ARJUNA 2.0 JEE 2026

Chemical Bonding and Molecular Structure

Inorganic Chemistry | Lecture - 23

By - Amitabh Sharma (ATS sir)

Topics to be covered

1. MOT

https://t.me/Chemistry_by_AmitabhSir

Aap selection ke saath rank bhi Lana chhate to ye sequence follow karne...

Perfect lecture sequence of chemical bonding...

1. Introduction of bond
2. Octet rule
3. Ionic bond
4. Covalent bond
5. Overlapping
6. Coordinate bond
7. Valency
8. Lewis dot structure
9. Hybridization
10. Solid state hybridization
11. Hybridization in odd e molecule
12. VSEPR theory
13. Bents rule
14. Drago rule
15. Back bonding
16. Bridge bonding
17. Oxi acid
18. Molecule do not exist
19. Hydrolysis
20. Fajans rule
21. MOT
22. Hydrogen bonding
23. Dipole moment
24. Weak Force

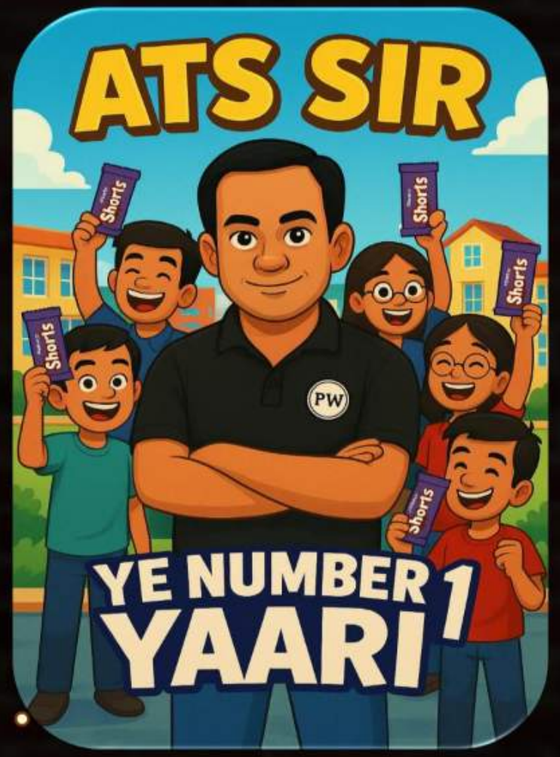
ATS-ANT TAK SAATH

Hello IITian
Lala Lali

IOC samjhne ka nahi,
Feel karne ka kaaa...!!

Love u Gucchu
Pucchu

Ready for
Shots pe shots
challenge



By the end
summary is
this

ATS-ANT
TAK SAATH

Paneer Gang

ATS Army

Total Recall

Drawback of VBT

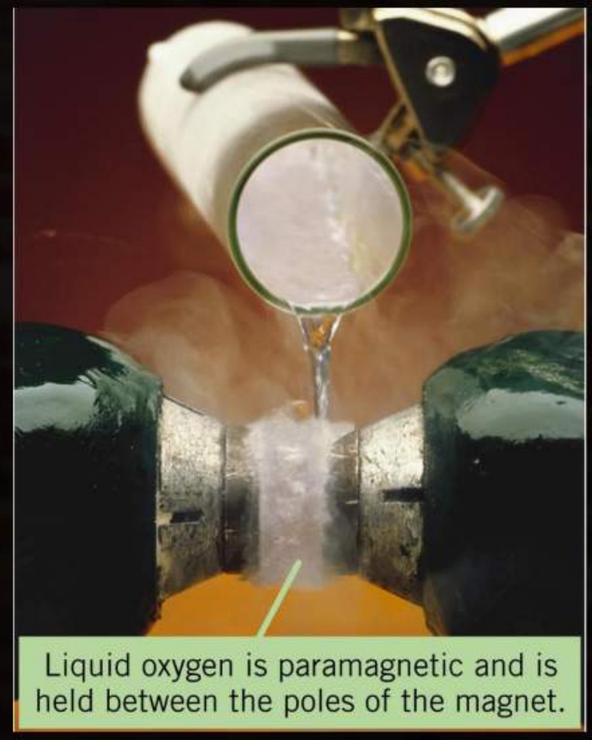
1. Magnetic Behaviour of O_2

$O_2 \Rightarrow$

Total no of e^-s $\rightarrow$ 16 e^-

Acc to VBT $\rightarrow$ Dia

But $\rightarrow$ Para



Liquid oxygen is paramagnetic and is held between the poles of the magnet.

