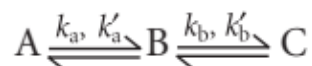


## Course: CHM202

### Energetics and dynamics of chemical reactions

#### Assignment –IX

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



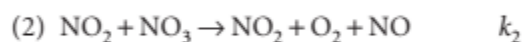
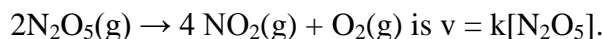
Show that the mechanism is equivalent to



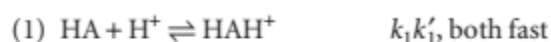
under specified circumstances.

**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

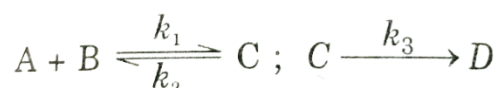


Deduce the rate law and show that it can be made independent of the specific term  $[\text{H}^+]$ .

**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  $\alpha$ -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  $\alpha$ -chymotrypsin was added to each one. The following data were obtained on the initial rates of the formation of product:

$[S]/(\text{mmol dm}^{-3})$	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.