2021

BIOCHEMISTRY — HONOURS

Paper : CC - 4

(Enzymes)

Full Marks : 50

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

1. Answer *any five* questions : 2×5

   (a) Draw the Lineweaver Burk plot for a competitive inhibition.

   (b) What is the relation between coenzyme and holoenzyme? Explain with an example.

   (c) Define ribozyme with example.

   (d) Write down the effect of Hg^{2+} on enzyme activity with an example.

   (e) What is feedback inhibition? Give an example.

   (f) Distinguish between pre-steady state and steady state of enzyme catalysed reaction.

   (g) What is the ratio of [S] to K_M when the velocity of an enzyme catalysed reaction is 60% of V_{max}?

   (h) What is zymogen? What is its significance?

   (i) Define Katal. What is its unit?

   (j) What is feedback inhibition?

2. Answer *any two* questions :

   (a) In a multi-step reaction, what would be the rate limiting step of the reaction? Explain with example. Do enzymes affect the reaction equilibrium? Justify your answer.   2+(l+2)

   (b) What is the active form of Vitamin B_6? Mention the reactions catalysed by those coenzymes. What is sedimentation coefficient?   3+2

   (c) What is burst phase of chemical catalysis? Write down the principle of Ion exchange chromatography.   2+3

   (d) Mention the differences between metalloenzyme and metal activated enzyme with example. Specific activity increases with purity of the enzyme.— Explain.   3+2

Unit - I

Answer *any one* question.

3. (a) Differentiate between biocatalysts and chemical catalysts mentioning at least two major points.

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(b) Show that if A reacts simultaneously according to A $\rightarrow$ B (k_1) and A $\rightarrow$ C (k_2), where k_1 and k_2 are the rate constants, then the half-life of A is given by $0.693/(k_1+k_2)$.

(c) 'Enzymes lower the activation energy barrier for a reaction.'— Explain.

(d) What is the function of biotin as a co-enzyme? 2+3+3+2

4. (a) An enzyme has a K_M of 4.7×10^{-5} M. If V_{max} of the preparation is 22 μmoles/lit/min, what velocity would be observed in presence of 2×10^{-4} M substrate and 5×10^{-4} M of a competitive inhibitor? ($K_1 = 3\times10^{-4}$ M)

(b) Derive Michaelis-Menten equation in presence of mixed inhibitor and draw the Lineweaver-Burk plot for the same.

(c) What are the differences between transferases and translocases? Explain with example.

(d) What do you mean by proximity and orientation effect in enzyme catalyzed reaction? 3+3+2+2

Unit - II

Answer *any one* question.

5. (a) Covalent modification by phosphorylation and dephosphorylation regulate the activity of some enzymes.— Explain.
(b) What are isozymes? Explain the significance of isozymes in the biological system with specific example.
(c) Name one antibiotic that can act as enzyme inhibitor and the enzyme it inhibits. What type of inhibition is this?
(d) What is the principle of ammonium sulphate fractionation? 3+3+2+2

6. (a) Explain why very tight binding of a substrate to an enzyme is not desirable for enzyme catalysis, whereas the reverse is desirable.

(b) An enzyme was assayed at an initial [S] of 2×10^{-5} M in 6 min half of the substrate has been used. The K_M for the substrate being 5×10^{-3} M, calculate V_{max} and conc. of product produced in 10 minutes.

(c) Explain why ethanol is used for methanol poisoning.

(d) What is transition state analog? What is its significance? 2+3+2+3

Unit - III

Answer *any one* question.

7. (a) What are Zymogens? Mention its significance.

(b) The rate constant of a reaction is 3.46×10^{-2} s^{-1} at 299°K. What is the rate constant at 350°K if the activation energy for the reaction is 50.2 kJ/mol? Can you identify the order of the reaction? — Explain.

(c) Suppose you are performing gel exclusion chromatography for isolating an enzyme.

  (i) How will you determine the presence of protein in elute?

  (ii) How will you determine the purity of the isolated enzyme?   2+4+2+2

8. (a) In what direction will the following proteins move in an electric field?
Egg albumin (pI - 4.6) at pH 5.0 and at pH 3.0
β lactoglobulin (pI - 5.2) at pH 5.0 and at pH 7.0

(b) What fractions of v_o are observed as V_{max} at $[S] = 4K_M$ and $[S] = 10K_M$?

(c) Explain the mechanism of regulation by Aspartate transcarbamoylase.

(d) What is R_f value?   3+2+3+2