2. Odd Electron Species

$NO \rightarrow 15e^-$

$N \equiv O$

formation of odd e^- Bond
or
Bonding in odd e^- molecule
] Not Possible

3. Fractional Bond Order

Possible { Acc to VBT
$A-B \rightarrow B.O \rightarrow 1$
$A=B \rightarrow B.O \rightarrow 2$
$A \equiv B \rightarrow B.O \rightarrow 3$

$H \cdot H^{7+}$
$B.O \rightarrow 0.5$
not Possible

4. π-bond in B_2 & C_2

Acc. to VBT

$A = B$

$A \overset{\sigma}{\underset{\pi}{=}} B$

But acc. to MOT

$B \overset{}{\underset{\pi}{=}} B$ B.O → 1

$C \overset{}{\underset{2\pi}{=}} C$ B.O → 2

5. Strength of σ & π bond in N_2

Acc to VBT

order of strength $\sigma > \pi$

Acc to MOT in case $N_2 \Rightarrow \pi > \sigma$

6. bond order of CO^+

CO $\boxed{3 < BO < 3.5}$

MOT

7. Order of Ionization energy

IE N_2 > N

Molecule atom

F_2 < F

Molecular Orbital Theory (MOT)

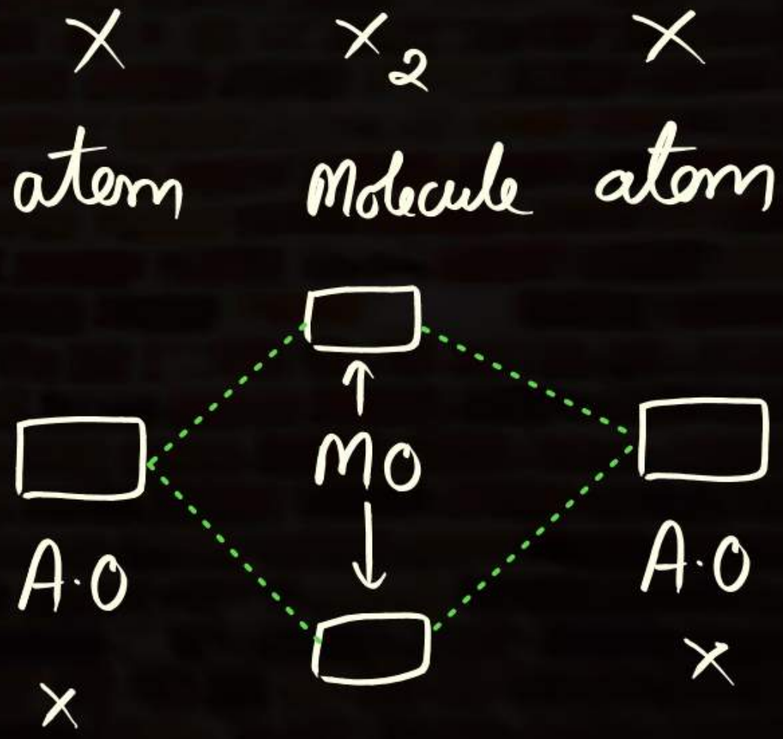
- **Given by Hund's & Mullikan**

  Two atomic orbital come nearer & then overlap each other to form two molecular orbitals (MO).

