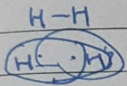


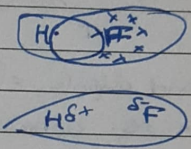
c. Dipole Moment

Non polar



Symmetrically
dist.

Polar



- Shared pair of e^- cloud is more towards highly EN atom
- partial ionic ch.
- arises due to diff in EN.
- $\mu = |q| \times d$

\downarrow
charge

\downarrow
distance

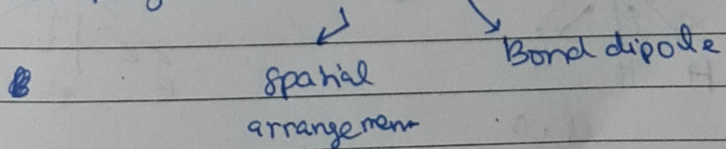
$8D = \text{Debye (D)}$

$1D =$

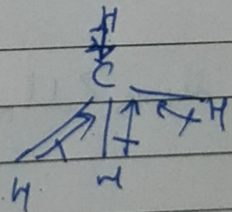
$3.33564 \times 10^{-30} \text{ Cm}$

- vector

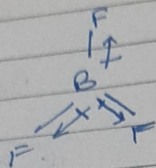
→ For polyatomic molecules



CH₄

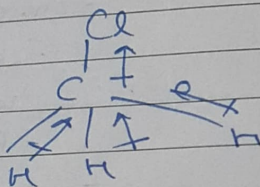


$\mu = 0$

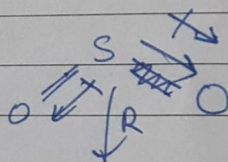


Trigonal planar $\rightarrow \mu = 0$

Bond dipole = eq. mag. opp. in dirn.
in reg. geometry

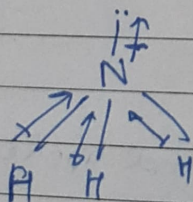


$\mu \neq 0 \Rightarrow \mu = +ve$

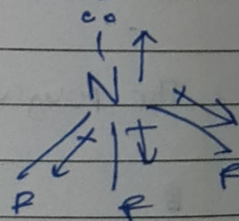
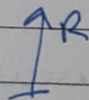


$\mu = +ve$

o
s
&
te



$\mu +ve$

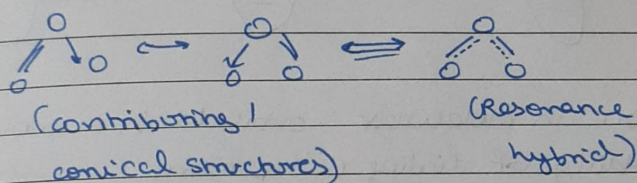


$R \neq 0 \therefore \mu \neq 0$

$\therefore \mu_{NH_3} > \mu_{NF_3}$

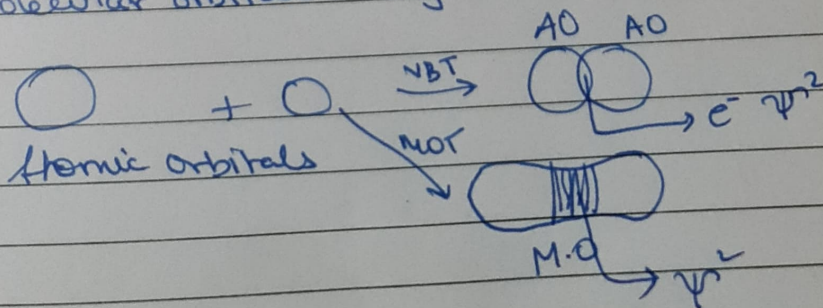
- All regular geo molecules will have $\mu = 0$
 ⇒ non polar, but surrounding atoms = same
- $\mu \neq 0$ Although geo = regular, surrounding = dissimilar
- $\mu \neq 0$, geo = distorted, irregular ∴ polar.

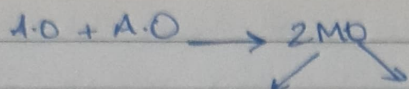
Resonance



In certain molecules ~~at~~ single Lewis structure cannot explain all the properties of the molecule. Then, the molecule is supposed to have many structures each of which explains most of the properties but not all. Actual structure lies in b/w all contributing structures and is known as resonating structure. This process is called resonance.

