

* characteristics of 2nd Order Reaction:-

① Half life period ($t_{1/2}$)

from 2nd order rate expression —

$$R = \frac{1}{t} \times \frac{\alpha}{a(a-\alpha)}$$

We put $\alpha = \frac{a}{2}$ when $t = t_{1/2}$

$$R = \frac{1}{t_{1/2}} \times \frac{\frac{a}{2}}{a(a - \frac{a}{2})}$$

$$\text{or } t_{1/2} = \frac{1}{R} \times \frac{a}{\alpha a/2}$$

$$\boxed{t_{1/2} = \frac{1}{R} \times \frac{1}{a}}$$

$$\therefore t_{1/2} \propto \frac{1}{a}$$

The half life period of 2nd order reaction is inversely proportional to the initial concentration.

(2) Unit :-

Unit of 2nd Order Reaction —

From 2nd Order rate expression —

$$R = \frac{1}{t} \times \frac{a}{a(a-x)}$$

$$R = \frac{1}{t} \times \frac{\text{Conc}^2}{\text{Conc}^2 \times \text{Conc}^2}$$

$$R = \frac{1}{\text{sec}} \times \frac{1}{\text{Conc}^2}$$

$$R = \frac{1}{\text{sec}} \times \frac{1}{\text{mol/L}}$$

$$R = \text{litre mol}^{-1} \text{ sec}^{-1}$$

(3) 2nd Order reaction becomes 1st Order reaction if the concentration of one of the reactant is too high —

from 2nd Order rate expression —

$$R = \frac{2.303}{t(a-b)} \log \frac{b(a-x)}{a(b-x)}$$

let $a \gg b$

$$a-b \approx a$$

$$a-x \approx a$$

then,

$$R = \frac{2.303}{t(a)} \log \frac{b.a}{a(b-x)}$$

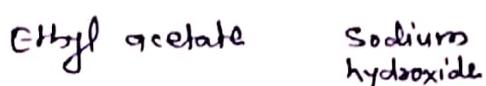
$$\text{or } K \cdot a = \frac{2.303}{t} \log \frac{b}{(b-a)}$$

$$\text{or } K' = \frac{2.303}{t} \log \frac{b}{(b-a)}$$

This expression is the rate constant of 1st order reaction.

(4) Examples of 2nd Order reactions :-

(i) Soapification of Ester -



(2). Decomposition of acetaldehyde -



(3).