  Types of Molecular orbital :

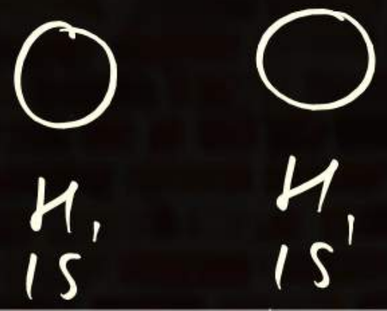
  (i) BMO (Bonding molecular orbital)

  (ii) ABMO (Anti Bonding molecular orbital)



Characteristics of Molecular orbital

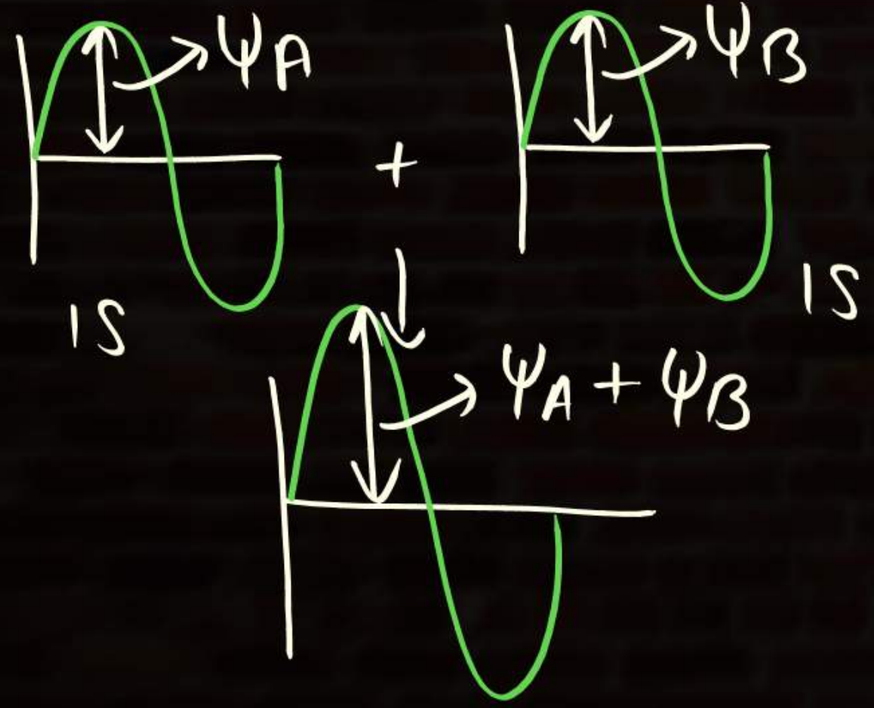
Electron wave function : Ψ



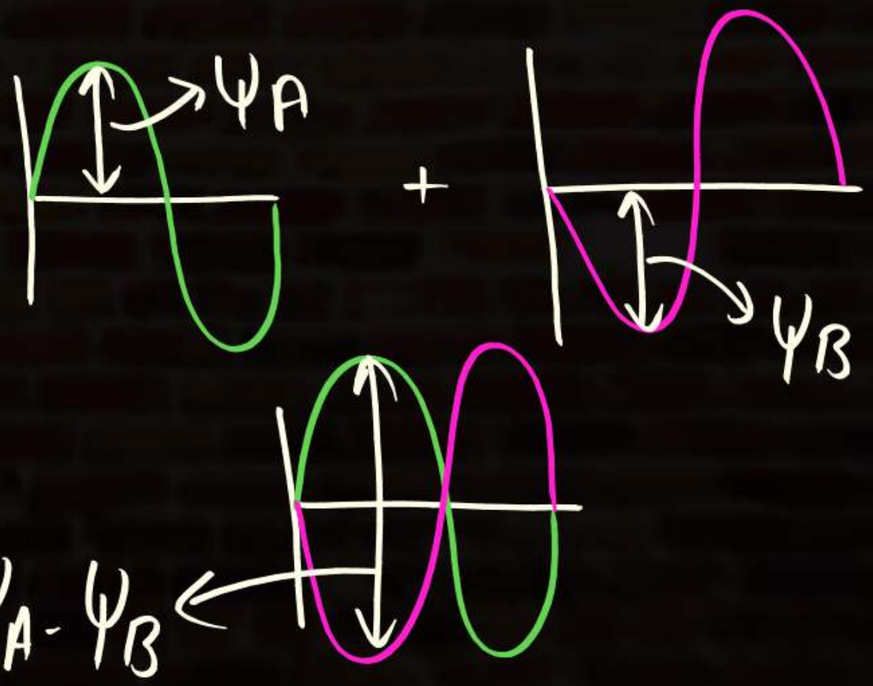
