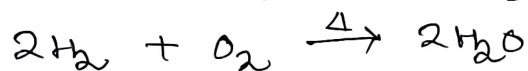
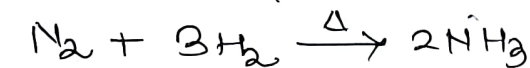


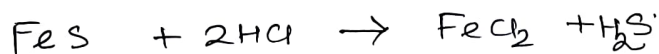
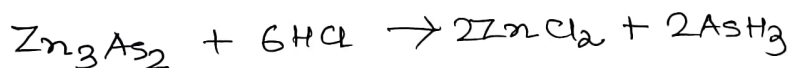
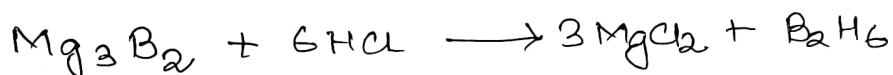
# Covalent hydride

## Preparation

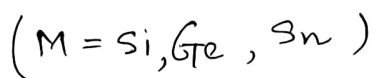
(i) By direct reaction of the free element with  $H_2$  at elevated temperature.



(ii) By the hydrolysis of compounds like borides, silicides and similar compounds. The hydrolysis may be effected either by  $H_2O$  only or dil. acid solution.



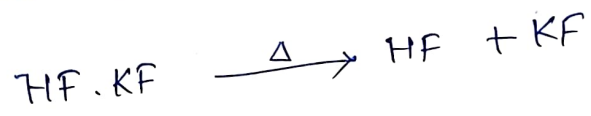
(iii) By reduction of appropriate anhydrous chloride in ether solution by  $Li[AlH_4]$ .



(iv) By decomposition of carbide with alkalis



(V) Halogen hydrides, HX may be obtained by heating double compounds such as HF.KF



(VI) Paneth and Rabino - Witsch's method - They prepared  $\text{SnH}_4$  by electrolysis of a sulphuric acid solution of  $\text{SnSO}_4$  containing glucose. The cell used had Pb-electrodes and the temperature kept was below  $50-60^\circ\text{C}$ .

### Properties

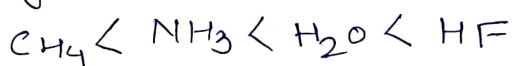
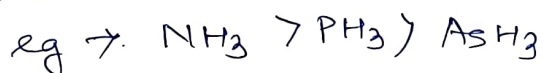
(i) Physical state  $\rightarrow$  Hydrides of groups 15, 16 and 17: the first element's hydride is always liquid due to H-bonding. Others are gases.

(ii) Hydrides of the elements of 2nd period are capable of H-bonding and hence has higher boiling points.

(iii) Electronegativity difference of C and H is very small, so, the hydrocarbons do not form H-bonds.

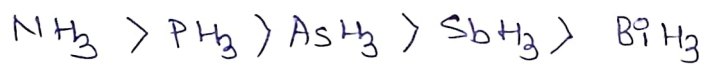
(iv) Relative stability - Size of the atom increases down the group. Relative stability decreases.

Across the period, electronegativity increases from left to right. So, relative stability increases in the same order.

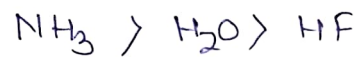


(v) Monomeric and polymeric form -  $\text{NH}_3$ ,  $\text{H}_2\text{O}$  and  $\text{HF}$  are found in  $(\text{NH}_3)_n$ ,  $(\text{H}_2\text{O})_n$  and  $(\text{HF})_n$  form due to H-bonding.

(vi) Basic strength  $\rightarrow$  Down the group electron density decreases. So basic strength decreases.

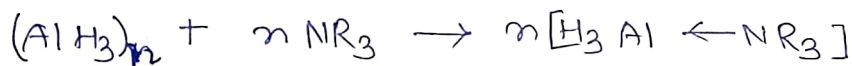


Across the period as electronegativity increases basic strength decreases.



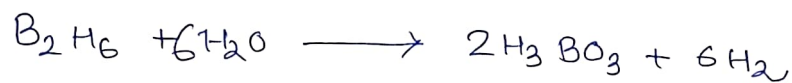
(vii) Property of acting as Lewis acid.

