

Half life of 1st order reaction $\rightarrow (t_{1/2})$
 It is the time during which the concentration of reacting species becomes half. It is indicated by $t_{1/2}$.

$$K = \frac{2.303}{t} \log_{10} \frac{a}{(a-x)}$$

When $t = t_{1/2}$, then $x = a/2$

$$\text{then } K = \frac{2.303}{t_{1/2}} \log_{10} \frac{a}{a - \frac{a}{2}}$$

$$\therefore K = \frac{2.303}{t_{1/2}} \log 2$$

$$\therefore K = \frac{2.303 \times 0.3010}{t_{1/2}}$$

$$\therefore \boxed{t_{1/2} = \frac{0.693}{K}}$$

By the above expression it is clear that the ~~rate~~ ~~constant~~ half life of 1st order reaction is independent from initial concentration 'a'.

$t_{1/2}$

LAJ

Teacher's Signature : _____

Half life of 2nd order reaction: $\rightarrow$
When initial Concentration of reacting
Species A & B are same then

$$k = \frac{1}{t} \cdot \frac{x}{a(a-x)}$$

$$\text{or } t = \frac{1}{k} \cdot \frac{x}{a(a-x)}$$

$$\text{When } t = t_{1/2} \quad a-x = a - \frac{a}{2} \quad (\because x = \frac{a}{2})$$

$$\text{hence, } t_{1/2} = \frac{1}{k} \cdot \frac{a/2}{a \cdot a/2}$$

$$\boxed{t_{1/2} = \frac{1}{ka}}$$

$$\text{or } \boxed{t_{1/2} \propto \frac{1}{a}}$$

Hence $t_{1/2}$ depends on rate constant & initial concentration, but $t_{1/2}$ is inversely proportional to initial concentration of reacting species.

Half life of zero order reaction:

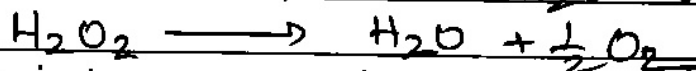
$$k = \frac{1}{t} (A_0 - A) \quad \text{or} \quad \frac{[A_0] - [A]}{t}$$

$$\text{When } t = t_{1/2} \text{ then } A = \frac{A_0}{2}$$

$$\boxed{t_{1/2} = \frac{A_0}{2k}}$$

Kinetics of decomposition of H_2O_2 : $\rightarrow$

Hydrogen peroxide decomposes very fast and convert into H_2O & O_2 .



It's Kinetics can be studied in two ways

- 1) The volume of O_2 gas collected is noted at different intervals of time & the result will be calculated by decomposition of H_2O_2

Volume of O_2 gas collected at zero any time '0' (V_0)	Amount of H_2O_2 ^{taken initially} decomposed _{sec = 0}
then $a \propto V_0$	

Volume of O_2 gas collected at any time 't' (V_t)	Amount of H_2O_2 decomposed at time ($a-x$)
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Hence $(a-x) \propto V_t$

If we set it on 1st order kinetic equation

i.e. $k = \frac{2.303}{t} \log \frac{a}{a-x}$

OR $k = \frac{2.303}{t} \log \frac{V_0}{V_t}$

II When H_2O_2 solution is titrated against $KMnO_4$ solution $\rightarrow$ At the interval of time usually 5 cc of H_2O_2 is taken and titrated it against $KMnO_4$ solution, and it is repeated.

Volume of KMnO_4 solution used before the starting of reaction (at zero time), then the initial volume is V_0

Initial concentration of H_2O_2 is 'a'

$$\text{So } a \propto V_0.$$

Volume of KMnO_4 solution used at any time i.e. 't' then its volume is V_t

Volume of H_2O_2 present at that time is ' $a - x$ '.

$$\text{i.e. } (a - x) \propto V_t$$

If the above values are substituted to 1st order reaction we get

$$k = \frac{2.303}{t} \log \frac{V_0}{V_t}$$