Electron density : Ψ^2

BMO **ABMO**

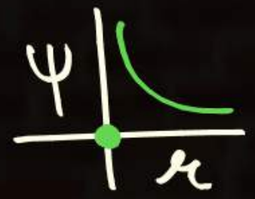
Same Phase Overlapping



Opposite Phase Overlapping

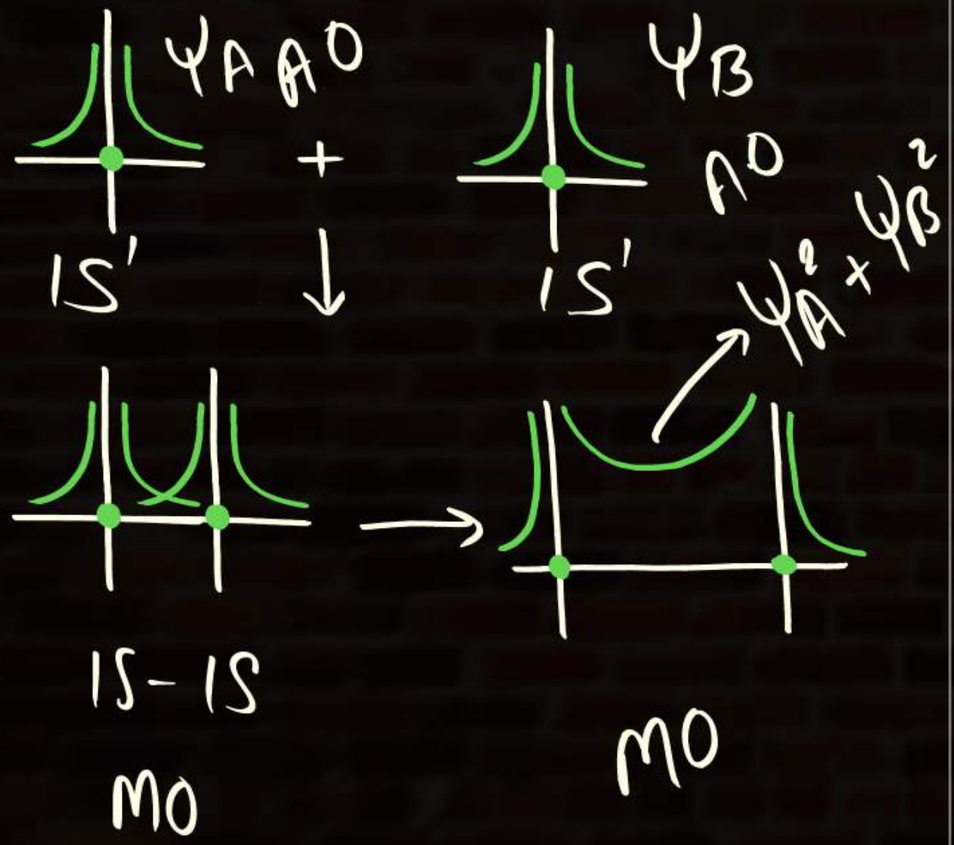


Characteristics of Molecular orbital



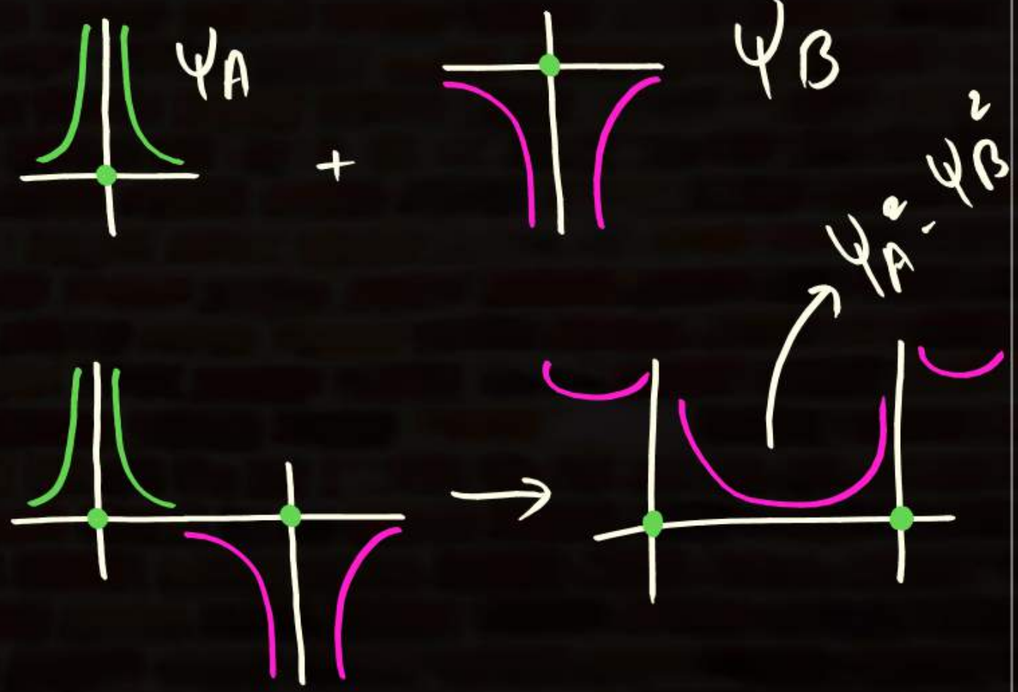
BMO

Result of constrictive interference



