CHEMICAL KINETICS

INTRODUCTION OF CHEMICAL KINETICS

❖ Introduction of Chemical Kinetics

Chemical kinetics is an important topic in Physical Chemistry and basically deals with helping students understand the different aspects of a chemical reaction. More specifically, the term 'kinetics' deals with the rate of change of some quantity. For example, the rate of change of displacement is given as velocity. Likewise, acceleration is the rate of change of velocity.

Usually, based on this rate, chemical reactions can be classified as fast (eg: $Na + H_2O$), Moderate ($Mg + H_2O$) and slow (esterification) reactions. In this article, we will learn more about chemical kinetics and see ways to quantify the rate of a reaction and look into various factors which affect the rate of reaction.

Chemical kinetics also called reaction kinetics helps us understand the rates of reactions and how it is influenced by certain conditions. It further helps to gather and analyze the information about the mechanism of the reaction and define the characteristics of a chemical reaction.

Types of reaction: -
Classification of reactions:
[In terms of rates]

1. There are certain reactions which are too slow e.g. rusting of iron, weathering of rocks.
2. Instantaneous reactions i.e. too fast e.g. Detonation of explosives, acid-base neutralization, precipitation of AgCl by NaCl and $AgNO_3$.
3. Neither too fast nor too slow e.g. combination of H_2 and Cl_2 in presence of light, hydrolysis of ethyl acetate catalyzed by acid, decomposition of azomethane

Rate/speed of velocity of reaction: -

Rate of reaction:

The change in concentration of either reactant or product per unit time.

Formula: $v = \pm\frac{dc}{dt}$

- dc = change in concentration in a small interval dt.
- [–] sign is used when we refer to reactant concentration.
- [+] sign is used when we refer to product concentration.

Ex. $N2 + 3H2 \rightarrow 2NH3$

1. Rate of formation of ammonia $= + \frac{d[NH_3]}{dt}$
2. Rate of disappearance of nitrogen $= - \frac{d[N_2]}{dt}$
3. Rate of disappearance of hydrogen $= - \frac{d[H_2]}{dt}$
4. Rate of reaction $= + \frac{1}{2}\frac{d[NH_3]}{dt} = - \frac{d[N_2]}{dt} = - \frac{1}{3}\frac{d[H_2]}{dt}$

Thus, Rate of reaction $= - \frac{d[N_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

or rate of formation of ammonia = Twice the rate of disappearance of nitrogen

i.e. $\frac{d[NH_3]}{dt} = \frac{2}{3}\left[- \frac{d[H_2]}{dt}\right]$