Exam.Code:1033
Sub. Code: 7872

2072

M.E. (Bio-Technology) Second Semester

MEBIO-203: Enzyme Engineering

Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt <u>five</u> questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section. State clearly your assumptions.*

x-x-x

1) Write briefly: *(2×5 =10)*

a) Define enzyme activity and specific enzyme activity?

b) What are the cofactors? How are they useful?

c) Write down the formula for the calculation of amylase activity.

d) According the Michaelis-Menten equation, what is the V/V_{max} ratio when [S] = 3 K_m?

e) Define Enzyme immobilization? List two advantages and disadvantages of immobilization.

SECTION - A

2) A carboxypeptidase was found to have K_m= 2 μM and k_{cat} = 150 s^{-1} for substrate A.

(a) What is the initial rate of reaction for [A] = 5 μM and [E_0] = 0.01 μM?

(b) The presence of 5 mM of a competitive inhibitor decreased the initial rate by a factor of 2. What is the value of K_I?

(c) A competing substrate B is added to part (a). It's K_m = 10 μM and k_{cat} = 100 s^{-1}. Calculate V_B/V_A.

(2, 5, 3)

3) a) Define substrate inhibitions? Derive a rate of expression (V) for substrate inhibition kinetics and show that at maximum reaction rate of substrate concentration is

$$S_{max} = \sqrt{K_m \times K_S}$$

b) Describe the type of enzyme inhibitions and compare V_{max} and K_m with controlled enzyme.

c) One microgram of a pure enzyme (MW=73000) catalyzed a reaction at a rate of 0.3 μmoles/min. under optimum conditions. Calculate the turnover number.

(3, 5, 2)

4) a) Defined Biocatalyst and what are differences between Biocatalyst and Chemical catalyst?

b) Show diagrammatically the role of enzyme in lowering the activation energy barrier.

c) Explain effect of substrate and enzyme concentration on enzyme activity.

(4, 3, 3)

SECTION - B

5) List ten name of enzyme. Write a critical review on any one of enzyme. *(10)*

6 a) Discuss various idealized enzyme reactor systems. Discuss which you justified to be the best?

b) A substrate is converted to a product by the catalytic action of an enzyme. Assume that The Michaelis-Menten kinetics parameters for this reaction are K_m = 0.03 mol /L, V_{max} = 1.3 mol / L min. What should be the size of steady-state CSTR to convert 90 percent to incoming substrate (S_0 = 10 mol/ L) with a flow rate of 10 L/ hr? *(6, 4)*

7a) Name the various methods of 'Enzyme Immobilization' in Block diagram. Discuss entrapment method.

b) Immobilized lactose is used to hydrolyze lactose in dairy waste to glucose and galactose. Enzyme is immobilized in resin particles and packed into at 0.05 m^3 Plug – flow column. The total effectiveness factor for the system is close to unity; K_m for the immobilized enzyme is 1.32 kg m^{-3}; V_{max} is 45 kg m^{-3} h^{-1}. The lactose concentration in the feed stream is 9.5 kg m^{-3}; a substrate conversion is 98% is required. At what flow rate should the reactor be operated? *(6, 4)*

x-x-x