# PREPARATION /

#### + From unsaturated hydrocarbons

$$CH_2 = CH_2 \xrightarrow{Pt/Pd/Ni} CH_3 - CH_3$$

#### + From alkyl halides

$$CH_3 - CH_2 - CI \xrightarrow{Zn} C_2H_6 + Na$$

#### + Wurtz RX

$$2CH_3$$
— $Cl + Na \xrightarrow{dry ether} CH_3CH_3$ 

# **→** From carboxylic acids

$$CH_3COO^{T}Na^{+} + NaOH \xrightarrow{CaO} CH_4 + Na_2CO_3$$

# + Kolbe's Electrolytic Method

$$2CH_3COONa^+ + 2H_2O \xrightarrow{\text{electrolysis}}$$
  
 $CH_3-CH_3 + 2CO_2 + H_2 + 2NaOH$ 

#### **PHYSICAL PROPERTIES** /

- → Generally, Non-polar in Nature.
- → Boiling point 

  Molecular mass

#### **CHEMICAL PROPERTIES**

$$CH_4 + Cl_2 \xrightarrow{UV} CH_3Cl + HCl$$

# Substitution Reaction → Halogenation

# - 1. Initiation ----

$$Cl_2 \xrightarrow{hv} \dot{C}l + \dot{C}l$$

2. Propagation
$$CH_4+\dot{C}l\longrightarrow \dot{C}H_3+HCl$$

$$\dot{C}H_4+Cl\longrightarrow \dot{C}H_4Cl+\dot{C}l$$

$$3. Termination$$

$$\dot{Cl} + \dot{Cl} \longrightarrow Cl_2$$

#### + Combustion

$$C_x H_y + (x + \frac{y}{4})O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$$

# + Isomerization

#### **→** Reaction with Steam

$$CH_4+ H_2O \xrightarrow{Ni} CO + 3H_2$$

# + Controlled Oxidation

$$CH_4 + O_2 \xrightarrow{Cu/523 \text{ K}} 2CH_3OH$$

$$CH_4+O_2 \xrightarrow{MO_2O_3} HCHO + H_2O$$

#### + Aromatic Reforming

#### + Pyrolysis

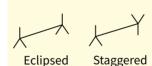
$$C_6H_{14} \xrightarrow{773 \text{ K}} C_6H_{12} + H_2$$
 $C_4H_8 + C_2H_6$ 
 $C_3H_6 + C_2H_4 + CH_4$ 

# ALKANES



#### CONFORMERS

#### **→** Sawhorse Projection



#### **→ Newman Projection**

# **10.HYDROCARBONS**

# **ALKENES**

C<sub>n</sub> H<sub>2n</sub>

#### **PREPARATION**

#### + From acidic dehydration of alcohols

$$HO-CH_{2}-CH_{3} \xrightarrow{conc. H_{2}SO_{4}} \xrightarrow{H} \xrightarrow{H} + H_{2}O$$

#### + From vicinal dihalides

$$\mathsf{Br}\mathsf{--CH}_2\mathsf{--CH}_2\mathsf{--Br} \xrightarrow{\mathsf{Zn}} \overset{\mathsf{H}}{\underset{\mathsf{H}}{\longleftarrow}} \overset{\mathsf{H}}{\underset{\mathsf{H}}{\longleftarrow}} \mathsf{+} \mathsf{ZnBr}_2$$

#### + From alkyl halides

$$CH_3-CH_2-X \xrightarrow{alc. KOH} H + Hx$$

# + From alkynes

$$R_2C = CR_1 + H_2 \xrightarrow{Pd/C} R_2$$

#### **PHYSICAL PROPERTIES**

- → Alkenes are insoluble in water but soluble non-polar solvents.
- → First few members are gases and rest are liquids & solids.

