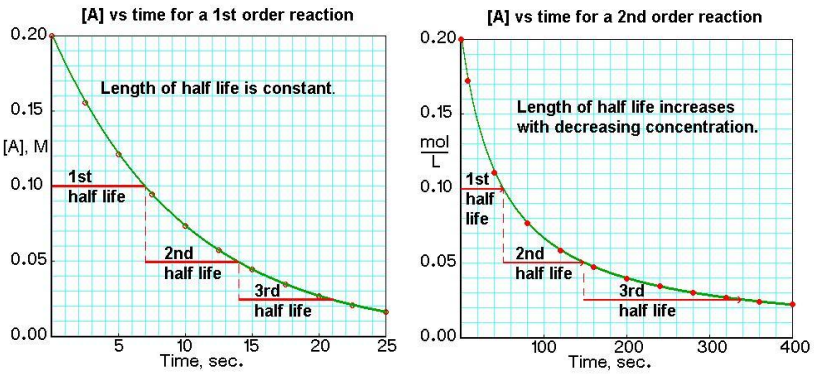
Half Life: Time for ½ of a initial concentration of the reactant(s) to be consumed.

First half life…..when 50 % (1/2) of the initial concentration has disappeared.
2nd Half life…..when 75% of the initial concentration has been consumed.



Half lives are only constant for first order reactions.

Equations for Half Lives

For a zero order reaction $A_{(s)} \rightarrow$ products , rate = $k[A]^0$:

$t_{½} = [A_o] / 2k$

For a first order reaction $A \rightarrow$ products , rate = k[A]:

$t_{½} = 0.693 / k$

For a second order reaction $2A \rightarrow$ products or $A + B \rightarrow$ products (when [A] = [B]), rate = $k[A]^2$:

$t_{½} = 1 / k [A_o]$

Determining a Half Life

To determine a half life, $t_{½}$, the time required for the initial concentration of a reactant to be reduced to one-half its initial value, we need to know:

- The order of the reaction or enough information to determine it.
- The rate constant, k, for the reaction or enough information to determine it.
- In some cases, we need to know the initial concentration, $[A_o]$

Substitute this information into the equation for the half life of a reaction with this order and solve for $t_{½}$. The equations are given above.

Converting a Half Life to a Rate Constant

To convert a half life to a rate constant we need to know:

- The half life of the reaction, $t_{½}$.
- The order of the reaction or enough information to determine it.
- In some cases, we need to know the initial concentration, $[A_o]$

Substitute this information into the equation for the half life of a reaction with this order and solve for k