Molecular orbital theory:

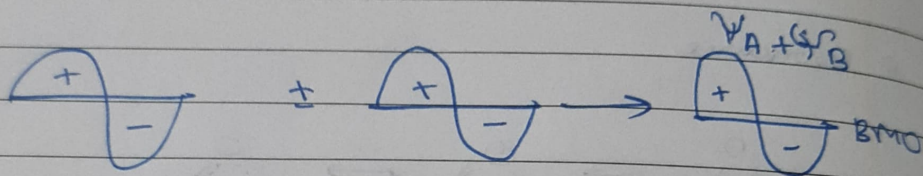




BMO
Bonding
molecular
orbital

ABMO
Anti bonding
molecular
orbital

Linear Combination of AO: $\psi_A + \psi_B$



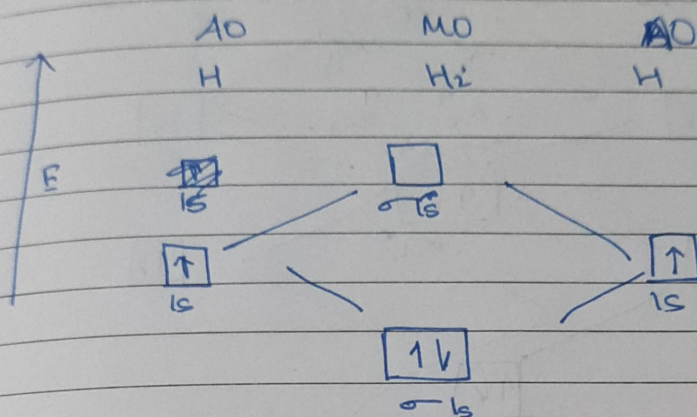
Region in molecular orbitals. In a molecule where probability of finding e^- is more

BMO

ABMO

Drawing MO formation

1) H_2 molecule



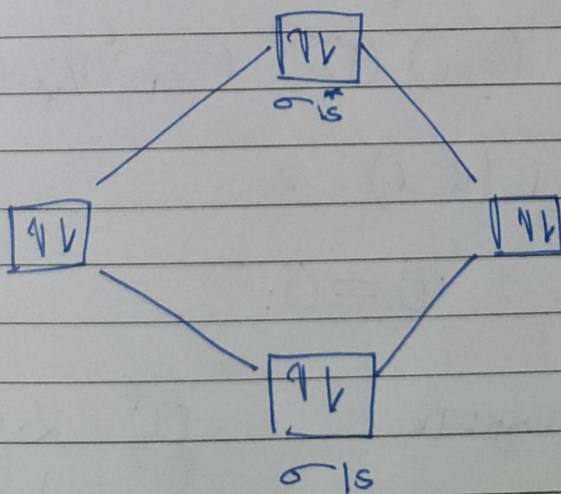
$$B.O = \frac{1}{2} (N_b - N_a)$$

$$= \frac{2}{2} = 1$$

\therefore Diamagnetic as no unpaired e^-

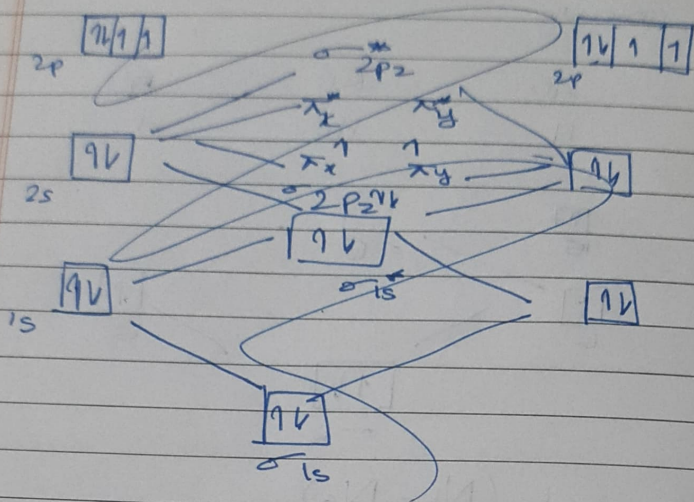
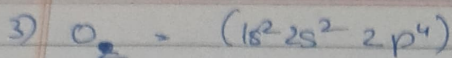
2) Test for He_2

$1s^2$



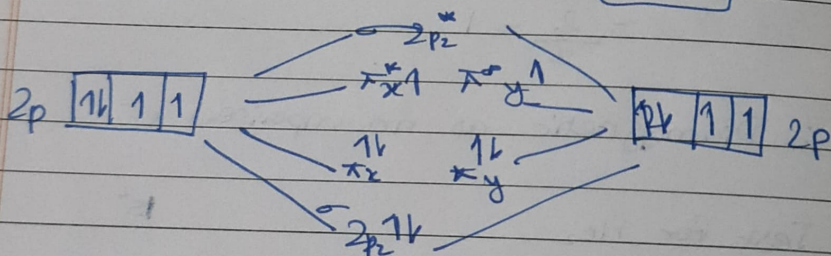
$$B.O = \frac{1}{2} (2 - 2) = 0$$

He_2 NOT possible as no bond



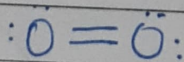
2s, 1s filled

$$Z \geq 8$$



$$(\sigma_{1s})^2 (\sigma_{1s}^*)^2 (\sigma_{2s})^2 (\sigma_{2s}^*)^2 (\sigma_{2p_z})^2 (\pi_{2p_x})^2 (\pi_{2p_y})^2 (\pi_{2p_x}^*)^1 (\pi_{2p_y}^*)^1$$

