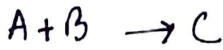


## Chemical kinetics:-

When we study about a reaction some basic questions arises in our mind, suppose for a reaction -



Is the reaction energetically feasible? We know metallic sodium reacts with water but not gold. Because for first one it is energetically feasible but second one not. But for a unknown reaction the answer is given by Thermodynamics. In a reaction if  $\Delta G = (-)$  then the reaction will be feasible but if  $\Delta G = +ve$  then not.

Similarly, upto what extent the reaction will proceed. The answer is thermodynamic  $\Delta G = -RT \ln K$  where  $K$  equm constant.

But how fast the reaction will be and what will be its mechanism, the answer lies on chemical kinetics.

## Rate of a reaction:-

If two friends decide to reach a certain destination with their motor cycle and starts their journey at a same time, who will reach earlier? The answer is simply, the person who have greater speed. Similarly for a reaction goes greater extent which have greater speed, eg Na reacts with water almost immediately but Mg slowly.

Now speed of a reaction is here we call rate of reaction. It means amount of product increase at unit time, similarly it means amount of reactant left at unit time. i.e. Rate of a reaction means the rate of advancement of a overall reaction and advancement of a reaction is considered as unity when stoichiometric amount of any one of reactant undergoes the reaction.

Suppose a reaction



if  $d\xi$  be the advancement of the reaction at very short time  $dt$ .

then

$$dn_A = -m dx$$

$$dn_B = -n dx$$

$$dn_C = p dx$$

$$dn_D = q dx$$

$$\frac{dn_A}{dt} = -m \frac{dx}{dt}$$

$$\frac{dx}{dt} = -\frac{1}{m} \frac{dn_A}{dt}$$

$$\frac{dx}{dt} = -\frac{1}{n} \frac{dn_B}{dt}$$

$$\frac{dx}{dt} = \frac{1}{p} \frac{dn_C}{dt}$$

$$\frac{dx}{dt} = \frac{1}{q} \frac{dn_D}{dt}$$

∴ where  $\left(\frac{dx}{dt}\right)$  = degree of advancement of the reaction  
 or advancement of a reaction per unit time.

now

$$-\frac{1}{m} \frac{dn_A}{dt} = -\frac{1}{n} \frac{dn_B}{dt} = \frac{1}{p} \frac{dn_C}{dt} = \frac{1}{q} \frac{dn_D}{dt}$$

where  $n_A$  mole of 'A' or  $dn_A$  change of mole of 'A'

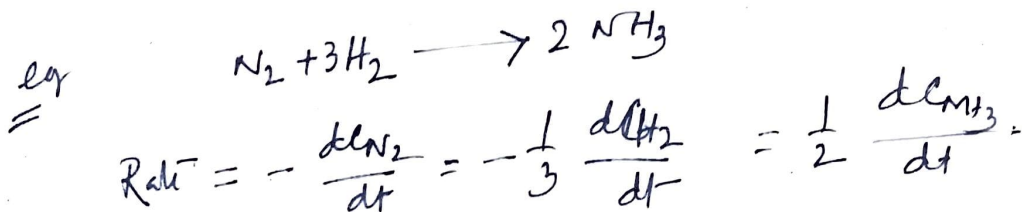
now we know that  $\frac{n}{V} = C$  (concentration)

So

$$\frac{1}{V} \frac{dx}{dt} = -\frac{1}{V} \left( \frac{1}{m} \frac{dn_A}{dt} \right) = -\frac{1}{m} \frac{d(n_A/V)}{dt} = -\frac{1}{m} \frac{dc_A}{dt}$$

i.e.  $\left(\frac{1}{V} \frac{dx}{dt}\right)$  is called rate of a reaction.

∴ degree of advance of a reaction at unit volume is called rate of a reaction.



or in general-

$$\text{Rate} = \frac{1}{\nu_i} \frac{dc_i}{dt}$$

where  $\nu_i$  = stoichiometric coefficient of  $i$ th constituent.