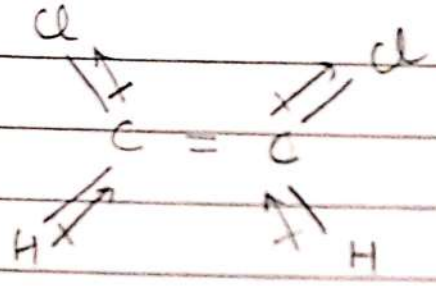
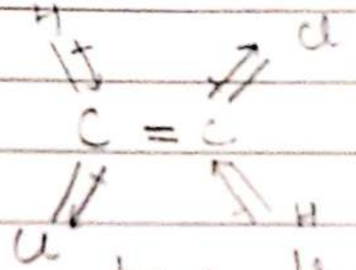
Dipole moment in Organic compound –

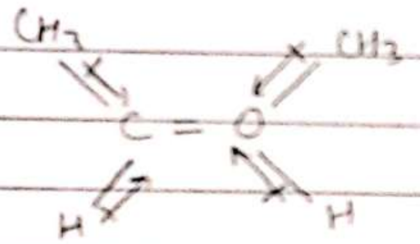


cis $\mu \neq 0$

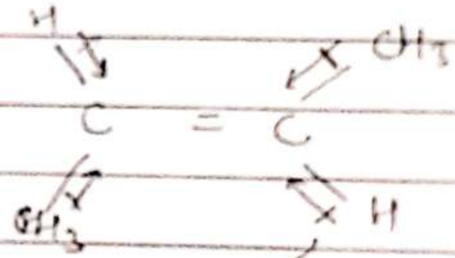


trans $\mu = 0$

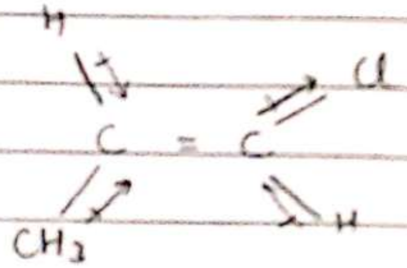
Generally trans compound are non-polar while cis isomer are polar.



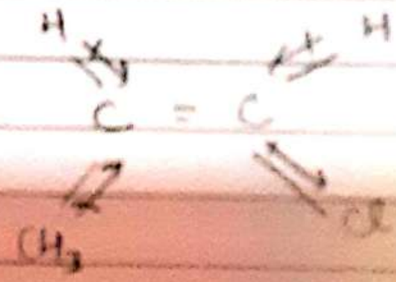
cis butene
$\mu \neq 0$
polar



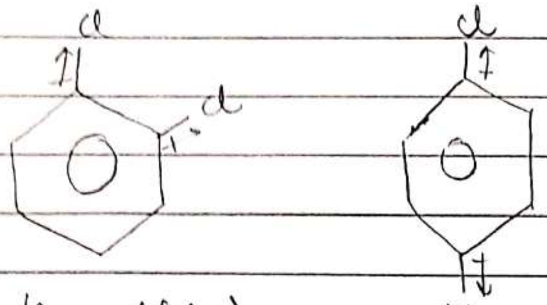
trans butene
$\mu = 0$
non-polar



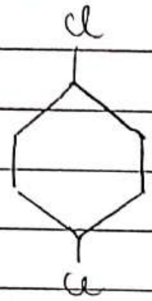
trans
$\mu \neq 0$ polar



cis
$\mu \neq 0$ (polar)



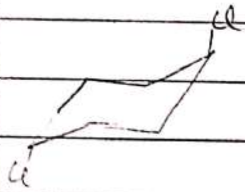
$\mu \neq 0$ (Polar) $\mu = 0$ (non-polar)

★ 

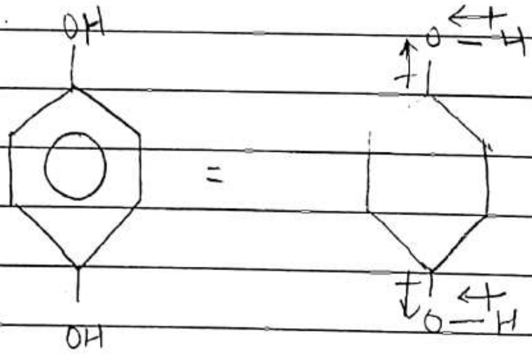
It seems to be planer but it is 3-D.

