

3.2. CHEMICAL KINETICS

IMPORTANT POINTS

- 1. Chemical kinetics** is concerned with the study of the **speed** of chemical reactions. Chemical kinetics deals with the Rates of reactions, Factors that affect them and the Mechanism by which the reactions take place.
- The chemicals that are used to start a reaction are called **reactants**.
 - The chemicals that are formed in the reaction are called **products**.
 - The amount of substance reacting per unit time is called **rate of reaction**.
 - On the basis of speed of reaction, chemical reactions are divided as follows.
 - i) Fast / Instantaneous reactions**
 - ii) Slow reactions:**
 - iii) Moderate reactions:**

☞ Reactions that take place violently and explosively are called **explosive** reactions.
Ex: Reaction of H_2 and F_2 in the presence of light. $H_2(g) + F_2(g) \rightarrow 2HF(g)$
- 3. Rate of reaction:** During a chemical reaction, as time passes, the concentration of reactants decreases and concentration of products increases. Hence, the rate of reaction is defined as the change in molar concentration of any one of reactants or products per unit time. Consider a hypothetical reaction $A \rightarrow B$. Then
 - i) Rate of reaction of A** is $\frac{-dc}{dt}$ (or) $-\frac{d[A]}{dt}$
 Here dc is the small decrease in the concentration of A in a small interval of time dt . $[A]$ represents the molar concentration of A.
 - ii) Rate of reaction of B** is $\frac{dc}{dt}$ (or) $\frac{d[B]}{dt}$
- 4. Factors effecting the reaction rates:**
 - i) Chemical nature of reactants:** The reactions between **ionic** compounds in solutions are **very fast** (instantaneous). The reactions between **covalent** compounds are generally **slow**.
 - ii) Concentration of reactants:** According to law of mass action, the rate of reaction is directly proportional to the product of the concentrations of the reactants.
 - iii) Temperature of the reaction:** In many reactions, the specific rate (k) of a reaction becomes double (approximately) for every $10^\circ C$ raise of temperature
 - iv) Catalyst:** Catalyst increases the rate of reaction by changing the path having low activation energy. As the activation energy decreases, the rate of reaction increases..
- 5. Rate equation or Rate law:**
 The mathematical equation that relates the rate of reaction to concentration of reactants is known as rate equation .
- 6. Order of reaction :** The sum of the powers of the concentration terms in the rate equation is called the order of reaction
- 7. Molecularity of the reaction:** The total number of reactant molecules taking part in the slowest step or rate determining step is known as molecularity of the reaction. It is always an integer and it does not exceed 3.

FORMULA BOX

- Rate constant, $k = \frac{2.303}{t} \log \frac{a}{(a-x)}$
- Half life period for first order reactions,

$$t_{1/2} = \frac{0.693}{k}$$

Our Daily LIFE

CHEM BEATS!

• ప్రస్తుత స్పీడ్ యుగంలో పనులన్నీ స్పీడ్స్పీడ్ గా జరిగిపోవాలని నిత్యం అనేకమంది 'అత్రం' పడుతుంటారు.

- మన సెల్ ఫోన్ బ్యాటరీ **Fast** గా ఛార్జింగ్ అవ్వాలి!
- మనం తిన్న **Food** ఫాస్ట్ గా **Digestion** కావాలి!
- వచ్చిన జబ్బుల నుండి 'త్వరగా' కోలుకోవాలి!
- బట్టలకు పట్టిన మురికి 'వెంటనే' తొలిగిపోవాలి!
- జుట్టుకి వేసిన **Hair dye** 'ఎక్కువ రోజులు' ఉండాలి!

• ఫ్రిడ్జ్ లో ఉంచిన ఆహారం 'ఎక్కువ కాలం' చెడిపోకుండా ఉండాలి!

• **Obesity** ఉన్న వారు డైటింగ్, ఎక్సర్ సైజ్ ప్రారంభించిన వెంటనే వేగంగా బరువు తగ్గాలి!

ఇలా రోజువారీ జరిగే నిత్యకృత్యాలలో కొన్ని **Speed** గా జరగాలి మరికొన్ని **Slow** గా జరగాలి!

ఇటువంటి విషయాలను **Micro Level** లో వివరించి, విశ్లేషించే రసాయనశాస్త్ర విభాగమే **CHEMICAL KINETICS!**