## Characteristic of Covalent Compound

SL AL

***(i)*** ***Physical state:-*** Covalent compounds are found in all the three states - Gas, Solid & Liquid.

Separate molecules – In gaseous state

Associate molecules – In liquid & solid state

(Due to strong vander waal's force and hydrogen bonding among the molecules.)

As the size of molecule increases physical state changes -

eg. $\underset{\text{gas}}{F_2, Cl_2} \longrightarrow \underset{\text{liquid}}{Br_2} \longrightarrow \underset{\text{solid}}{I_2}$

***(ii)*** ***Covalent solid :*** Those solids in which atoms are linked together by covalent bonds, forms inifinite three dimensional giant structure.

e.g. Diamond, Graphite, AlN, SiC, $SiO_2$ etc.

Molecular solid : Discrete (separate) molecules are formed by covalent bonds and then the molecules associated due to intermolecular force of attraction. (Vander waal force)

eg. Solid $I_2$, dry ice (Solid $CO_2$) etc.

**(iii) Conductivity : -** Mostly covalent compounds are bad conductor of electricity. But few polar covalent compounds due to self ionisation can conduct electricity.e.g. $H_2O$, liq. $NH_3$ etc.

$$H_2O + H_2O \rightleftharpoons H_3O^+ + OH^-$$

$$2NH_3 \rightleftharpoons NH_4^+ + NH_2^-$$

Free ions are formed which can conduct electricity.

***Exceptions:- Graphite, HCl in water.***

$HCl_{(aq)} \rightarrow H^+_{(aq)} + Cl^-_{(aq)}$

$NaCl_{(aq)} \rightarrow$ free ions $Na^+_{(aq)} + Cl^-_{(aq)}$

**(iv) Solubility:-** Non polar compound are soluble in non polar solvents. Non polar compounds forms Vander waal bond with non polar solvent molecules.

**(v) Isomerism : -** Covalent bond is rigid and directional, so it shows isomerism.
eg. Organic compounds.

**(vi) Reaction:-** Reaction between covalent compounds are slow. Because it involves breaking of existing bonds and formation of new bonds.

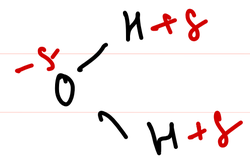
example: $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$

$:N \equiv N:$ $\quad H-H$

'like dissolve like'

polar compound are more soluble in polar solvent.

$Na^+ Cl^-$




more ionic AgF

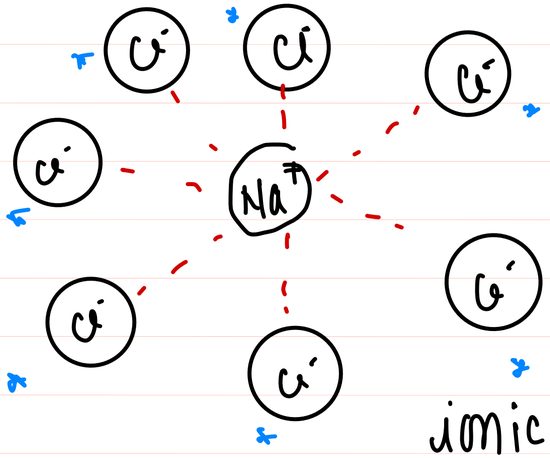
more covalent AgI

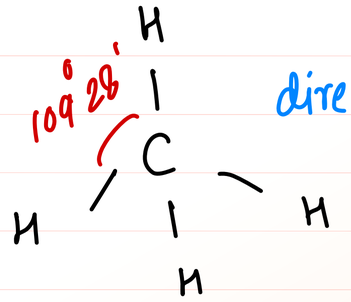
$Na^+ Cl^-$ $\quad C_6H_6$ (Benzene) → nonpolar. (Solvent)

isomer: are the compounds having same molecular formula but different physical or chemical properties.

① $CH_3 - CH_2 - OH$ — alcohol. Mf: $C_2H_6O$

$CH_3 - O - CH_3$ — Ether. Mf: $C_2H_6O$.




directional in nature.

ionic bond is non-directional in nature.

## Co-ordinate bond

SL AL

**(a)** It is a covalent bond in which the shared electron pair come from one atom is called coordinate bond.

**(b)** Necessary conditions for the formation of co-ordinate bond are -

**(i)** Octet of donor atom should be complete and should have atleast one lone pair of electron.

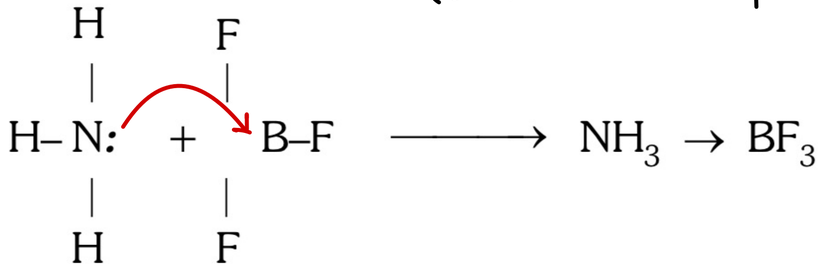
**(ii)** Acceptor atom should have a defficiency of at least one pair of electron.

**(c)** Atom which provide electron pair for shairing is called donor.

**(d)** Other atom which accepts electron pair is called acceptor. That is why it is called donor-acceptor or dative bond.

Lewis base Lewis acid (L.A) : Lone pair acceptor (LA)

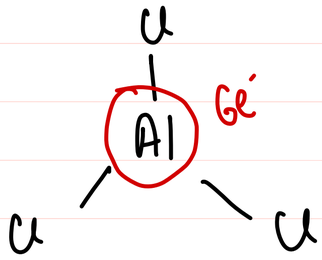
1.

