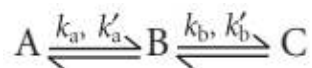


Course: CHM202

Energetics and dynamics of chemical reactions

Assignment –IX

Q.1 Set up the rate equations for the reaction mechanism:



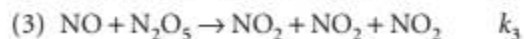
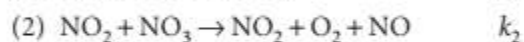
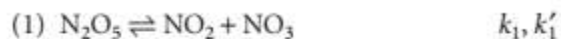
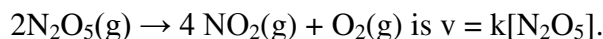
Show that the mechanism is equivalent to



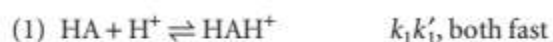
under specified circumstances.

Q.2 Derive an equation for the steady-state rate of the sequence of reactions $A \rightleftharpoons B \rightleftharpoons C \rightleftharpoons D$, with $[A]$ maintained at a fixed value and the product D removed as soon as it is formed.

Q.3 On the basis of the following proposed mechanism, account for the experimental fact that the rate law for the decomposition



Q.4 Consider the acid-catalysed reaction

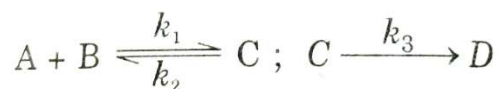


Deduce the rate law and show that it can be made independent of the specific term $[\text{H}^+]$.

Q.5 The half-life period of a first-order decomposition of $\text{N}_2\text{O}_5(\text{g})$ is expressed as

$t_{1/2} = -30.3 + \frac{12581.78}{T}$ when time is expressed in sec. Find out (i) Frequency factor A , (ii) Energy of activation and (iii) fraction of the reactant undergoing the reaction in 1 hour at 300 K.

Q.6 For the mechanism



Derive the rate law using the steady state approximation to eliminate the concentration of C .

Q.7 The enzyme-catalysed conversion of a substrate at 298 K has a Michaelis constant of $0.042 \text{ mol dm}^{-3}$. The rate of the reaction is $2.45 \times 10^{-4} \text{ mol dm}^{-3} \text{ s}^{-1}$ when the substrate concentration is $0.890 \text{ mol dm}^{-3}$. What is the maximum velocity of this enzymolysis?

Q.8 The enzyme α -chymotrypsin is secreted in the pancreas of mammals and cleaves peptide bonds made between certain amino acids. Several solutions containing the small peptide N-glutaryl-L-phenylalanine-p-nitroanilide at different concentrations were prepared and the same small amount of α -chymotrypsin was added to each one. The following data were obtained on the initial rates of the formation of product:

$[\text{S}]/(\text{mmol dm}^{-3})$	0.334	0.450	0.667	1.00	1.33	1.67
$v/(\text{mmol dm}^{-3} \text{ s}^{-1})$	0.152	0.201	0.269	0.417	0.505	0.667

Determine the maximum velocity and the Michaelis constant for the reaction.