

1. (d) $k = \frac{2.303}{t} \log \frac{a}{a-x} = \frac{2.303}{24} \log \frac{1}{\frac{1}{8}} = \frac{2.303}{24} \log 8$
2. (b) Since doubling the concentration of B does not change half-life, the reaction is of 1st order w.r.t. B .
Order of reaction with respect to $A = 1$ because rate of reaction doubles when concentration of A is doubled keeping concentration of B constant.
 \therefore Order of reaction = $1 + 1 = 2$ and units of second order reaction are $\text{L mol}^{-1} \text{sec}^{-1}$.
3. (d) The molecularity of a reaction is the number of reactant molecules taking part in a single step of the reaction. Thus the reaction involving two different reactants can never be unimolecular.
4. (a) Let the rate law be $r = k[A]^x[B]^y$
Divide (3) by (1) $\frac{0.10}{0.10} = \frac{[0.024]^x[0.035]^y}{[0.012]^x[0.035]^y}$
 $\therefore 1 = [2]^x, x = 0$
Divide (2) by (3) $\frac{0.80}{0.10} = \frac{[0.024]^x[0.070]^y}{[0.024]^x[0.035]^y}$
 $\therefore 8 = (2)^y, y = 3$
Hence rate equation, $R = k[A]^0[B]^3 = k[B]^3$
5. (a) If we write rate of reaction in terms of concentration of NH_3 and H_2 , then
Rate of reaction = $\frac{1}{2} \frac{d[\text{NH}_3]}{dt} = -\frac{1}{3} \frac{d[\text{H}_2]}{dt}$
So, $\frac{d[\text{NH}_3]}{dt} = -\frac{2}{3} \frac{d[\text{H}_2]}{dt}$
6. (a) As doubling the initial conc. doubles the rate of reaction, order = 1
7. (b) Rate law has to be determined experimentally as Cl_2 is raised to power $\frac{1}{2}$ in rate law whereas its stoichiometric coefficient in balanced chemical equation is 1.
8. (a)
9. (c) $\frac{(t_{1/2})_1}{(t_{1/2})_2} = \left(\frac{a_2}{a_1}\right)^{n-1}; \frac{120}{240} = \left(\frac{4 \times 10^{-2}}{8 \times 10^{-2}}\right)^{n-1}; n = 2$
10. (b)
11. (b)
12. (c) Activation energy is lowered in presence of +ve catalyst.
13. (d) Overall order = sum of orders w.r.t each reactant.
Let the order be x and y for G and H respectively

Exp.No	$ G \text{molc}$ litre^{-1}	$ H \text{molc}$ litre^{-1}	rate(molc $\text{litre}^{-1} \text{sec}^{-1}$)
1	a	b	r
2	$2a$	$2b$	$8r$
3	$2a$	b	$2r$

\therefore For (1) and (3), the rate is doubled when conc. of G is doubled keeping that of H constant i.e.,

$$\text{rate} \propto |G| \therefore x = 1$$

From (2) and (3), $y = 2$

\therefore Overall order is 3.

14. (b) For a first order reaction

$$k = \frac{2.303}{t} \log \frac{a}{a-x} = \frac{2.303}{40} \log \frac{0.1}{0.025} \\ = \frac{2.303}{40} \log 4 = \frac{2.303 \times 0.6020}{40} \\ = 3.47 \times 10^{-2} \text{ min}^{-1}$$

$$\text{Rate} = k[A] = 3.47 \times 10^{-2} \times 0.01 \\ = 3.47 \times 10^{-4} \text{ M/min}$$

15. (c) Third order

16. (c) For a first order reaction

$$k = \frac{2.303}{t} \log_{10} \frac{a}{a-x}$$

when $t = t_{1/2}$

$$k = \frac{2.303}{t_{1/2}} \log_{10} \frac{a}{a-a/2}$$

$$\text{or } t_{1/2} = \frac{2.303}{k} \log_{10} 2 = \frac{\ln 2}{k}$$

17. (d) The integrated rate equations are different for the reactions of different reaction orders. We shall determine these equations only for zero and first order chemical reactions.

18. (b) $T_2 = T(\text{say}), T_1 = 25^\circ\text{C} = 298\text{K}, E_a = 104.4 \text{ kJ mol}^{-1} = 104.4 \times 10^3 \text{ J mol}^{-1}$
 $k_1 = 3 \times 10^{-4}, k_2 = ?$,

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$$

$$\log \frac{k_2}{3 \times 10^{-4}} = \frac{104.4 \times 10^3 \text{ J mol}^{-1}}{2.303 \times (8.314 \text{ J K}^{-1} \text{ mol}^{-1})} \left[\frac{1}{298} - \frac{1}{T} \right]$$

$$\text{As } T \rightarrow \infty, \frac{1}{T} \rightarrow 0$$

$$\therefore \log \frac{k_2}{3 \times 10^{-4}} = \frac{104.4 \times 10^3 \text{ J mol}^{-1}}{2.303 \times 8.314 \times 298}$$

$$\log \frac{k_2}{3 \times 10^{-4}} = 18.297, \frac{k_2}{3 \times 10^{-4}} = 1.98 \times 10^{18}$$

$$k_2 = (1.98 \times 10^{18}) \times (3 \times 10^{-4}) = 6 \times 10^{14} \text{ s}^{-1}$$

19. (c) Adsorption lowers the activation energy.

20. (a) For the change $2A + 3B \rightarrow \text{products}$

$$-\frac{1}{2} \frac{d[A]}{dt} = -\frac{1}{3} \frac{d[B]}{dt}, \frac{1}{2} r_1 = \frac{1}{3} r_2, 3r_1 = 2r_2$$