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5981

Your Roll No.

B.Sc. (Hons.) Bio-Chemistry / III Sem. B

Paper – BCHT-304 : Proteins and Enzymes

Time : 3 hours

Maximum Marks : 75

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

*Answer five questions in all, including
Q. No. 1, which is compulsory.*

1. (a) State whether each of the following statements is True or False with 2-3 lines of justification.
 - (i) All holoenzymes have covalently linked prosthetic groups.
 - (ii) Fibrous proteins predominantly consist of one type of secondary structure.
 - (iii) Enzymes can be relieved of suicide inhibition by dialysis.
 - (iv) Activity and specific activity are essentially the same.
 - (v) The Hill coefficient of Hb binding to O_2 is 1.

P.T.O.

- (vi) Carboxypeptidase A is an excellent choice for protein sequencing from C-terminus.
 - (vii) V_{\max} is V_0 under saturating concentration of substrate.
 - (viii) ATCase has the regulatory and catalytic sites on the same polypeptide.
 - (ix) Sickle cell anaemia is caused due to misfolding of the subunits.
 - (x) Steady state conditions envisage that product is formed at a steady rate. $(1 \times 10 = 10)$
- (b) Name a protein in each category (i) metalloprotein (ii) glycoprotein (iii) fibrous protein (iv) transporter (v) lipoprotein. $(\frac{1}{2} \times 5 = 2.5)$
- (c) What would happen and why ?
- (i) In Hb β (beta) chain Glu(6) is changed to Asp.
 - (ii) In chymotrypsin if Ser 195 is altered to Thr.
 - (iii) A transaminase contg. pyridoxal phosphate is reduced with sodium borohydride.
 - (iv) ATCase is treated with a mercaptan.
 - (v) An enzyme is treated with a transition state analog. $(1 \times 5 = 5)$

- (d) Discuss the main contributions of any **one** Nobel Laureate to the area of protein chemistry among the following Limes Pauling, Max Perutz, D.C. Phillips. (1.5)
2. (a) Derive the Michaelis-Menten equation and show under what conditions $K_m = [S]$. (5)
- (b) In a bisubstrate reaction catalysed by the enzyme sucrose phosphoryllase, if sucrose and a little amount of radio-labelled fructose are added to the enzyme (omitting P_i) a small amount of labelled sucrose results. Explain. (5)
- (c) Provide evidence (with an example) to show that enzymes bind to transition states of their substrate. (4)
3. (a) Explain the molecular basis of the Bohr effect. (5)
- (b) Haem has a higher affinity (25,000 times) for carbon monoxide than oxygen. Why then are animals not poisoned with the prevalent level of CO in the environment? (4)
- (c) An anaemic patient is suspected to having a mutant α (alpha chain). How can this be confirmed. Also provide an explanation for his/her anaemia. (5)

4. (a) Provide experimental strategies for the following investigations in protein structure

(i) Determination of N-terminus of a protein available in small quantity.

(ii) Location of disulfide bonds in a polypeptide.
(2×3=6)

(b) In the presence of an enzyme which catalyses disulfide-sulphydryl exchange reactions denatured RNase is converted to active enzyme whereas insulin under the same conditions is inactivated. Explain. (4)

(c) A polypeptide has been discovered but unfortunately you have a sequencer which can go through only four cycles and stops. The following information is however obtained.

(i) Hydrazinolysis : Val

(ii) Dansyl chloride treatment followed by acid hydrolysis : Dansyl-Pro

(iii) Trypsin followed by Edman degradation of the separated fragments

Gly - Lys

Phe - Ile - Val

Pro - Gly - Ala - Arg

Ser - Arg

Provide as much information as you can concerning the amino acid sequence of the polypeptide. In lieu of the dysfunctional sequence what additional experiment would you do to complete the sequence determination of the polypeptide? (4)

5. (a) Explain why $\text{NAD}^+/\text{NADP}^+$ dehydrogenases are stereospecific? (4)
- (b) Write the mechanism of any one pyridoxal phosphate using enzyme reaction. Also give an example of an enzyme which uses pyridoxal phosphate atypically. (6)
- (c) Why is Methotrexate useful in cancer chemotherapy? (4)
6. (a) Enzymes can be subjected to feedback inhibition. How can you kinetically differentiate competitive inhibitors from allosteric inhibitors? (5)
- (b) What are the various ways by which glycogen phosphoryllase is regulated? (9)
7. (a) Enzymes use several mechanisms to speeden up reactions. Cite any 5 mechanisms. (5)

- (b) Explain the mechanism of lysozyme action providing experimental evidence for the same. (9)
8. Write short notes on :
- (a) Hair/silk structure (4)
- (b) Reversible inhibitors/suicide inhibitors (5)
- (c) Solid phase peptide synthesis (5)