

Although hydrocarbons are primarily consumed in fuels, non-fuel applications of hydrocarbons are of great importance to society and the economy. Certain hydrocarbons can be found in lubricating oils, greases, solvents, fuels, wax, asphalts, cosmetics and plastics.

### Saturated

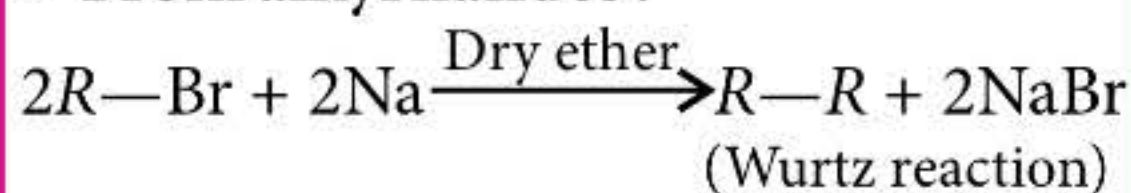
C—C single bonds present

### Alkanes

General formula,  $C_nH_{2n+2}$

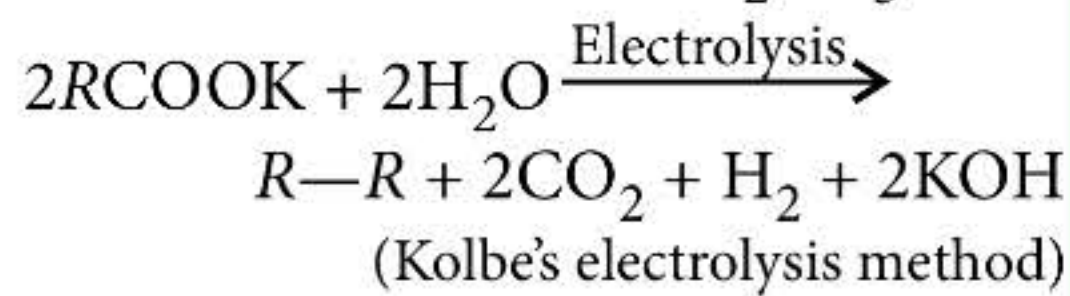
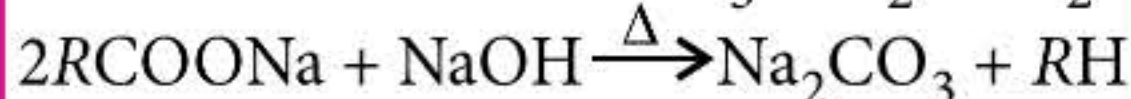
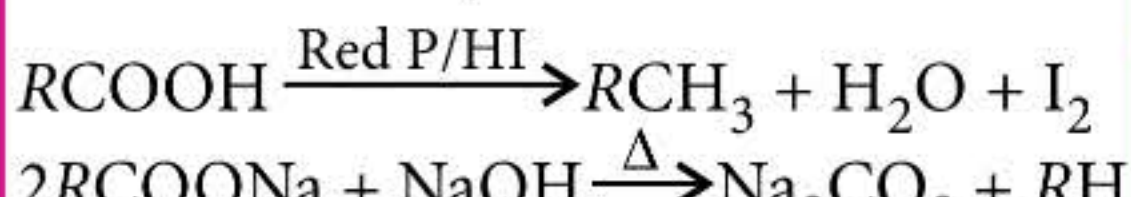
#### Preparation

- From alkyl halides:

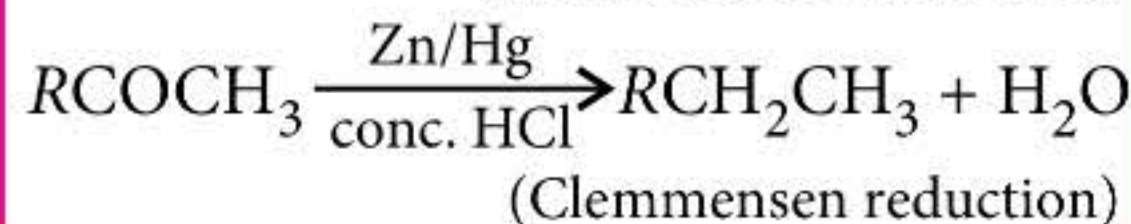
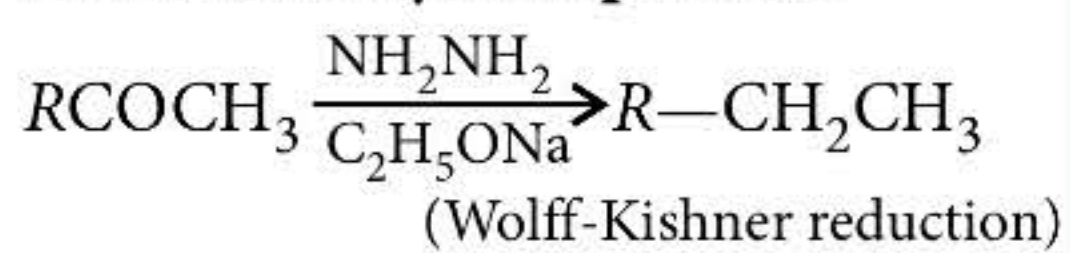


$R-X$  can be converted to alkane using  $Zn + CH_3COOH$ ,  $Zn + \text{dil. HCl}$ ,  $Zn-Cu + C_2H_5OH$ ,  $LiAlH_4$ ,  $Zn + NaOH$ ,  $NaBH_4$  and  $Ph_3SnH$  reducing agents.

- From carboxylic acids:

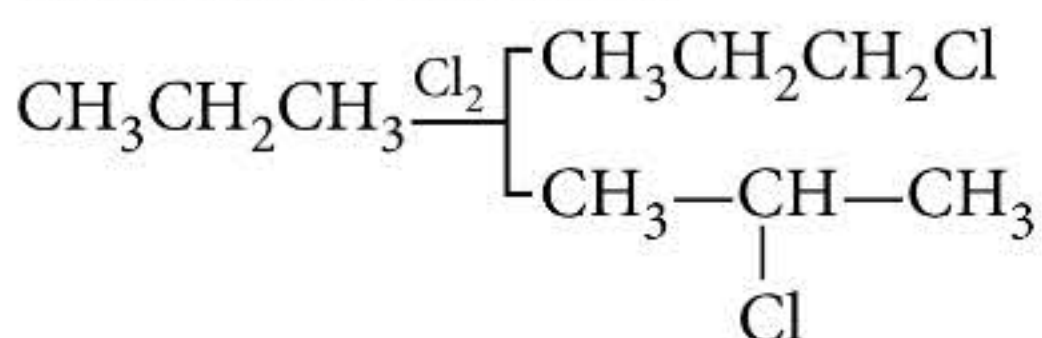


- From carbonyl compounds:



#### Properties

- Substitution reaction:



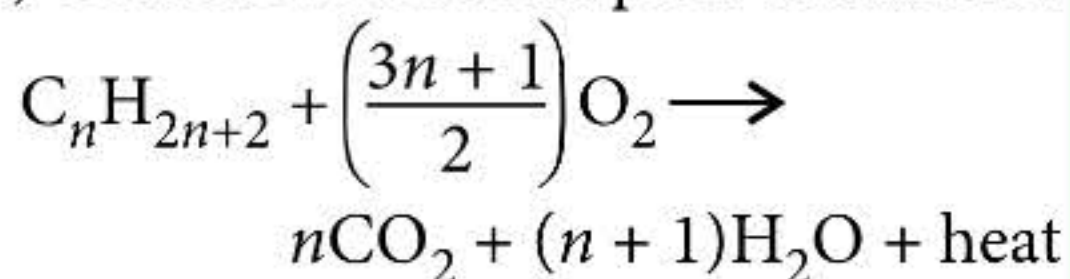
Order of reactivity:

Alkanes:  $3^\circ > 2^\circ > 1^\circ > CH_4$

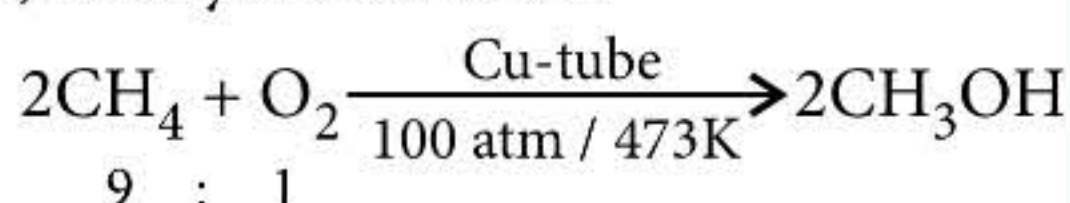
Halogens:  $F_2 > Cl_2 > Br_2 > I_2$

- Oxidation:

(a) Combustion or complete oxidation:



(b) Catalytic oxidation:



### Unsaturated

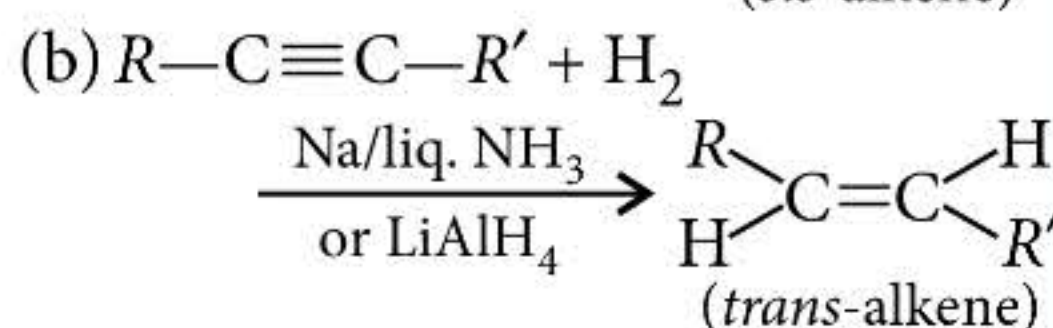
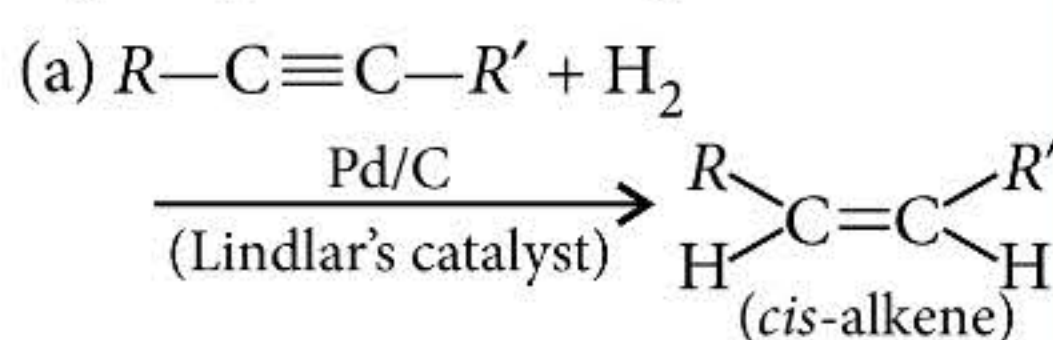
C—C multiple bonds present