$\mu \neq 0$ (Polar)

(1,4 dichloro cyclohexane)
not a planer molecule so it is polar in nature



3-D shape

★ 

$\mu \neq 0$ (Polar in nature)

★ **Fazan's Rule** (Covalent character in Ionic compound)

According to Fazan's, we can find out covalent character in ionic molecule or compounds.

Smaller the cation polarized electron from anion So partial covalent character generated in ionic molecules

⊕ (−) → ⊕(−)

Cation attract as anion e^-

Factors affecting covalent character in ionic compound –

a) Size of cation.

Cation size ↓ Anion size ↑ Covalent character ↑

b) Charge on cation and Anion

Charge on cation ↑ cation size ↓ covalent character ↑

Charge on anion ↑ anion size ↑ Covalent character ↑

eg → a)

LiCl	·O	Cation size ↑ ↓	Covalent ↓ or Ionic character ↑ ↓
NaCl	∘O		
KCl	∘O		
RbCl	OO		

b)

NaCl	Na^{1}	Cation size ↓, Covalent character ↑ or Ionic character ↓
$MgCl_2$	Mg^{+2}	
$AlCl_3$	Al^{+3}	
$SiCl_4$	Si^{+4} ↓	

Que Arrange the above molecules in ↑ing order of melting and boiling point.

a) $NaCl > MgCl_2 > AlCl_3 > SiCl_4$

Ionic character ↑ boiling – melting point ↑

b) $FeCl_2$ and $FeCl_3$

$FeCl_2 > FeCl_3$

$Fe^{+2} < Fe^{+3}$ ⟶ covalent character

$Fe^{+2} > Fe^{+3}$ ⟶ ionic character

i) $CuSO_4$ and $Cu_2(SO_4)_2$
Copper sulphate ↳ Cuprric Sulphate
Cu^{+2} Cu^{+1}
Size - $Cu^{+2} < Cu^{+1}$
Ionic character $Cu^{+2} < Cu^{+1}$
m.P, B.P - $CuSO_4 < Cu_2SO_4$

d) HgCl and $HgCl_2$
Hg^{+1} Hg^{+2}
Ionic character $Hg^{+} > Hg^{+2}$
m.P, B.P - $HgCl > HgCl_2$

c) $MgSO_4$ and $CaSO_4$
$Mg^{+2} < Ca^{+2}$
$MgSO_4 < CaSO_4$ - B.P, m.P

★ IONIC BOND :- (Electrovalent Bond)

Bond between metal and non-metal
During formation of ionic bond, comp. transfer of electron from 1 atom to (metal) to another atom (non-metal)

Due to transfer of e^- each atom acquires noble gas electronic configuration

Conditions for formation of Ionic bond:-

$M(g) + IE \longrightarrow M^{+}(g) + e^-$ IE↓
lower IE, favour formation of Ionic Bond
of metal

$X(g) + e^- \longrightarrow X^- + \text{Energy}$ EGE ($\Delta H = -ve$)

Electron gain Enthalphy ($\Delta H = -ve$)↑ is higher non- metals, favour the formation of ionic compounds

$M^+(g) + X^-(g) \longrightarrow MX(s) + \text{Energy}$ ↑ (Lattice energy)

higher Lattice Energy of ionic molecule favour formation of ionic bond.

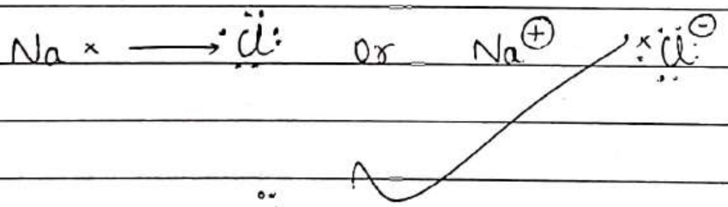
Lattice Energy -

The energy released due to the formation of 1 mole of crystal Latticee called Lattice energy.