$\text{B}_2\text{H}_6$ ,  $(\text{AlH}_3)_n$  are electron deficient and accepts electrons. from  $\text{NR}_3$ ,  $\text{PR}_3$ ,  $\text{PF}_3$ ,  $\text{CO}$  etc.



(viii) Hydridic and Protonic Properties

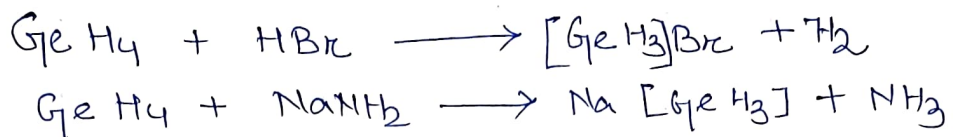
(a) Covalent hydrides having low electronegativity (eg.  $\text{B}_2\text{H}_6$ ) react with  $\text{H}_2\text{O}$  to produce  $\text{H}_2$  (hydrolysis) i.e.  $\text{B}_2\text{H}_6$  shows hydridic character.



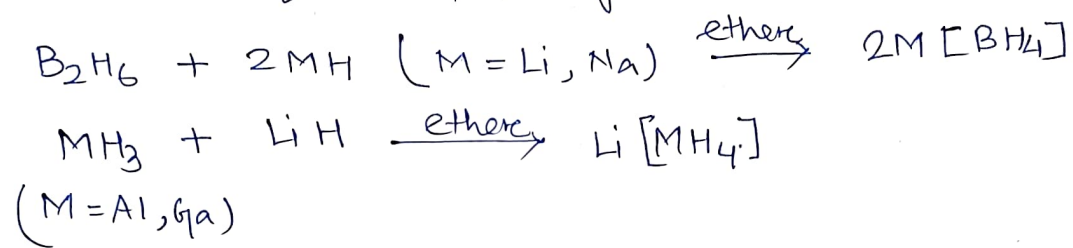
(b) The covalent hydrides of elements having high electronegativity (eg.  $\text{HCl}$ ) react with a base to give a salt and  $\text{H}_2\text{O}$ .  $\text{HCl}$  shows protonic property.



(C) The hydrides of the elements having intermediate electronegativity can show hydridic as well as protonic properties, For example —



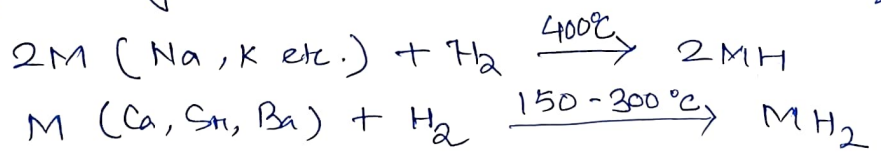
(IX) Formation of complex hydride



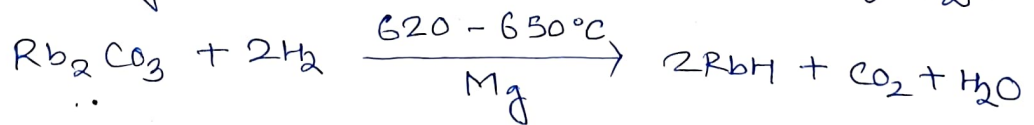
## Ionic hydrides

### Synthesis

(i) By heating metal in a current of  $\text{H}_2$



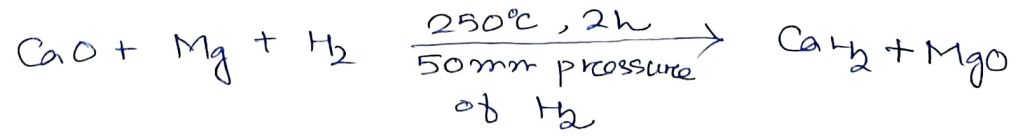
(ii) By heating carbonates in a current of  $\text{H}_2$ .



(iii) By heating metal nitride in a current of  $\text{H}_2$



(iv) By Alexander's method

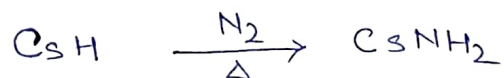


(VII) Reaction of ionic hydride with  $N_2$

a)  $LiH$  is oxidised by  $N_2$  forming  $LiNH_2$  (amide) and  $Li_2NH$  (imide) and  $Li_3N$  (nitride)



b)  $CsH$ , which is the most reactive hydride among the alkali metal hydrides, gives  $CsNH_2$  when heated with  $N_2$ .



