

INDIAN SCHOOL MUSCAT

CHEMISTRY DEPARTMENT

QUESTION BANK

Chemical Kinetics

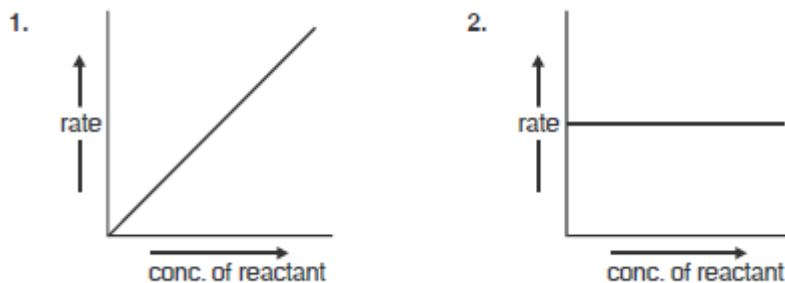
VSA QUESTIONS (1 - MARK QUESTIONS)

1. Why does the rate of a reaction not remain constant throughout the reaction process?
2. What is meant by order of a reaction being zero?
3. What is the shape of graph between $\log k$ vs $1/T$. What is the relationship between its slope and activation energy (E_a) ?
4. For a chemical reaction rate constant $k = 5.3 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$. what will be the order of the reaction?
5. Express the rate of reaction in terms of disappearance of hydrogen and appearance of ammonia in the given reaction. $\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
6. For the elementary step of a chemical reaction : $\text{A} + \text{H}_2\text{O} \rightarrow \text{B}$ rate = $[\text{A}]^1$.
What is the molecularity and order of the reaction.
7. Mention one example of pseudo first order reaction.
8. For the reaction $\text{Cl}_2(\text{g}) + \text{NO}(\text{g}) \rightarrow 2\text{NOCl}(\text{g})$, the rate law is expressed as rate = $k[\text{Cl}_2][\text{NO}]^2$. What is the overall order of this reaction?

SA (I) QUESTIONS (2 - MARK QUESTIONS)

9. What do you mean by the rate law and rate constant of a reaction? Identify the order of a reaction if the units of its rate constant are
 - i. $\text{L}^{-1} \text{mol s}^{-1}$
 - ii. $\text{Lmol}^{-1} \text{ s}^{-1}$

10. A reaction is second order with respect to a reactant A. How is the rate of this reaction altered if the concentration of A is
- Doubled
 - Reduced to half?
11. Explain the terms
- Rate determining step of a reaction
 - Molecularity of a reaction
12. iii. The rate constant for a reaction of zero order in A is $0.0030 \text{ mol L}^{-1} \text{ s}^{-1}$. How long will it take for the initial concentration of A to fall from 0.10M to 0.075 M?
13. A first order reaction takes 40 minutes for 30% decomposition. Calculate its $t_{1/2}$ value.
14. Show that for a first order reaction, the time required for half life is independent of initial concentration.
15. A reactant has a half life of 10 minutes.
- Calculate the rate constant for the first order reaction.
 - What fraction of the reactant will be left after an hour of the reaction has occurred?
16. Calculate the rate constant of a reaction at 293 K, given that:
 $E_a = 103 \text{ KJ/Mol}$, $k = 7.87 \times 10^{-7} \text{ s}^{-1}$, at 273 K, $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$
17. The graphs (1 and 2) given below are plots of rate of reaction verses concentration of the reaction. Predict the order from the graphs



SA (II) QUESTIONS (3- MARK QUESTIONS)

17. For a decomposition reaction, the values of rate constant k , at two different temperatures are given below.

$$K_1 = 2.15 \times 10^{-8} \text{ L mol}^{-1} \text{ s}^{-1} \text{ at } 650 \text{ K}, \quad K_2 = 2.39 \times 10^{-7} \text{ L mol}^{-1} \text{ s}^{-1} \text{ at } 700 \text{ K}$$

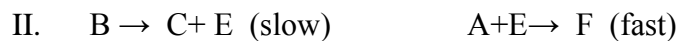
Calculate the value of activation energy for this reaction $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$

18. Consider the reaction $2A + B \rightarrow C + D$

Following results were obtained in experiments designed to study the rate of reaction.

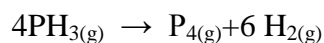
Exp no;	Initial concentration (Mol L^{-1})		Initial rate of formation
	[A]	[B]	[D] (M/min)
1	0.10	0.10	1.5×10^{-3}
2	0.20	0.20	3×10^{-3}
3	0.20	0.40	6×10^{-3}

- Write the rate law for the reaction.
- Calculate the value of rate constant for the reaction
- Which of the following possible reaction mechanisms is constant with the rate law found in (i)





- 19.. Explain the following :
- A lump of coal burns at moderate rate in air while coal dust burns explosively.
 - Average rate of reaction does not give the true picture of the reaction.
 - Reactions of high molecularity are less in number.
20.
 - Write four points of difference between order and molecularity of a reaction.
 - List four methods for determination of order of reactions?
21. The decomposition of PH_3 proceeds according to the following equation.



It is found that the reaction follows the following rate equation, $\text{Rate} = k [\text{PH}_3]$. The half life of PH_3 is 37.9 s at 120°C .

- How much time is required for $\frac{3}{4}$ th of PH_3 to decompose?
- What fraction of the original sample of PH_3 remains behind after 1 minute?

LONG ANSWER QUESTION (5- MARK QUESTION)

22.
 - Define elementary reaction in a process.
 - State the role of activated complex in a reaction and state its relation with activation energy.
 - H_2O_2 (aq) decomposes to $\text{H}_2\text{O}(\text{l})$ and $\text{O}_2(\text{g})$ in a reaction that is of first order in H_2O_2 and has a rate constant $K = 1.06 \times 10^{-3} \text{min}^{-1}$.
 - How long will it take 15% of a sample of H_2O_2 to decompose?
 - How long will it take 85% of a sample of H_2O_2 to decompose?