### Alkenes ( $>C=C<$ )

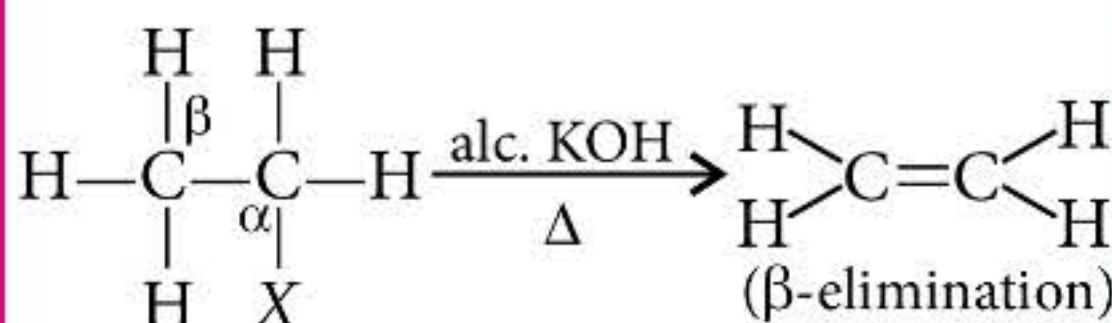
General formula,  $C_nH_{2n}$

#### Preparation

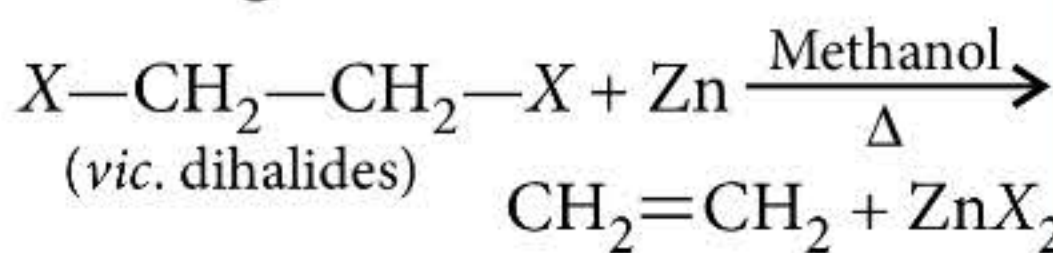
- Hydrogenation of alkynes:



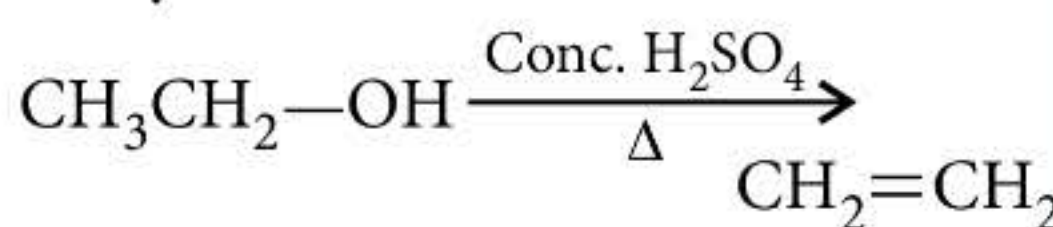
- Dehydrohalogenation:



- Dehalogenation:

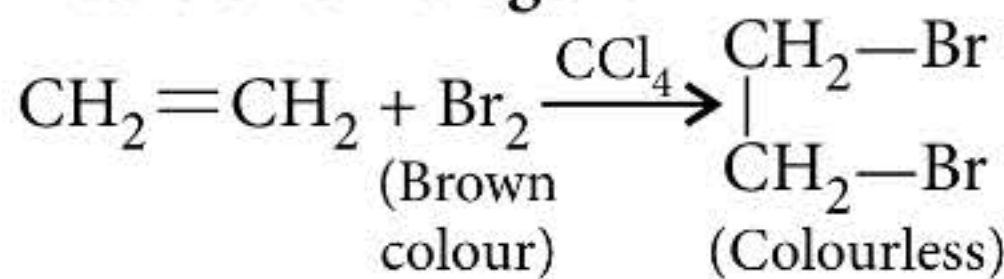


- Dehydration of alcohols:

