

CHEMICAL KINETICS- Previous HSE Questions

- Rate of a reaction is the change in concentration of any one of the reactants or products in unit time.
 - Express the rate of the following reaction in terms of reactants and products
$$2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}_2(\text{g}) \quad (1)$$
 - (i) $\text{N}_2\text{O}_5(\text{g}) \rightarrow 2\text{NO}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$ is a first order reaction. Find the unit of k. (1)
(ii) Calculate the time required for the completion of 90% of a first order reaction. ($k = 0.2303 \text{ s}^{-1}$) (2)
[SAY 2016]
- The molecularity of the reaction $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}$, is,
a) 5 b) 2 c) 3 d) 0 (1)
 - What do you mean by rate of a reaction ? (1)
 - What will be the effect of temperature on rate of a reaction ? (1)
 - A first order reaction is found to have a rate constant, $k = 5.5 \times 10^{-1} \text{ s}^{-1}$. Find out the half-life of the reaction. (1) [March 2016]
- Integrated rate expression for rate constant of a first order reaction $\text{R} \rightarrow \text{P}$ is given by $k = \frac{2.303}{t} \log \frac{[\text{R}]_0}{[\text{R}]}$
 - Derive an expression for half life period of first order reaction (2)
 - A first order reaction has a rate constant $1.15 \times 10^{-3} \text{ s}^{-1}$. How long will 5 g of the reactant take to reduce 3g? [SAY 2015]
- The terms order and molecularity are common in chemical kinetics.
 - What do you mean by order and molecularity? (2)
 - Write two factors influencing rate of a reaction. (1)
 - Write Arrhenius equation. (1) [March 2015]
- Consider a general reaction $a\text{A} + b\text{B} \rightarrow c\text{C} + d\text{D}$. The rate expression for the reaction is $r = k[\text{A}]^x[\text{B}]^y$
 - Establish the significance of (a+b) and (x+y) in terms of order and molecularity. (1)
 - Write any two differences between order and molecularity. (2)
 - "Reactions with zero order are possible, but zero molecularity is not". Justify the statement. (1) [March '14]
- Unit of rate constant (k) of a reaction depends on the order of the reactions. Values of 'k' of two reactions are given below. Find the order of each reaction.
 - $k = 3 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$
 - $k = 5 \times 10^{-3} \text{ mol}^{-1} \text{ L s}^{-1}$ (1)
 - Write integrated rate equation for a first order reaction. (1)
 - Write the relation between half life ($t_{1/2}$) and rate constant (k) of a first order reaction. (1)
 - Rate constant of a reaction is $5 \times 10^{-2} \text{ s}^{-1}$. Find the half life ($t_{1/2}$) of the reaction. (1) [SAY 2014]
- The conversion of a molecule A to B follows second order kinetics.
 - Write the rate equation for the second order reaction. (1)
 - If the concentration of A is increased to four times, how will it affect the formation of B. (2)
 - Indicate the order and Molecularity of the reaction given below:
$$\text{C}_{12}\text{H}_{22}\text{O}_{11} \xrightarrow{\text{H}^+} \text{C}_6\text{H}_{12}\text{O}_6 + \text{C}_6\text{H}_{12}\text{O}_6 \quad (1) \quad (\text{SAY 2013})$$
- Zero order reaction means that the rate of a reaction is independent of the concentration of the reactants.
 - Write an example for a zero order reaction. (1)
 - Write the integral rate expression for the zero order reaction, $\text{R} \longrightarrow \text{P}$. (1)
 - The temperature dependence of rate of a chemical reaction can be accurately explained by Arrhenius equation. With the help of Arrhenius equation, calculate the rate constant for the first order reaction

$\text{C}_2\text{H}_5\text{I} \longrightarrow \text{C}_2\text{H}_4 + \text{HI}$ at 700K. Energy of activation (E_a) for the reaction is 209 kJ/mol and rate constant at 600 K is $1.6 \times 10^{-5} \text{ s}^{-1}$ ($R = 8.314 \text{ J/K/mol}$). (2) (March 2013)

9. Rate of a reaction is the change in concentration of any one of the reactants or any one of the products in unit time.
 - i) Express the rate of the following reaction in terms of reactants and products: $2\text{HI} \longrightarrow \text{H}_2 + \text{I}_2$ (1½)
 - ii) If the rate expression for the above reaction is $\text{rate} = k[\text{HI}]^2$, what is the order of the reaction? (½)
 - iii) Define order of a reaction. (1)
 - iv) Whether the Molecularity and order of the above reaction are the same? Give reason (1) [March 2012]
10. For a first order reaction half life period is independent of initial concentration of its reacting species.
 - i) What is mean by half life period of a reaction? (1)
 - ii) By deriving the equation for $t_{1/2}$ of first order reaction, prove that $t_{1/2}$ is independent initial concentration of reacting species. (3) [SAY 2012]
11. The hydrolysis of an ester in acidic medium is a first order reaction.
 - a) What do you mean by a first order reaction? (½)
 - b) What is the relation between Rate constant and Half life period of a first order reaction? (½)
 - c) Half life period of a first order reaction is 20 seconds. How much time will it take to complete 90% of the reaction? (3) [March 2011]
12. The value of rate constant k of a reaction depends on temperature. From the values of k at two different temperatures, the Arrhenius parameters E_a and A can be calculated.
 - a) The rate constants of a reaction at 600K and 900K are 0.02s^{-1} and 0.06s^{-1} respectively. Find the values of E_a and A . (3)
 - b) Write the unit of rate constant of a 2nd order reaction if concentration is in mol L^{-1} and time in S.(1) [SAY 11]
13. The order of a reaction can be zero and even a fraction but Molecularity cannot be zero or a non-integer.
 - i) What do you mean by the order of a reaction? (1)
 - ii) What is Molecularity of a reaction? (1)
 - iii) The conversion of molecules A to B follows second order kinetics. If concentration of A is increased to three times, how will it affect the rate of formation of B? (2) [March 2010]
14. The value of rate constant k of a reaction depends on temperature. From the values of k at two different temperatures, the Arrhenius parameters E_a and A can be calculated.
The rate constants of a reaction at 1000K and 1060K are $0.01\text{M}^{-1}\text{s}^{-1}$ and $0.10\text{M}^{-1}\text{s}^{-1}$ respectively. Find the values of E_a and A . (3) [March 2010]
15. Unit of rate constant (k) of a reaction depends on the order of the reaction. If concentration is expressed in mol L^{-1} and time in seconds (s), find the unit of k for zero, first and second order reaction. (3) [March 2009]
16. An archeological substance contained wood had only 66.66% of the ^{14}C found in a tree. Calculate the age of the sample if the half life of ^{14}C is 5730 years. (3) [March 2008]