# DIHYDROGEN

## Laboratory Preparation of Dihydrogen

(i) by the reaction of granulated zinc with dilute hydrochloric acid:
$Zn + 2H^+ \rightarrow Zn^{2+} + H^2$

(ii) by the reaction of zinc with aqueous alkali:
$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$

## Commercial Production of Dihydrogen

(i) Electrolysis of acidified water using platinum electrodes gives hydrogen:
$2H_2O\ (l) \rightarrow 2H_2\ (g) + O_2\ (g)$

(ii) High purity (>99.95%) dihydrogen is obtained by electrolysing warm aqueous barium hydroxide solution between nickel electrodes.

(iii) obtained as a byproduct in the manufacture of sodium hydroxide and chlorine by the electrolysis of brine solution. During electrolysis, the reactions that take place are:
at anode: $2Cl^-\ (aq) \rightarrow Cl_2(g) + 2e^-$
at cathode: $2H_2O\ (l) + 2e^- \rightarrow H_2(g) + 2OH^-\ (aq)$
The overall reaction is
$2Na^+\ (aq) + 2Cl^-\ (aq) + 2H_2O(l) \rightarrow Cl_2(g) + H_2(g) + 2Na^+\ (aq) + 2OH^-\ (aq)$

(iv) Reaction of steam on hydrocarbons or coke at high temperatures in the presence of catalyst:
$CH_4\ (g) + H_2O\ (g) \rightarrow CO\ (g) + 3H_2\ (g)$

**CHEMICAL PROPERTIES OF DIHYDROGEN**

(i) Reaction with halogens:
$H_2\ (g) + X_2\ (g) \rightarrow 2HX\ (g)$ (X F,Cl, Br,I)

(ii) Reaction with dioxygen
$2H_2(g) + O_2\ (g) \rightarrow 2H_2O(l)$; $\Delta H = -285.9\ kJ\ mol^{-1}$

(iii) Reaction with dinitrogen:
$3H_2\ (g) + N_2\ (g) \rightarrow 2NH_3\ (g)$ ;

(iv) Reactions with metals:
$H_2(g) + 2M(g) \rightarrow 2MH(s)$