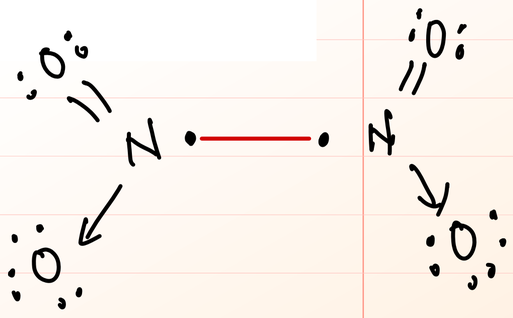



$\longrightarrow NH_3 \rightarrow BF_3$

$BF_3$ is electron defficient compound.

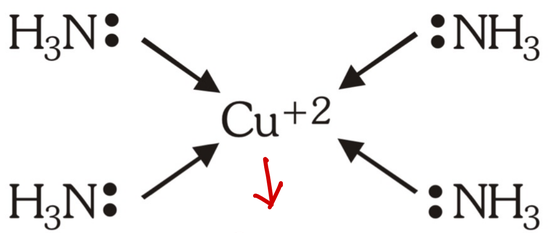
$AlCl_3$



2.

Metal co-ordinate compounds - $[Cu(NH_3)_4]^{+2} \Rightarrow$




→ Lewis base.

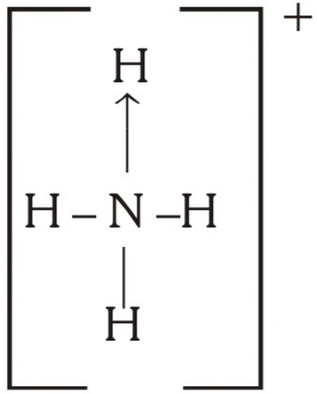
Complex. Compound.

Lewis acid

In complex
Metal ions: $Cu^{+2}$ (Lewis acid)

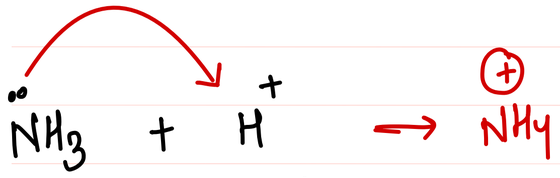
Ligand: ($NH_3$) Lewis base.

3.

**Ex.** $NH_4^+$ ; $H_3\ddot{N}$ + $H^+$ ⟶ 

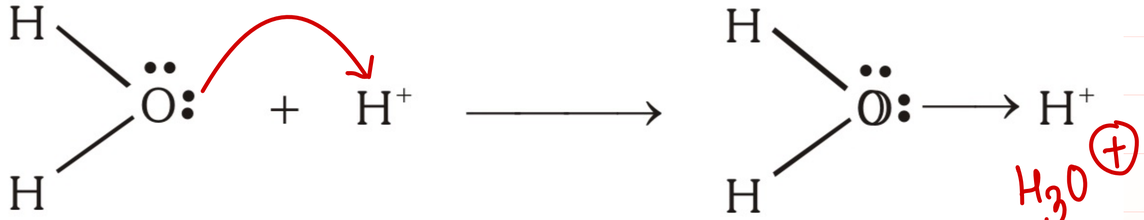
(Lewis base) (Lewis acid)

(Lowry-Bronsted acid)
($e^-$ acceptor)




protonation of ammonia.

4.

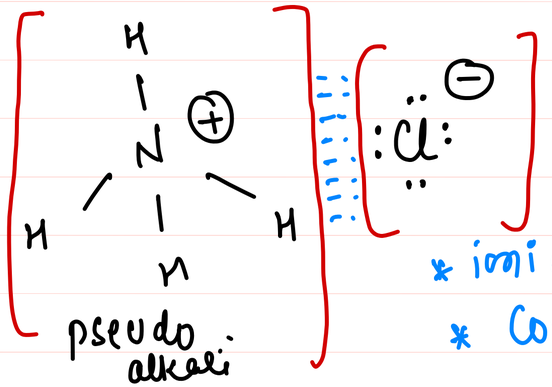
$H_3O^+$ ; 

5.

$N_2O$ ; $N \equiv N: \rightarrow O$

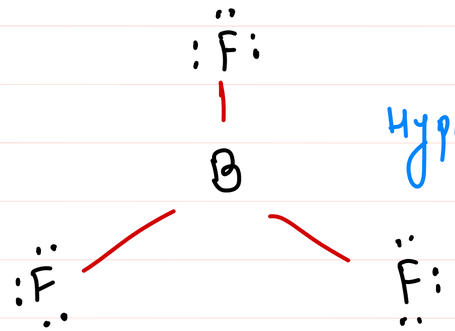
## Draw structure of the following compound : practice of structure of molecule

1. $NH_4Cl$




* ionic Bond
* Covalent Bond.

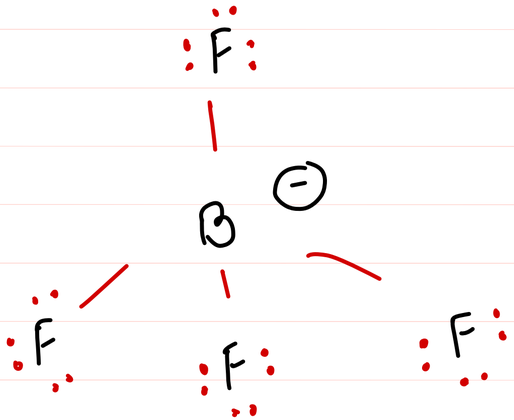
2(a) $BF_3$



Hypovalent Species.

Surrounding atom (total lone pair) = 9

2(b) $BF_4^-$



2(c) $AlCl_4^-$