

Topic :- Chemical Kinetics

1. In a reaction between A and B, the initial rate of reaction was measured for differential initial concentrations of A and B as given below :

A./mol L <sup>-1</sup>	0.20	0.20	0.40
B/mol L <sup>-1</sup>	0.30	0.10	0.05
r <sub>0</sub> / mol L <sup>-1</sup> s <sup>-1</sup>	5.07 x 10 <sup>-5</sup>	5.07 x 10 <sup>-5</sup>	7.6 x 10 <sup>-5</sup>

what is the order of reaction with respect to A and B ?

2. The following results have been obtained during the kinetic studies of the reactions :



Experiment	[A] / M	[B] / M	Initial rate of formation of D/M min <sup>-1</sup>
I	0.1	0.1	6.0 x 10 <sup>-3</sup> mol L <sup>-1</sup> min <sup>-1</sup>
II	0.3	0.2	7.2 x 10 <sup>-2</sup> mol L <sup>-1</sup> min <sup>-1</sup>
III	0.3	0.4	2.88 x 10 <sup>-1</sup> mol L <sup>-1</sup> min <sup>-1</sup>
IV	0.4	0.1	2.4 x 10 <sup>-2</sup> mol L <sup>-1</sup> min <sup>-1</sup>

Determine the rate law and the rate constant for the reaction.

3. The rate constant for the decomposition of hydrocarbons is 2.418 x 10<sup>-5</sup> s<sup>-1</sup> at 546 K. If the energy of activation is 179.9 kJ mol<sup>-1</sup>, What will be the value of pre-exponential factor.

4. The decomposition of A into product has value of k as 4.5 x 10<sup>3</sup>s<sup>-1</sup> at 10 °C and energy of activation 60 kJ mol<sup>-1</sup>. At what temperature would K be 1.5 x 10<sup>4</sup> s<sup>-1</sup> ?

5. For a reaction, X<sub>2</sub>(g) + 2 Y(g) → 2XY<sub>2</sub>(g), write the rate equation in terms of the rate of disappearance of Y<sub>2</sub>.

6. When does the rate of the reaction become equal to specific reaction rate.

7. What is meant by elementary reaction?

8. The reaction, A + B → C has zero order. What is the rate reaction?

9. A reaction is 50% complete in 2 hours and 75% complete in 4 hours. What is the order of reaction ?

10. The reaction,  $A + 2B \rightarrow C + D$ , obeys the rate equation ;  $\text{Rate} = k [A]^2[B]^2$  .What would be the order of the reaction?

11. The following experimental data was collected for the reaction



Trial	Initial conc. $[\text{Cl}_2]$	Initial conc. $[\text{NO}]$	Initial Rate ( $\text{mol L}^{-1} \text{s}^{-1}$ )
1	0.010	0.010	$1.2 \times 10^{-4}$
2	0.010	0.030	$10.8 \times 10^{-4}$
3	0.020	0.030	$21.6 \times 10^{-4}$

Construct the rate equation for the reaction.

12. Nitric oxide( NO) reacts with oxygen to produce nitrogen dioxide:



The rate law for this reaction is  $\text{rate} = k [\text{NO}]^2 [\text{O}_2]$

Propose a mechanism for the above reaction.

13. The reaction  $\text{SO}_2\text{Cl}_2 \rightarrow \text{SO}_2 + \text{Cl}_2$  is a first order reaction with half life  $3.15 \times 10^4$  s at  $320^\circ\text{C}$ .What percentage of  $\text{SO}_2\text{Cl}_2$  would be decomposed on heating at  $320^\circ\text{C}$  for 90 minutes.

14. A reaction is first order in A and second order in B

(i) Write differential rate affected if the concentration of B is tripled ?

(ii) How is the rate affected when the concentration of both A and B are doubled.

15. Following reaction takes place in one step,  $2\text{NO}(\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$

of the above reaction change if the volume of the reaction vessel is diminished to one-third of its original volume ? Will there be any change in the order of the reaction with the reduced volume?