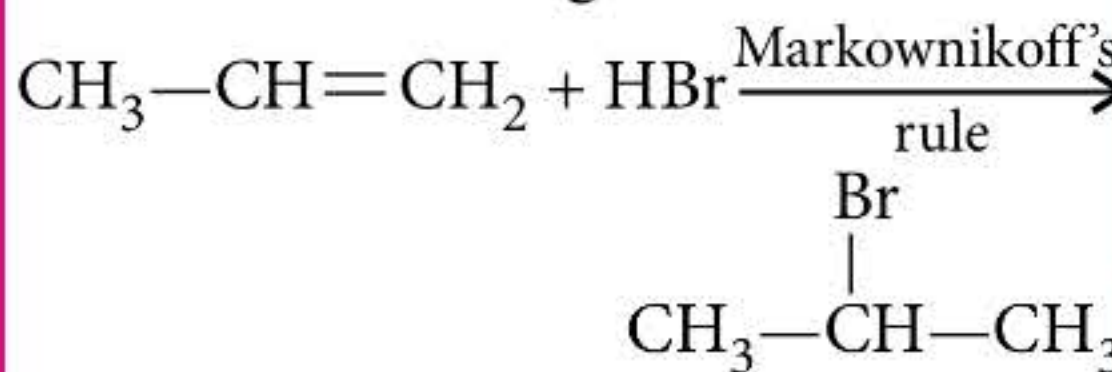


#### Properties

- Addition of halogen:

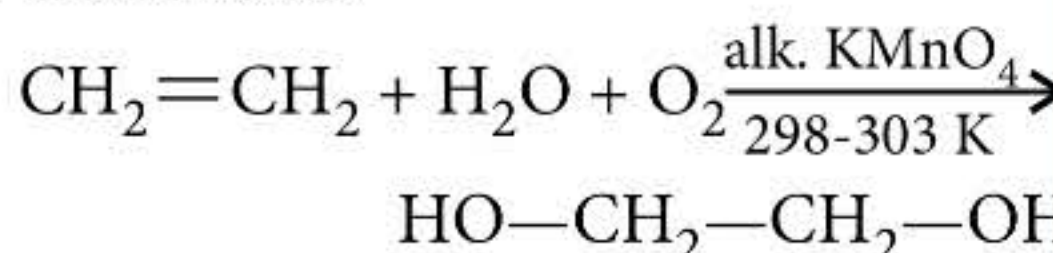


- Addition of halogen acid:



HBr addition in presence of peroxide follows *anti-Markownikoff's rule*, known as *Kharasch effect* or *peroxide effect*.

- Oxidation:

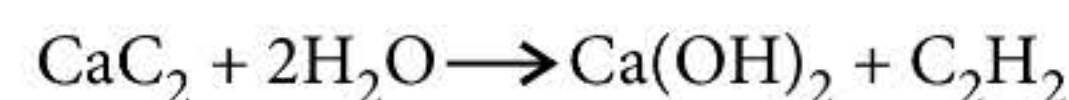


### Alkynes ( $-C\equiv C-$ )

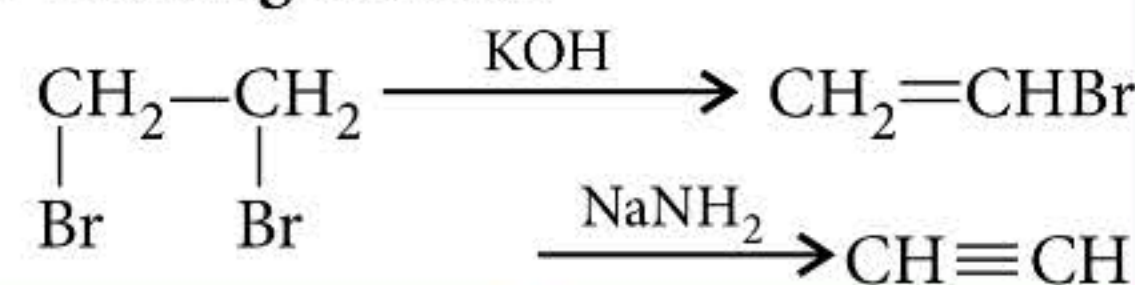
General formula,  $C_nH_{2n-2}$

#### Preparation

- From calcium carbide:

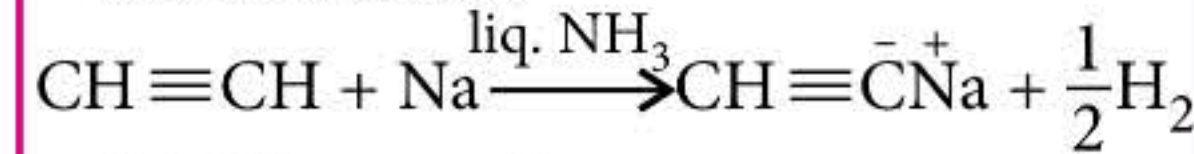


- Dehalogenation:

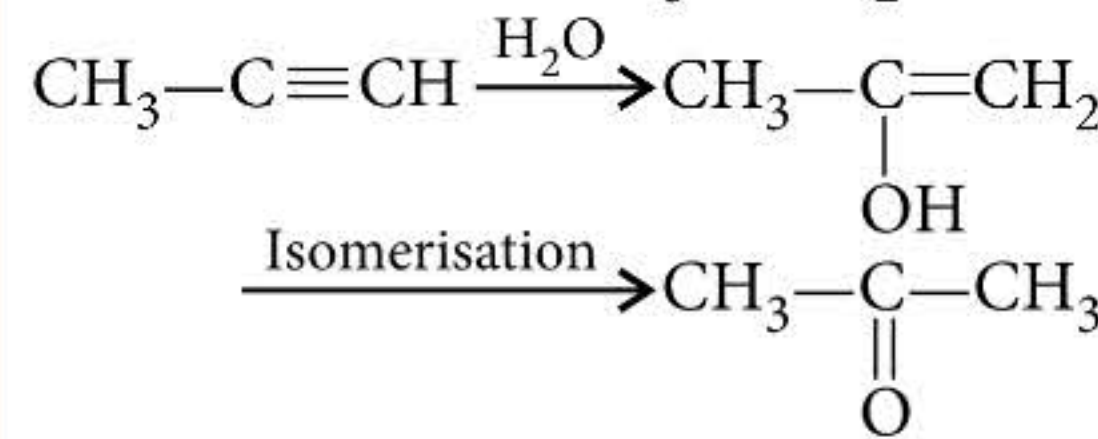
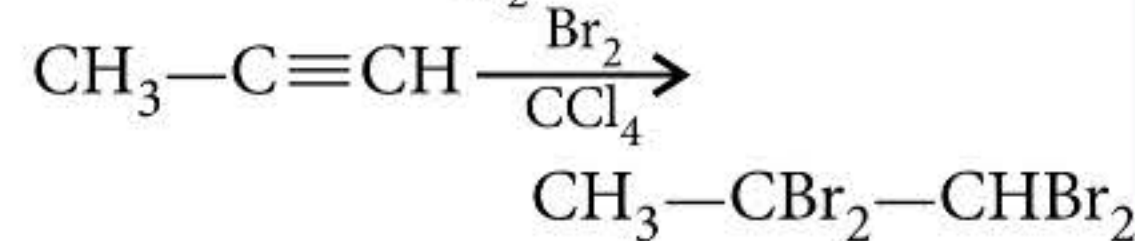
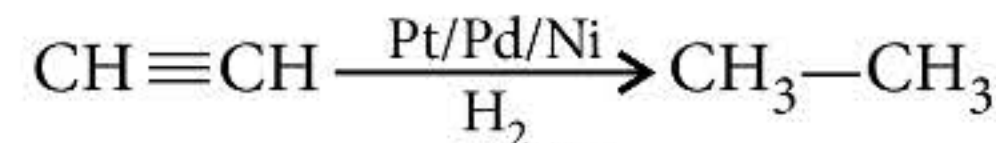


#### Properties

- Acidic nature:



- Addition reactions:



#### Commercial Uses

- Alkanes:** Ethane is used for making hexachloroethane which is an *artificial camphor*. Higher alkanes in the form of gasoline, kerosene oil, diesel, lubricating oils and paraffin wax are widely used.

- Alkenes:** Ethene is used as a general anaesthetic. It is a starting material for a large number of compounds such as glycol, ethyl halides, ethyl alcohol, ethylene oxide, etc.

- Alkynes:** Acetylene is used as a general anaesthetic under the name *naracylene*. Acetylene is used as an illuminant.