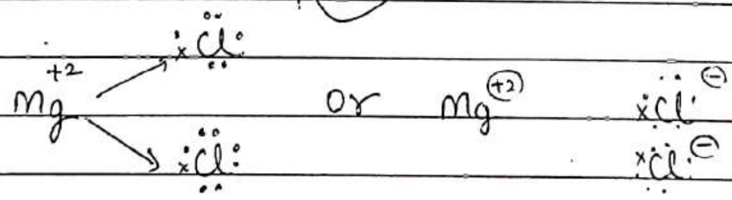
Lewis dot structure in Ionic Molecule :-

an Individual ionic molecular does not have definite shape. but crystals have.

NaCl -



$MgCl_2$ -



Electrovalency

No. of e^- completely transferred on from one atom to another atom.

Atom	Na	Mg	Al	N	O	F
electrovalency	1	2	3	3	2	1

Note — d-block and f-block elements show variable electrovalency

For ex - iron (Fe) = 2, 3

Que Arrange the following molecule in ↑ order of ionic character

i) NaCl, KCl, RbCl, CsCl.

Cation size ↑ ionic character ↑

ii) LiF, LiCl, LiBr, LiI

Size of anion ↑ ionic character ↓

★ Born - Haber Cycle (BHC) :→

For any ionic compound Lattice energy does not calculate directly. It can be calculated in indirect way i.e. born- Haber cycle.

i) $Na(s) + \frac{1}{2} Cl_2(g) \xrightarrow{\Delta H_f} NaCl(s)$

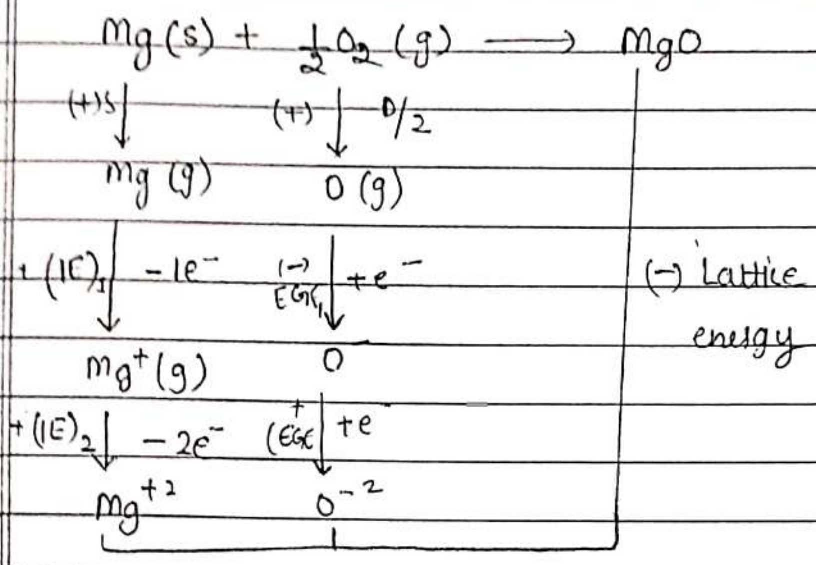
(+) S ↓ Na (g)   (+) ↓ D/2 Cl (g)

(+) I.E ↓ $-e^-$ $Na^+(g)$ (-) EGE ↓ $+e^-$ $Cl^-(g)$

(−) Lattice Energy ↑

$$\Delta H_f = S + I.E + D/2 - EGE - LE$$

ii) $Mg + \frac{1}{2} O_2 \longrightarrow MgO$



Hydrogen Bond

Hydrogen Bond

- Inter molecular H. bond
  - Homolytic I.M.H.B
  - Heterolytic I.M.H.B
- Intra molecular H. bond

(formed between small atom)

It is an electrostatic attraction force between covalently bonded hydrogen atom of one molecule and an electronegative atoms. It is represented by dotted line

These are two types –

i) Intermolecular H. bond
ii) Intramolecular H. bond

* Homolytic intermolecular H-bond.