ABMO

Result of destructive interference



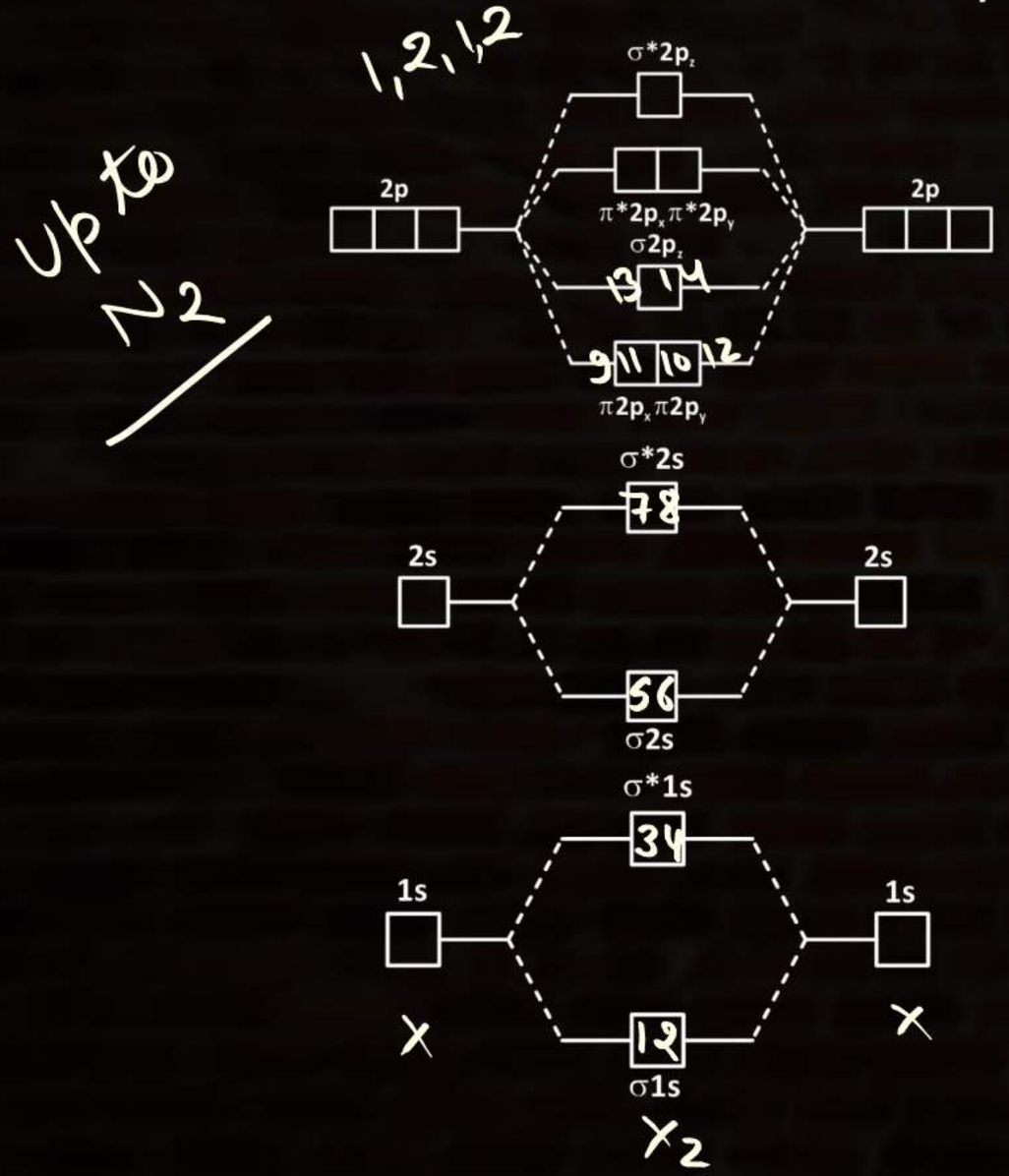
BMO	ABMO
Electron density is present in between two nucleus	Absent
$(\psi_A + \psi_B) \longleftrightarrow (\psi_A + \psi_B)^2$	$(\psi_A - \psi_B) \longleftrightarrow (\psi_A - \psi_B)^2$
$(\psi_A + \psi_B)^2 \Rightarrow \psi_A^2 + \psi_B^2 + 2\psi_A\psi_B$	$(\psi_A - \psi_B)^2 = \psi_A^2 + \psi_B^2 - 2\psi_A\psi_B$
	

BMO	ABMO
Energy level lower than the atomic orbital 	Higher 
Electrons are involved in bonding	Do not involved in bonding
Nodal Plane = x	Nodal plane = x + 1
Presentation σ & π	σ^* and π^*

