Assignment 10

Indian Institute of Science Education and Research

CHM202: Energetics and dynamics of chemical reactions

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Ques. 1 The enzyme-catalysed conversion of a substrate at 25°C has a Michaelis constant of 0.024 mol dm^{-3}. The rate of the reaction is 1.15×10^{-4} mol dm^{-3} s^{-1} when the substrate concentration is 0.890 mol dm^{-3}. What is the maximum velocity of this enzymolysis?

Ques.2 The following results were obtained for the action of an ATPase on ATP at 20°C, when the concentration of the ATPase was 20 nmol dm^{-3}:

[ATP]/(μmol dm^{-3})	0.60	0.80	1.4	2.0	3.0
v/(μmol dm^{-3} s^{-1})	0.81	0.97	1.30	1.47	1.69

Determine the Michaelis constant, the maximum velocity of the reaction, the turnover number, and the catalytic efficiency of the enzyme.

Ques.3 The slope and intercept obtained from (1/Rate) against (1/substrate concentration) of an enzyme catalyzed reaction are 300 and 2 x 10^5 , respectively. Calculate the Michaelis-Menten constant of the enzyme in this reaction.

Ques.4 Consider an enzyme-catalysed reaction that follows Michaelis-Menten kinetics with K_M = 0.75mmol dm^{-3}. What concentration of a competitive inhibitor characterized by K_1 = 0.56 mmol dm^{-3} will reduce the rate of formation of product by 75 percent when the substrate concentration is held at 0.10 mmol dm^{-3} ?

Ques.5 Some enzymes are inhibited by high concentration of their own substrates. **(a)** Show that when substrate inhibition is important the reaction rate v is given by

$$v = \frac{v_{max}}{1 + \frac{[S]_0}{K_1} + \frac{K_M}{[S]_0}}$$

Where K_1 is the equilibrium constant for dissociation of the inhibited enzyme-substrate complex. **(b)** What effect does substrate inhibition have on a plot of $1/v$ against $1/[S]_0$?