



CHEMICAL KINETICS

Class 12 - Chemistry

Time Allowed: 1 hour and 29 minutes

Maximum Marks: 45

- For which type of reactions, order and molecularity have the same value? [1]
- What is molecularity? [1]
- Give two examples of non-chemical process which obeys the first order kinetics. [1]
- The time required to decompose SO_2Cl_2 to half of its initial amount is 60 min. If the decomposition is a first order reaction, calculate the rate constant of the reaction? [1]
- Is it possible to determine or predict the rate law theoretically by merely looking at the equation? [1]
- Write units of rate constant k for zero, first, second and n^{th} order reactions. [1]
- A first order reaction is found to have a rate constant $k = 5.5 \times 10^{-14} \text{ s}^{-1}$. Find the half-life of reaction. [1]
- Why are chemical reactions irreversible? [1]
- Calculate the overall order of a reaction which has the rate expression. [1]
 - Rate = $k [A]^{\frac{1}{2}} [B]^{\frac{3}{2}}$
 - Rate = $k [A]^{\frac{3}{2}} [B]^{-1}$
- The reaction between $H_2(g)$ and $O_2(g)$ is highly feasible yet allowing the gases to stand at room temperature in the same vessel does not lead to the formation of water. Explain [1]
- A reaction is first order in A and second order in B. [3]
 - Write the differential rate equation.
 - How is the rate affected on increasing the concentration of B three times?
 - How is the rate affected when the concentrations of both A and B are doubled?
- The data given below is for the reaction, [3]



S. No.	N_2O_5 (mol L ⁻¹)	Rate of disappearance of N_2O_5 (mol L ⁻¹ min ⁻¹)
1.	1.13×10^{-2}	34×10^{-5}
2.	0.84×10^{-2}	25×10^{-5}
3.	0.62×10^{-2}	18×10^{-5}

Determine for this reaction,

- Order of reaction
 - Rate law
 - Rate constant
- The decomposition of phosphine, $2PH_3(g) \rightarrow P_4(g) + 6H_2(g)$ has the rate law = $k [PH_3]$. The rate constant is $6.0 \times 10^{-4} \text{ s}^{-1}$ at 300 K and activation energy is $3.05 \times 10^5 \text{ J mol}^{-1}$. Calculate the value of rate constant at [3]

310 K.

[Given: $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$]

14. The first order rate constant for the decomposition of ethyl iodide by the reaction [3]
 $\text{C}_2\text{H}_5\text{I}(\text{g}) \rightarrow \text{C}_2\text{H}_4(\text{g}) + \text{HI}(\text{g})$

at 600 K is $1.60 \times 10^{-2} \text{ s}^{-1}$. Its energy of activation is 209 kJ/mol. Calculate the rate constant of the reaction at 700 K.

15. The rate of a particular reaction triples when temperature changes from 50°C to 100°C. Calculate the activation energy of the reaction. [3]

[Given $\log 3 = 0.4771$; $R = 8.314 \text{ K}^{-1} \text{ mol}^{-1}$]

16. The following data were obtained during the first order thermal decomposition of SO_2Cl_2 at a constant volume. [5]
 $\text{SO}_2\text{Cl}_2(\text{g}) \rightarrow \text{SO}_2(\text{g}) + \text{Cl}_2(\text{g})$

Experiment	Time/ s^{-1}	Total pressure/atm
1	0	0.5
2	100	0.6

Calculate the rate of the reaction when total pressure is 0.65 atm.

17. a. The half life for the decomposition of nitramide is 2.1 hours at 15°C. [5]

$\text{NH}_2\text{NO}_2(\text{aq}) \rightarrow \text{N}_2\text{O}(\text{g}) + \text{H}_2\text{O}(\text{l})$. If 6.2 g of NH_2NO_2 decomposes, calculate:

i. Time taken for 99% decomposition of NH_2NO_2 .

ii. Volume of N_2O (dry) produced at STP

b. The conversion of X to Y follows second order kinetics. If concentration of 'X' is increased to three times how will it affect the rate of formation of 'Y' and why?

18. a. What is the signification of negative sign in the rate expression in term of reactant? [5]

b. The decomposition of a compound is found to follow a first order rate law. If it takes 15 min. for 20% of original material to react, calculate:

i. the specific rate constant,

ii. the time at which 10% of the original material remains unreacted,

iii. the time it takes for the next 20% the reactant left to react after the first 15 min.

19. The decomposition of A into product has value of k as $4.5 \times 10^3 \text{ s}^{-1}$ at 10^0 C and energy of activation [5]
 60 kJ mol^{-1} . At what temperature would k be $1.5 \times 10^4 \text{ s}^{-1}$?

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