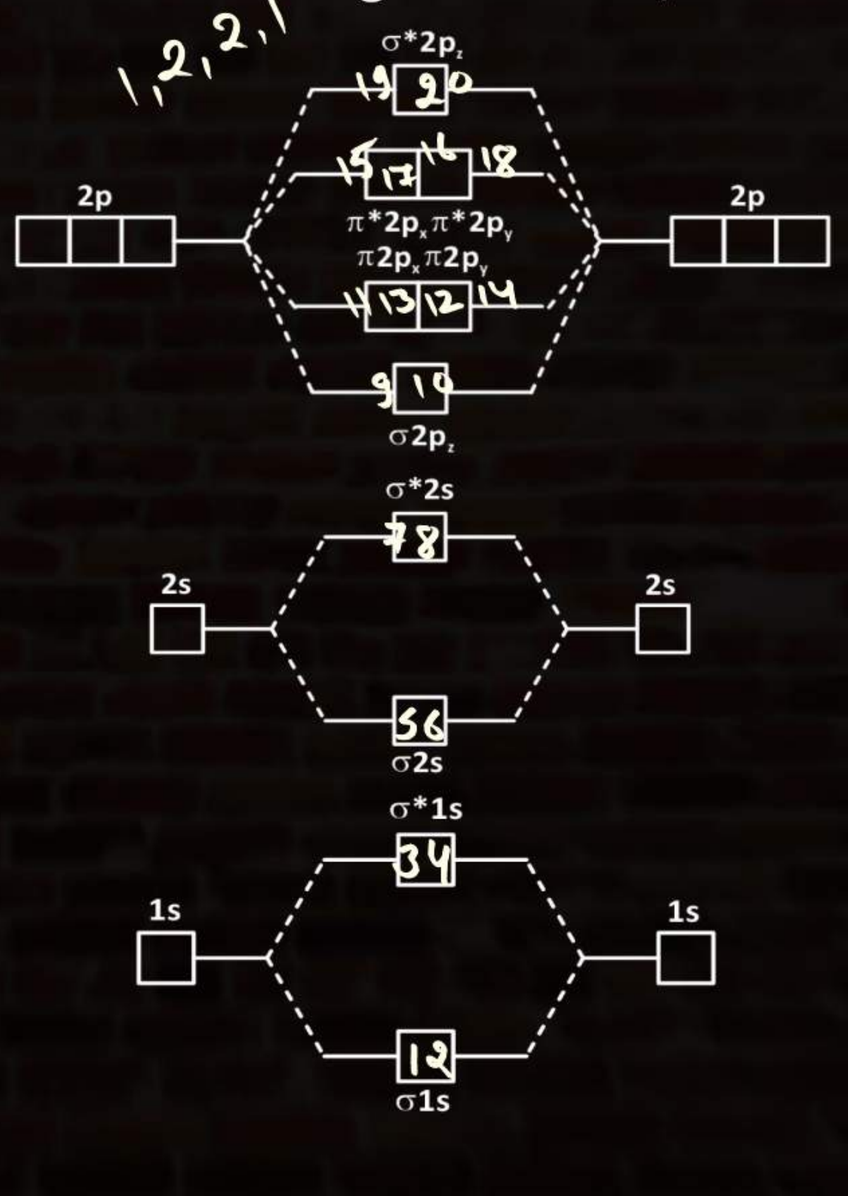
Molecular Orbital Energy Diagram

$X \rightarrow 1s, 2s\ 2p$ H to Ne

- Molecular orbitals can be filled by electrons according to Aufbau, Hund's, Pauli's principle.



up to N_2



above the N_2

Bond Order :

$$\text{Bond order} = \frac{N_B - NA}{2}$$

N_B = No. of electron in BMO

N_A = No. of electron in ABMO

- Value of bond order may be 0, odd, even or in fractional
- If bond order is 0, it means species does not exist.
- Bond order ↑ bond length ↓ stability of molecule ↑

Magnetic behavior :

(1) Paramagnetic :

- Unpair electron must be present.
- It attracts the magnetic field lines

(2) Diamagnetic :

- Unpair electron must be absent.
- It repels the magnetic field lines

Magnetic moment :

