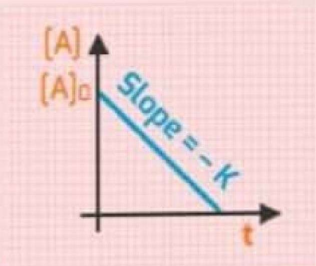
ORDER OF REACTION

Zero Order Reactions

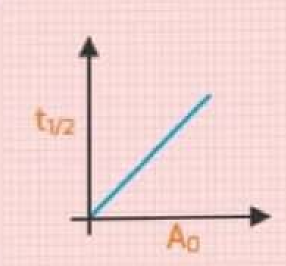


A zero order reaction has a constant rate that is independent of the concentration of the reactant(s); the rate law is simply. **Rate = k**

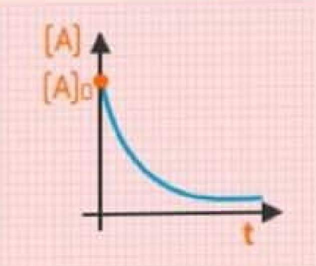
HALF LIFE ($t_{1/2}$)

Time in which half of inital amount is left.

$$t_{1/2} = \frac{[A]_0}{2k}$$



First Order Reactions

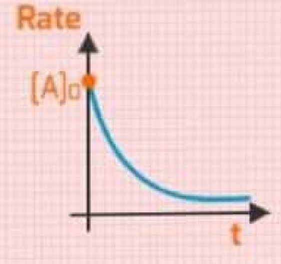


A first-order reaction is a reaction that proceeds at a rate that depends linearly on only one reactant concentration.

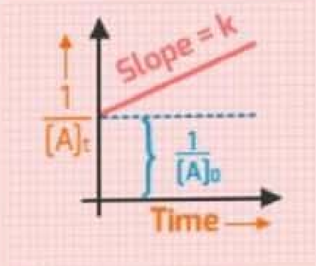
$$k = \frac{2.303}{t} \log \frac{[A]_0}{[A]}$$

HALF LIFE ($t_{1/2}$)

$$t_{1/2} = \frac{0.693}{k} \qquad [A] = \frac{[A]_0}{2^n}$$



Second Order Reactions

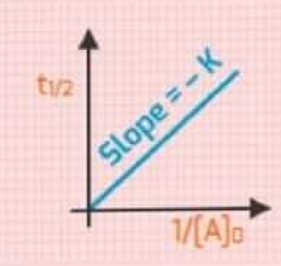


A chemical reaction in which the rate of the reaction is determined by the concentration of two chemical reactants involved or the square of the concentration of one chemical reactant.

$$k = \frac{1/[A] - 1/[A]_0}{t}$$

HALF LIFE ($t_{1/2}$)

$$t_{1/2} = \frac{1}{k[A]_0}$$

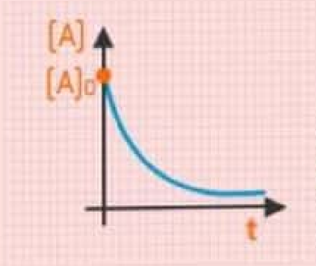


Pseudo first order reactions

If the concentration of a reactant remains constant (because it is a catalyst or it is in great excess with respect to the other reactants), its concentration can be included in the rate constant, obtaining a pseudo–first-order (or occasionally pseudo–second-order) rate equation.

For example, the hydrolysis of sucrose in acid solution rate r = k[sucrose]. The true rate equation is third-order, r = k[sucrose] [H+] [H_2O]; however, the concentrations of both the catalyst H^+ and the solvent H_2O are normally constant, so that the reaction is pseudo–first-order.

N^{th} order reactions



N_{th} order reaction is one which proceeds at the rate that depends on concentration of multiple reactants or on multiple steps.

$$\Rightarrow k = \frac{1}{(n-1)\,t}\left[\frac{1}{[A]_t^{n-1}} - \frac{1}{[A]_o^{n-1}}\right]$$

HALF LIFE ($t_{1/2}$)

$$t_{1/2} = \lim_{x \to n} \frac{2^{x-1}-1}{(x-1)\,k[A]_0^{x-1}}$$