements (any four) :

    (i) Amino acids are zwitter ions

    (ii) Proteins show absorption of ultraviolet light

    (iii) Uncommon amino acids have important functions to perform

P.T.O.

(iv) Synthetic peptides are biologically active

(v) Peptide bond is rigid

(vi) Protein folding is not a random process

(b) The approximate molecular weight of a protein is 77 kDa (77000 Daltons). Determine the total number of amino acid residues present in a protein.

OR

Give the principle of Ion Exchange Chromatography.

(12,3)

2. (a) Write all the steps involved in the synthesis of a peptide Lys-Arg through Solid Phase Peptide Systhesis.

OR

Give the detail account of various covalent and non-covalent bonds stabilising protein three-dimensional structure.

(b) You are being provided with a polypeptide chain of 100 amino acids with intra-disulphide bonds. Design a method to determine the sequence of a polypeptide chain (hint: you are required to mention

the steps to linearize the polypeptide chain, to cleave it into smaller peptides, determination of N-terminal sequence etc.)

(c) Differentiate by giving suitable examples between conjugated proteins and multimeric proteins.

(5,7,3)

3. (a) What is Ramachandran plot? Discuss its application.

OR

A specific protein has 18 amino acid long alpha-helix. Answer the following with respect to this protein :

(i) How many full turns are in this helix

(ii) What is the length of the alpha-helix (Angstrom) in the direction of helix axis?

(b) Justify the following statements (any four) :

(i) Negatively charged amino acids are often found near amino terminus of the helical segment.

P.T.O.

(ii) Waving of hair is a biochemical process

(iii) Sailors are advised to eat fresh fruits and vegetables

(iv) β-pleated structures are stabilized by inter-chain disulphide bonds

(v) Membrane proteins are difficult to solubulise   (5,10)

4.   (a) Myoglobin and hemoglobin, have similar structures, but perform very different roles. Explain with the help of the graphs.

    (b) What is the underlying cause of sickle cell anemia? Explain why sickle cell anemia, have an advantage when residing in regions endemic for malaria.

    (c) Hemoglobin protein is electrophoresed using SDS-PAGE. How many bands do you expect to observe? Justify your answer.

OR

Distinguish between Tertiary and Quaternary structure of proteins with an example.

      (6,6,3)

1121

5. (a) Discuss the principle and applications of Size Exclusion Chromatography.

OR

What do you understand by the FASTA format? Explain the purpose of visualization softwares. Name any three.

(b) Explain the following (any four) :

    (i) Fractionation range

    (ii) Sedimentation coefficient

    (iii) Extinction coefficient

    (iv) Void volume

    (v) Exclusion limit   (7,8)

6. (a) Explain the underlying concept of Isoelectric Focussing. Discuss its applications.

OR

Give the principle of separation of proteins using 2-D Gel Electrophoresis. Discuss its applications.

(b) 2, 3-BPG levels increase as an adaptation to high altitude acclimatization. Explain the mechanism.

P.T.O.

(c) Give the underlying principle of HPLC and why it is a preferred method for the estimation of pharmaceutical and biological samples.   (6,4,5)

7. (a) Differentiate between (any three) :

      (i) Intergral and membrane associated proteins

      (ii) Protein Sequence and structure databases

      (iii) Keratin and Collagen

      (iv) Salt fractionation and solvent fractionation

(b) Give the principle and applications of affinity chromatography with examples.   (9,6)

8. (a) Predict the fragments that will be generated from the treatment of the following peptide with (a) Trypsin (b) Chymotrypsin and (c) CNBr

Gly-Ala-Trp-Arg-Asp-Ala-Met-Lys-Glu-Phe-Gly-Gln

OR

Proteins have diverse role to play. Comment.

(b) Write a short note on Hydropathy plot.

(c) Explain the secondary structures commonly seen in proteins.   (3,5,7)

(100)

[This question paper contains 6 printed pages.]

Sr. No. of Question Paper : 1331   A

Unique Paper Code   : 32491202

Name of the Paper   : Enzymes

Name of the Course   : B.Sc. (H) Biochemistry

Semester   : II

Duration : 3 Hours   Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. Attempt **five** questions in all, including Question No. **1** which is compulsory.

1. (a) Explain the following (**any five**) :

   (i) Activity versus pH graph is a bell shaped curve

   (ii) Asparatate transcarbamylase (ATCase) is regulated by allosteric modulators.

   (iii) Taq polymerase is used in research.

P.T.O.

(iv) Effect of temperature on the activity of an enzyme

(v) Hexokinase and glucokinase are isoenzymes.

(vi) Pyridoxal phosphate is the most versatile coenzyme.

(vii) Lysozyme stains its substrate during its catalysis.

(viii) Penicillin is used as antibiotic.   (2×5)

(b) Give the contributions of the following scientists **(any five)** :

(i) James Sumner

(ii) Frederick W. Kuhne

(iii) J.B.S Haldane

(iv) Louis Pasteur

(v) J.B.S Haldane

(vi) Emil Fischer   (1×5)

2. (a) Giving an example, explain how are enzymes regulated by feedback inhibition?

(b) How are enzymes useful :

    (i) in Therapy

    (ii) as Reagents

(c) What are transition state analogs, write application of them by giving one example. (4,6,5)

3. (a) Derive Michaelis Menten equation and explain the significance of Km and Vmax.