$$\mu = \sqrt{n(n+2)} \text{ B.M.}$$

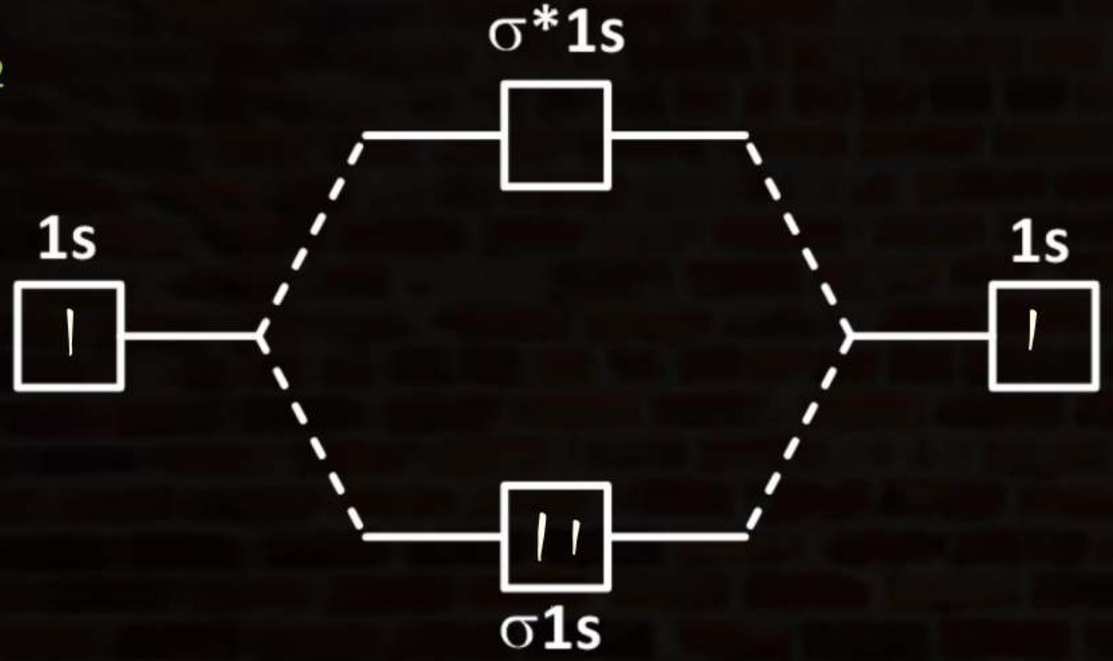
n : no of unpaired electron

no of U.Pe	μ
1	1.73
2	2.83
3	3.87
4	4.90
5	5.92

Homo-diatomic Molecule

Example of M.O.T.

1. H_2



BO ⇒ 1

	$2e^-$	$1e^-$	$3e^-$
	H_2	H_2^+	H_2^-
B.O.	1	0.5	0.5
B.L.		<	<
B.E.		>	>
M.B	D	P	P

B.O → Same

no of e^-S in ABMO ↑ B.L ↑

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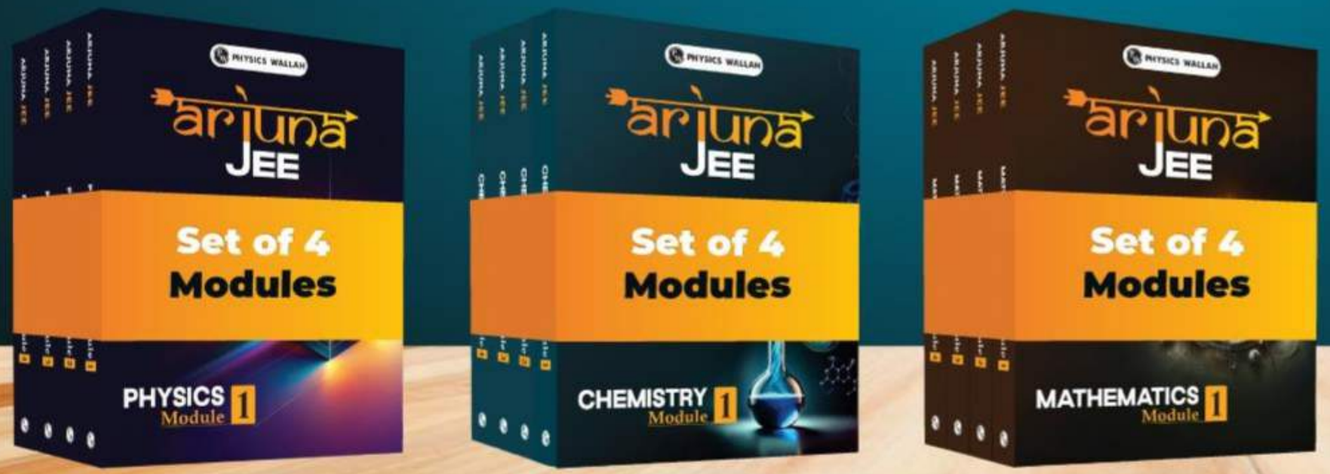

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