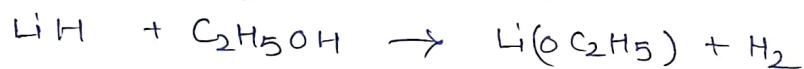
c)  $CaH_2$  gives  $Ca_3N_2$  with  $N_2$ .



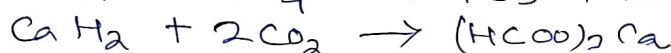
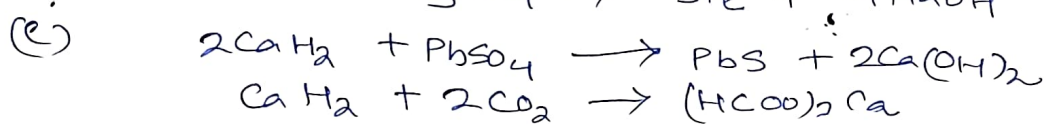
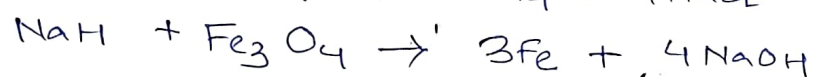
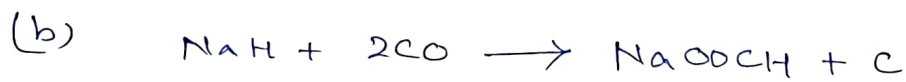
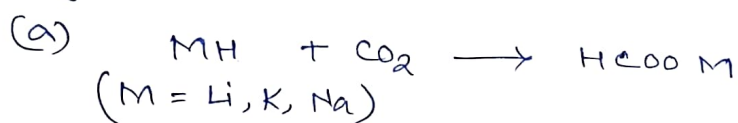
(VIII) Decomposition of by  $SO_2$



(IX) Action of protonic solvent and reducing properties.



Due to generation of  $H_2$ , these hydrides can reduce many substances.



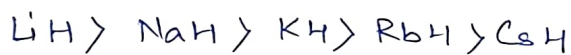
## Properties

- (I) a. Alkali metal hydrides are crystalline solids having ionic lattices.  
b.  $\text{CaH}_2$ ,  $\text{SrH}_2$  and  $\text{BaH}_2$  which are ionic hydrides of alkaline earth metals are white powders with ionic lattices.  
c. As ionic compounds, they have high m.p. and b.p. and conduct electricity in their fused state.

(II) Ionic / covalent character  $\rightarrow$  Ionic character increases down the group as polarising power decreases.  
 $\text{LiH} < \text{NaH} < \text{KH} < \text{RbH} \dots$

\*  $\text{BeH}_2$  is covalent,  $\text{MgH}_2$  is partly covalent and partly ionic.  $\text{CaH}_2$ ,  $\text{SrH}_2$ ,  $\text{BaH}_2$  are ionic.

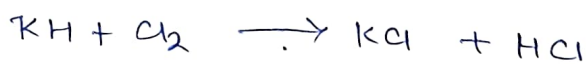
(III) Order of thermal stability, reactivity and heat of formation  $\rightarrow$  Thermal stability and heat of formation decreases down the group as ionic size increases.



Reactivity increases down the group.

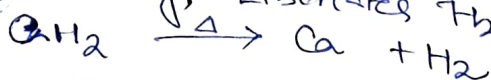
\*  $\text{LiH}$  can be heated upto red hot,  $\text{NaH}$  inflames in air at 500K,  $\text{KH}$  inflames at room temperature.

\*  $\text{LiH}$  does not react with  $\text{Cl}_2$ ,  $\text{NaH}$  reacts slowly and  $\text{KH}$  inflames.



(IV) Electrolysis  $\rightarrow$  In fused state  $\text{M}^+$  goes to cathode and  $\text{H}_2$  is liberated from anode.

(V) Action of air  $\rightarrow$  Some burn spontaneously and other catch fire on heating, liberates  $\text{H}_2$  which is inflammable.



(VI) Decomposition  $\rightarrow$  Except  $\text{LiH}$ , others decompose on fusion.

(X) Action of  $\text{BCl}_3$

