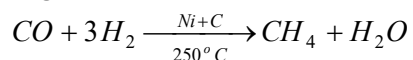


Individual members of alkanes.

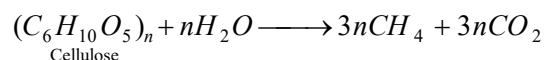
(1) **Methane:** Known as **marsh gas**.

(i) **Industrial method of preparation:** Methane gas is obtained on a large scale from natural gas by liquefaction. It can also be obtained by the application of following methods,

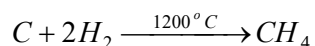
(a) From carbon monoxide: A mixture of carbon monoxide and hydrogen is passed over a catalyst containing nickel and carbon at $250^{\circ}C$ when methane is formed.



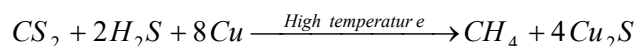
(b) Bacterial decomposition of cellulose material present in sewage water: This method is being used in England for production of methane.



(c) Synthesis: By striking an electric arc between carbon electrodes in an atmosphere of hydrogen at $1200^{\circ}C$, methane is formed.



By passing a mixture of hydrogen sulphide and carbon disulphide vapor through red hot copper, methane is formed.



(ii) **Physical properties**

(a) It is a colorless, odorless, tasteless and non-poisonous gas.

(b) It is lighter than air. Its density at NTP is 0.71 g/L.

(c) It is slightly soluble in water but is fairly soluble in ether, alcohol and acetone.

(d) Its melting point is $-182.5^{\circ}C$ and boiling point is $-161.5^{\circ}C$.

(iii) Uses

- (a) In the manufacture of compounds like methyl alcohol, formaldehyde, methyl chloride, chloroform, carbon tetrachloride, etc.
- (b) In the manufacture of hydrogen, used for making ammonia.
- (c) In the preparation of carbon black which is used for making printing ink, black paints and as a filler in rubber vulcanization.
- (d) As a fuel and illuminant.

(2) Ethane

(i) Methods of preparation

- (a) Laboratory method of preparation:
$$\underset{\text{Ethyl iodide}}{C_2H_5I} + 2H \xrightarrow[C_2H_5OH]{Zn-Cu \text{ couple}} \underset{\text{Ethane}}{C_2H_6} + HI$$
- (b) Industrial method of preparation:
$$\underset{\substack{\text{Ethylene} \\ \text{(ethene)}}}{CH_2 = CH_2} + H_2 \xrightarrow[300^\circ C]{Ni} \underset{\text{Ethane}}{CH_3 - CH_3}$$

(iii) Physical properties

- (a) It is a colorless, odorless, tasteless and non-poisonous gas.
- (b) It is very slightly soluble in water but fairly soluble in alcohol, acetone, ether, etc.
- (c) Its density at NTP is 1.34 g/L
- (d) It boils at $-89^\circ C$. Its melting point is $-172^\circ C$.

(ii) Uses

- (a) As a fuel. (b) For making hexachloroethane which is an artificial camphor.

(3) Interconversion of Alkanes

Ascent of alkane series,

- (i) **Methane to ethane:**
$$\underset{\text{Methane}}{CH_4} \xrightarrow[UV]{Cl_2} CH_3Cl \xrightarrow[\text{Heat with Na in ether}]{\text{Wurtz reaction}} \underset{\text{Ethane}}{CH_3 - CH_3}$$
- (ii) **Butane from ethane:**
$$\underset{\substack{\text{Ethane} \\ \text{(excess)}}}{C_2H_6} \xrightarrow[UV]{Cl_2} \underset{\text{Ethyl chloride}}{C_2H_5Cl} \xrightarrow[\text{Heat with Na in ether}]{\text{Wurtz reaction}} \underset{\text{Butane}}{C_2H_5 - C_2H_5}$$

Descent of alkane series: Use of decarboxylation reaction is made. It is a multistep conversion.

Ethane to methane