(b) What is the ratio of the $[S]$ to K_M when the velocity of an enzyme catalyzed reaction is 80% of its V_{max}.

(c) What are bisubstrate reactions? Explain single and double displacement reactions with suitable examples. (7,2,6)

4. (a) Mention the importance of EC and discuss the IUBMB classification of enzymes with the type of reaction catalyzed (one example of each class).

P.T.O.

(b) Write name of the co-enzymes that assist following enzymes, give their structure, reaction catalyzed and also write their vitamin precursor, **(any four)** :

      (i) Succinate dehydrogenase

      (ii) Dihydrofolate reductase

      (iii) Pyruvate carboxylase

      (iv) Transaminase

      (v) Lactate dehydrogenase

      (vi) Transketolase   (7,8)

5.   Differentiate between **(any five)** :

      (i) Proteolytic cleavage and reversible covalent modification

      (ii) Multienzyme complex and multifunctional enzyme

      (iii) Active site and regulatory site

      (iv) Holoenzyme and apoenzyme

(v). Metal ion catalysis and acid base catalysis

(vi) Substrate inhibition and Product inhibition

(vii) Collision theory and transition state theory

(3×5)

6. (a) What are constituent amino acids of the catalytic triad of Chymotrypsin? Explain its catalytic mechanism.

(b) What are mechanism-based inhibitors? Explain by writing any two examples.

$(8,7)$

7. (a) Differentiate between competitive, uncompetitive and mixed inhibition on the basis of enzyme kinetics.

(b) What are metalloenzymes and metal activated enzymes? Explain the catalytic role of each with suitable examples.

$(9,6)$

8. Write a short note on :

(i) Immobilized enzymes

P.T.O.

(ii) Isoenzymes

(iii) Induced fit hypothesis

(iv) Enzyme Assays (4,4,4,3)

⑥ Your Roll No. 2022

Sr. No. of Question Paper : 745   **B**

Unique Paper Code   : 32491202

Name of the Paper   : Enzymes

Name of the Course   : **B.Sc. (Hons.) Biochemistry**

Semester   : II

Duration : 3 Hours   Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. There are **8** questions.

3. Attempt any **5** questions.

4. Question no. **1** is compulsory.

1. (a) State whether true or false with justification (**Any five**) :

 (i) Disopropyl flurophosphate (DIFP) reacts with serine present at the active site of the enzyme and inactivates it.

P.T.O.

(ii) Histidine is a particularly versatile amino acid in enzyme reactions.

(iii) Allosteric enzymes follow Michealis-Menten kinetics.

(iv) Substrate inhibition is encountered at low substrate concentration.

(v) Enzymes with high K_m have more affinity for the substrate.

(vi) Hexokinase and Glucokinase are isozymes.

(vii) Reversible covalent modification occurs once in the lifetime of an enzyme.

(b) Give one example of each :

(i) Metalloenzyme

(ii) Oxidoreductase

(iii) Diagnostic enzyme

(iv) PLP-dependent enzyme

(v) Lyase   (10,5)

2. Differentiate between the following :

   (i) Random and ordered single displacement reactions.

   (ii) Competitive and uncompetitive inhibition.

   (iii) Lock and key and induced fit hypothesis.

   (iv) Acid-base and covalent catalysis.

   (v) Prosthetic group and holoenzyme.

                               (3,3,3,3,3)

3. (a) What are the important catalytic residues of Lysozyme? Explain its mechanism of action.

   (b) Define specific activity of an enzyme. What is the relation between specific activity and the purity of enzyme?

   (c) With an example explain a continuous enzyme assay.   (2.5+5,4,3.5)

4. (a) What are immobilized enzymes? Explain any two methods of immobilization. Give any two uses of these enzymes in biotechnology.

(b) Explain Eadie-Hofstee and Hanes plot.

(c) Explain why: Isozyme LDH-1 (H4) is designed to oxidize lactate to pyruvate while LDH-5 (M4) is optimized to operate in reverse direction.

(2+4+2,4.5,2.5)

5. (a) How are zymogens activated? Give one example.

(b) Mention any other two ways of enzyme regulation.

(c) Derive Michealis Menten equation for a monosubstrate reaction. Give the significance of K_m. (4,4,7)

6. (a) How are enzymes classified? Give one example of each class.

(b) Give an example of enzyme and the reaction that requires the following coenzyme :

(i) Biotin

(ii) Coenzyme A

(iii) NAD^+

(c) Mention any four features of an enzyme catalyzed reaction.   (5+3,3,4)

7.   (a) Explain why :

     (i) Electronic complementarity and geometric complementarity are important for enzyme-substrate binding.

     (ii) Chymotrypsin follows a ping pong mechanism.

     (iii) Enzymes are large molecules with active sites almost located in clefts and depressions rather than on protrusions.

     (iv) Taq polymerase is used in research.

   (b) What are mechanism-based inhibitors? Explain by writing any two examples.   (2+3+2+2,6)

8.   Write short notes on :

     (i) Dependence of enzyme activity on pH and temperature

(ii) Enzymes in therapy

(iii) Penicillin as antibiotic

(iv) Role of HRP and ALP in ELISA   (4,3,4,4)