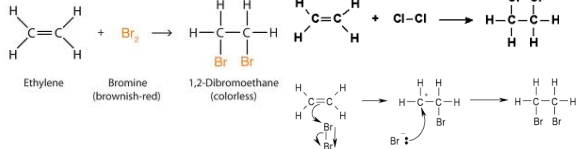


CHAPTER: 14 – PRINCIPLES OF METALLURGY

PERIOD PLAN-13 : Chemical properties of carbon compounds
Addition and substitutions

Content Analysis	Class Room Environment	Teaching Learning Material
<p>Addition reactions of Carbon compounds: A reaction which one molecule combines with another to form only one new large molecule is called addition reaction. Unsaturated organic compounds that contain multiple bonds (either double bond or triple bond) like alkenes and alkynes undergo addition reactions to become saturated. During this addition reactions the addition of the reagent takes place at the double bond or triple bond. This means C=C converts to C-C and two atoms bonded to both carbons with single bond. C≡C converts to C=C or C-C and respectively one or two atoms bonded to both carbons with single bond</p> <p>Catalyst: A catalyst is a substance which regulates the rate of a given reaction without itself finally undergoing any chemical change. Catalyst is a substance that increase or decrease the rate of reaction without involve in the reaction.</p> <p>Example: Ni, Pt, V₂O₅, MnO₂, KMnO₄, K₂Cr₂O₇ like substances are generally used as catalysts.</p> 	<p>Conversation: Addition reactions of hydrocarbons like alkenes and alkynes. Why alkenes and alkynes can participate in addition reactions? Alkanes does not participate in addition reactions. Why?</p> <p>Example:</p> <p>(i)</p> $\text{CH}\equiv\text{CH} \xrightarrow[\text{H}_2]{\text{Ni catalyst}} \text{CH}_2=\text{CH}_2 \xrightarrow[\text{H}_2]{\text{Ni Catalyst}} \text{CH}_3-\text{CH}_3$ <p style="text-align: center;">Ethyne Ethene Ethane</p> <p>(ii) Formula of a compound is C₃H₆. Structure:</p> $\begin{array}{c} \text{H} & & \text{H} & & \text{H} \\ & & & & \\ \text{H}-\text{C} & - & \text{C} & = & \text{C}-\text{H} \\ & & & & \\ \text{H} & & & & \end{array}$ <p>It is unsaturated hydrocarbon. So it participates in addition reactions.</p> <p>Ex: C₃H₆ + H₂ → C₃H₈</p> $\begin{array}{c} \text{H} & & \text{H} & & \text{H} \\ & & & & \\ \text{H}-\text{C} & - & \text{C} & - & \text{C}-\text{H} \\ & & & & \\ \text{H} & & \text{H} & & \text{H} \end{array}$ <p>Explanation: About catalyst reactions. Definition of a catalyst. Examples of catalysts.</p>	<p>Chart (Contains some addition reactions)</p>
<p>Hydrogenation of oils: Oils are unsaturated substances. These are having C=C or C≡C bonds in them. They were made to react with hydrogen in the presence of Nickel catalyst at 450°C to get saturated fats like vanaspathi, dalda.</p>	<p>Explanation: about the industry of making dalda from vegetable oils.</p> <p>Example: In a vegetable ghee industry, the unsaturated vegetable oils were reacted with hydrogen in the presence if Nickel catalyst at 450°C temperature. They produce saturated fats like ghee. This is an example of Addition reaction.</p> $\text{Vegetable oil} + \text{H}_2 \xrightarrow{\text{Ni}} \text{Fat like ghee}$	<p>Chart (Contains hydrogi-nation of oils, addition reactions)</p>
<p>Substitution reactions of Carbon compounds: A reaction in which an atom or a group of atoms in a given compound is replaced by other atom or group of atoms is called a substitution reaction. Alkanes, the saturated hydrocarbons are chemically least reactive. Therefore they are also called <i>paraffins</i> (<i>parum</i> = little; <i>affins</i> = affinity). However they undergo some chemical changes under suitable conditions which are substitution reactions.</p> <p>Ex: Methane (CH₄) reacts with chlorine in the presence of sunlight. Hydrogen atoms of CH₄ are replaced by chlorine atoms.</p>	<p>Conversation: About substitution reactions. Why alkanes participate in substitution reactions?</p> <p>Example:</p> $\text{CH}_4 + \text{Cl}_2 \longrightarrow \text{CH}_3\text{Cl} + \text{HCl}$ <p style="text-align: center;">Methane Methyl Chloride</p> $\text{CH}_3\text{Cl} + \text{Cl}_2 \longrightarrow \text{CH}_2\text{Cl}_2 + \text{HCl}$ <p style="text-align: center;">Methyl Chloride Methylene Chloride</p> $\text{CH}_2\text{Cl}_2 + \text{Cl}_2 \longrightarrow \text{CHCl}_3 + \text{HCl}$ <p style="text-align: center;">Methylene Chloride Chloroform</p> $\text{CHCl}_3 + \text{Cl}_2 \longrightarrow \text{CCl}_4 + \text{HCl}$ <p style="text-align: center;">Chloroform Carbon Tetrachloride</p>	<p>Chart (Contains some substitution reactions)</p>