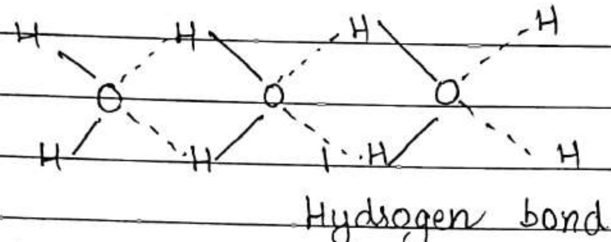
HF, H_2O, NH_3 etc.

HF –

H–F ---- H–F ---- H–F

Hydrogen bond

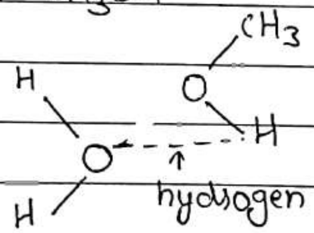
H_2O –



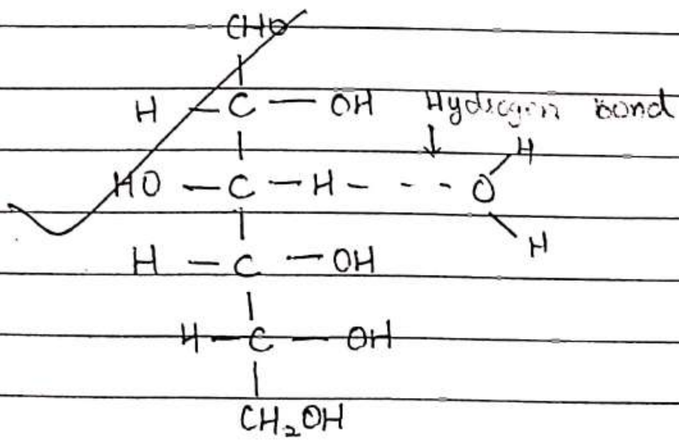
1 molecule of H_2O forms 4 no. of H bond.

* Heterolytic intermolecular H-bond –

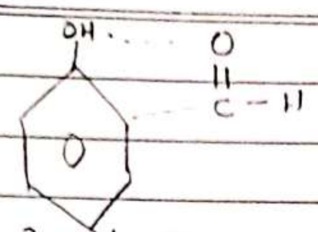
H_2O and CH_3OH



H_2O and $C_6H_{12}O_6$



INTRAMOLECULAR HYDROGEN BOND –



2- hydroxy benzaldehyde.

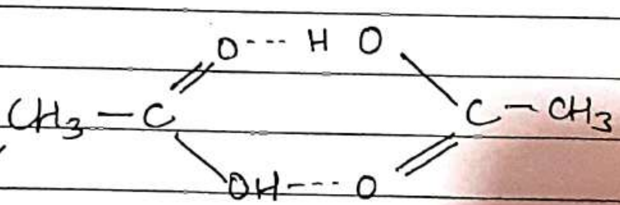
Significance of Hydrogen Bond on Physical state –

a) Solubility – some organic molecule (non-polar) are dissolve in water due to formation of Hydrogen bond
e.g – CH_3OH, C_2H_5OH, CH_3COOH etc.
CH_3-O-CH_3 (Ether) does not form H. bond. so not soluble in water.

b) Melting point and boiling point – high due to H. bond.
$C_2H_5OH > CH_3-O-CH_3$
78°C

c) Viscocity – $H_2O > C_2H_5OH > CH_3OCH_3$
d) Physical state – H_2O is liquid and H_2S is gas because H_2S does not form hydrogen bond

e) Molecular weight – Theoritically mol. wt. of Acitic acid is 60 but experimentally it is found to be 120. It is due to hydrogen bond form dimer of acetic acid.



Good Both
07/09