$$BO = \frac{1}{2} (10 - 6) = 2$$



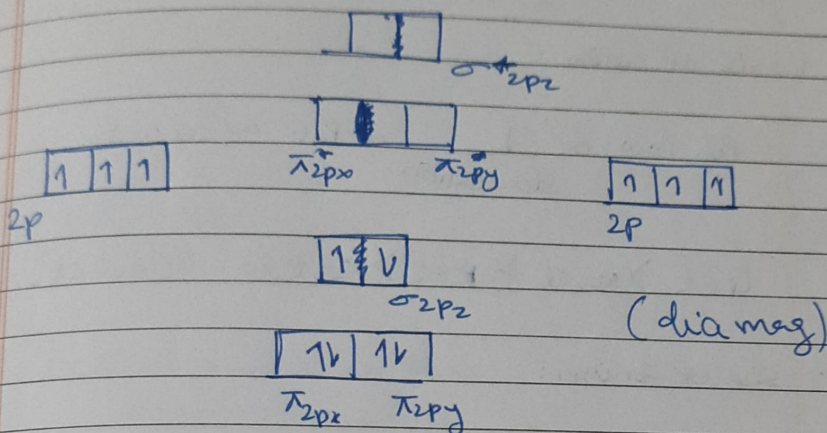
Paramagnetic

$$O_2^+ = 2.5 \text{ (paramag)}$$

$$O_2^- = 1.5 \text{ (paramag)}$$

$$O_2^{2-} = 1 \text{ (diamagnetic)}$$

4) N_2 molecule ($1s^2, 2s^2$ same) $Z \leq 7$



$$\frac{1}{2} (10 - 4) = 3$$

$$N_2^+ = 2.5 \text{ (para)}$$

Fajan's Rule

→ Explains covalent character in ionic bond.

Polarization: Distortion in anion due to cation

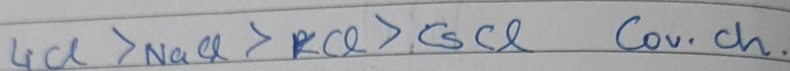
Polarizability - ability of anion to undergo distortion.

Polarizing power - ability of cation to distort anion e^- cloud.

Factors affecting polarization

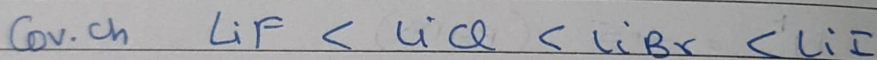
1. size of cation:

$$\text{Pol. Pow} \propto \frac{1}{\text{size cation}} \quad \& \quad \text{Pol.} \propto \text{cov. ch.}$$



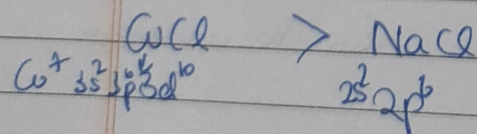
2. size of anion:

$$\text{Polarizability} \propto \text{size of anion} \propto \text{polarization} \propto \text{cov. ch.}$$

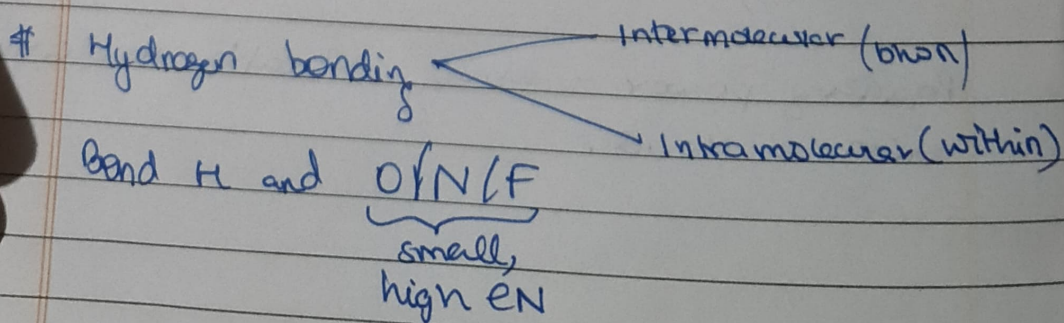


3.

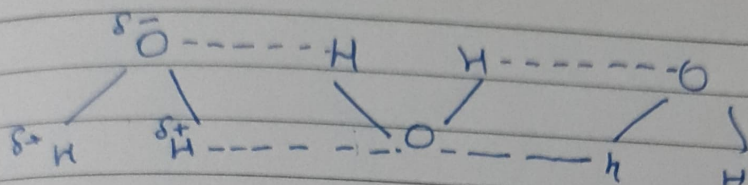
For cation of similar size and charge, the one with pseudo noble gas config ($ns^2 np^6 nd^{10}$) has larger polarizing power than actual noble gas config ($ns^2 np^6$)



4. Hydrogen bonding



Inter mol. H bond



$H_2O \rightarrow$ liq.

$H_2S \rightarrow$ gas (no H bond)

Alcohol soluble in H_2O

↓
form H bond

