**Methods to Determine Order of Reaction**

1. **Graphical method**



Graphs are plotted of rate of reaction against concentration and the initial rate determined from the gradient at time = 0.

* If it is a straight line the reaction is first order.
* If a curve is obtained then we can say it is 2nd order reaction.
* A reaction which is independent on concentration is zero order.
1. **Data plotting method**:
* Plot of conc. against time is if linear then it is zero order reaction.
* Plot of 1/C against time is linear then second order.
* Plot of ln C against time is linear then first order reaction.
1. **Half-life determination method:**

The relationship in general between half-life of a reaction in which the concentrations of all reactants are identical, is t1/2 ∞ 1/a(n-1) Where n is the order of reaction.

1. **Van't Hoff Differential Method**
* As we know that, the rate of a reaction varies as the nth power of the concentration of the reactant where 'n' is the order of the reaction.
* Thus, for two different initial concentrations C1 and C2, equations can be written in the form

 ….(i)

and

....(ii)

Taking logarithms,

Subtracting Eq. (ii) from (i),



or

**n = [log(-(dC1)/dt)-log((dC2)/dt)] ÷ [logC1 - log C2]     ....(iii)**

* -dc1/dt and -dc2/dt are determined from concentration vs. time graphs and the value of 'n' can be determined.

**Pseudo unimolecular Reactions**

There are a number of reactions, which follow the first order kinetics though more than one kind of reactants is involved in the reaction. Common examples are the inversion of cane sugar or the hydrolysis of an ester in an acid medium.

C12 H22 O11 +H2O = 2 C6 H12 O6

CH3COO C2H5 +H2O = CH3COOH +C2H5OH

These are truly second order reactions. Two substances water and cane sugar, or water

and ester participate, but the rate of reaction is experimentally observed to depend only

on the concentration of cane sugar or ester.