# **CHEMICAL PROPERTIES IN ALKENES**

#### **+ ELECTROPHILIC REACTIONS**

# $CH_3-CH=CH_2 \xrightarrow{cold conc.} CH_3-CH-CH_3$ $CH_{3}-CH=CH_{2}\xrightarrow{H_{2}O}CH_{3}-CH-CH_{3}$ OH

# → ADDITION OF HYDROGEN HALIDES —

#### Symmetrical Alkene

$$CH_2 = CH_2 + HBr \longrightarrow BrCH_2 - CH_3$$

# Asymmetrical alkene

$$CH_{3}-CH = CH_{2} + HBr$$
(I)  $CH_{3}CH BrCH_{3}$  (II)  $CH_{3}CH_{2}CH_{2}Br$ 

# + OXIDATION

$$CH_2 = CH_2 + H_2O \xrightarrow{\text{dil. KMnO}_4} CH_2 - CH_2 - CH_2$$

$$0H OH$$

#### + OZONOLYSIS

# **Anti-Markovnikov Effect / Kharash Effect/ Anti-Peroxide Effect**

This mechanism proceeds via free radical mechanism and the minor product via Markovnikov effect becomes major product. (II) is major product.

#### Markovnikov's rule

"Negative part of the addendum gets attached to the carbon containing lesser number of hydrogens". (I) is major product.

#### + POLYMERIZATION

n-(
$$CH_2$$
= $CH_2$ -) High temp.  $-(CH_2-CH_2-)_n$ 

CH2- $CH_2$ -CH2- $-$ 1

# **ALKYNES**

C<sub>n</sub> H<sub>2n-2</sub>

# **CHEMICAL PROPERTIES** /

#### **ELECTROPHILIC ADDITION**

$$HC \equiv CH \xrightarrow{Pt, Pd, Ni} CH_2 = CH_2 \xrightarrow{H_2} CH_3 - CH_3$$

$$HC \equiv CH \xrightarrow{Br_2} CH = CH$$

$$Br Br$$

$$HC \equiv CH \xrightarrow{H_2O} CH_2 = C - H$$

$$OH$$

$$HC \equiv CH \xrightarrow{HCI/} CH_3COOH$$

$$CH_2 = CH - H$$

$$OH$$

$$CH_2 = CH - H$$

# **PREPARATION**

#### + From Calcium Carbide

$$CaC_2 \xrightarrow{H_2O} C_2H_2 + Ca(OH)_2$$

#### **→ From Vicinal dihalides**

$$CH_{2} - CH_{2} - H + KOH$$

$$Cl \quad Cl$$

$$\downarrow \text{alcohol}$$

$$CH_{2} = CH_{2} - Cl \xrightarrow{\text{NaNH}_{2}} CH \equiv CH$$

#### **PHYSICAL PROPERTIES** /

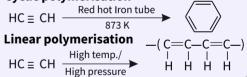
- ★ First few members of alkynes are gases.

- ◆ Soluble in non-polar solvents and insoluble in water.

# **POLYMERISATION**

**Cyclic polymerisation** 

Electrophilic



# **PHYSICAL PROPERTIES** /

- → Immiscible in water but completely soluble in polar solvents.
- → Characteristic smell.
- → Burn with a sooty flame.
- → Highly volatile in nature.

#### **AROMATICITY**

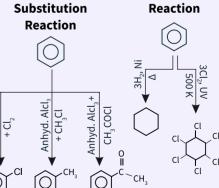
- 1. Planarity
- 2. Delocalisation of  $\pi$ -electrons.
- 3. Presence of  $(4n + 2)-\pi$  electrons.

**ARENES** 

Conc. H<sub>2</sub>SO<sub>4</sub> (323-333 K)

Conc. HNO<sub>3</sub>

# **CHEMICAL PROPERTIES** /



**Addition** 

### **PREPARATION**

+ Decarboxylation of carboxylic acids

+ Reduction of Phenol Using Zn Dust

$$OH \qquad Zn \qquad D + ZnO$$

Conc. H, SO<sub>4</sub> + SO<sub>5</sub>

**CARCINOGENICITY AND TOXICITY** Aromatic compounds are toxic in nature and most of them are classified as carcinogens.