

VIDYAPEETH



BATCH CODE: 19-PJ301EA 2025

SUBJECT NAME: CHEMISTRY

CHAPTER NAME:

Chemical bonding and molecular structure

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Lecture No.

06

By – Swapnil Sir



Today's Goal

Subtopic

Molecular Orbital Theory (MOT)

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Molecular Orbital Theory →



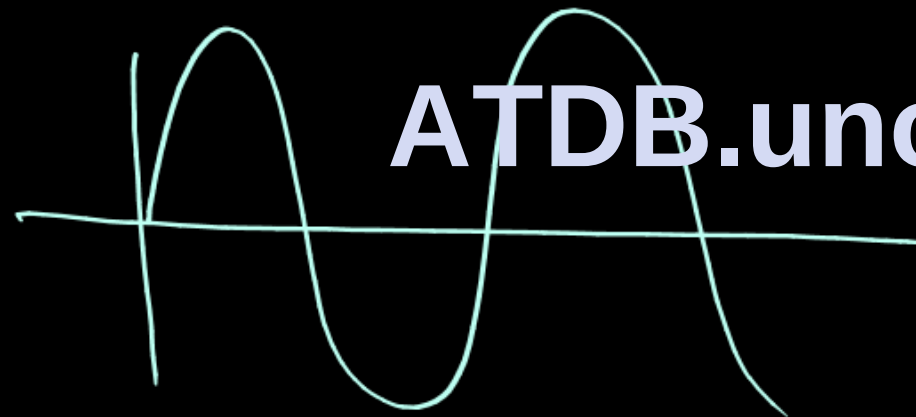
Atomic orbitals (wavefunction)

→ Molecular Orbitals

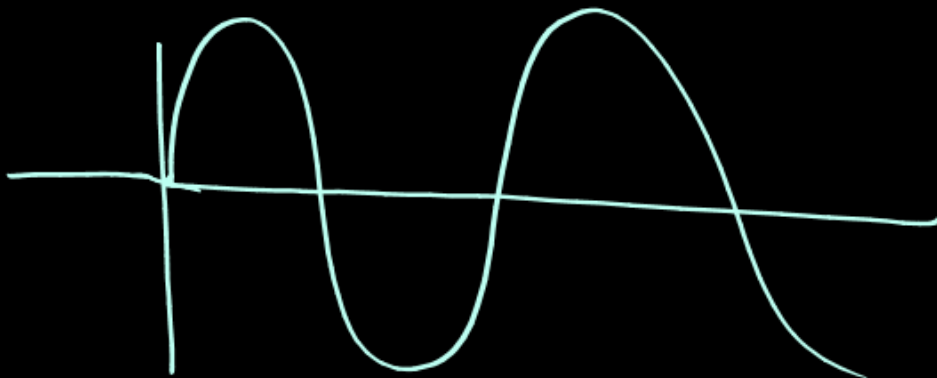
(same energy or
nearly same energy)

Superposition of wave

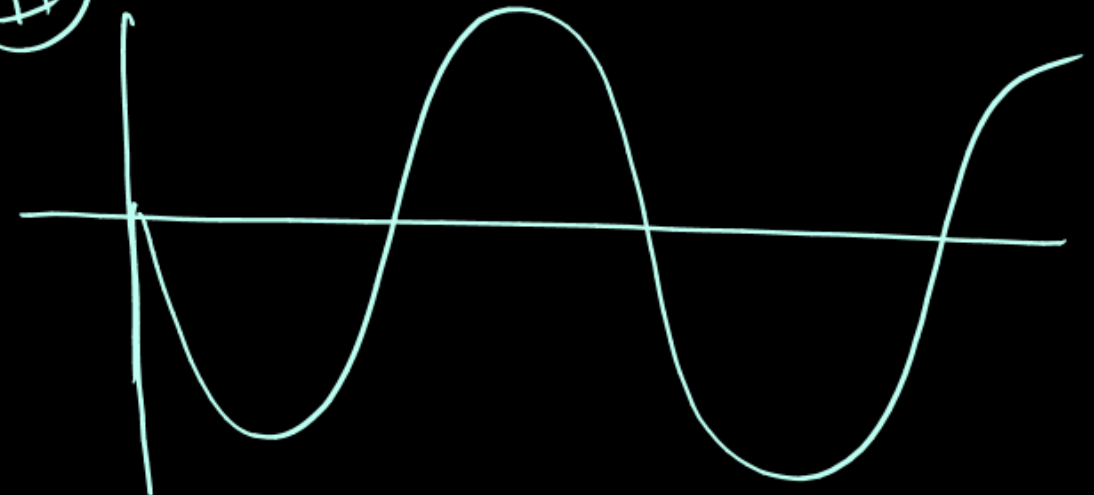
Ⓘ



Ⓡ



Ⓡ



Phase change

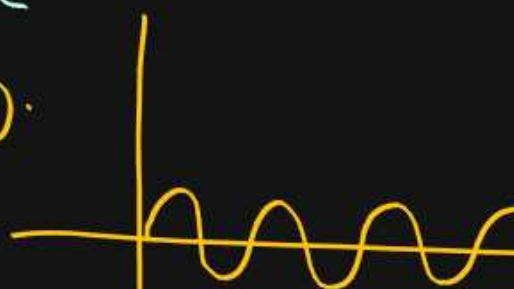
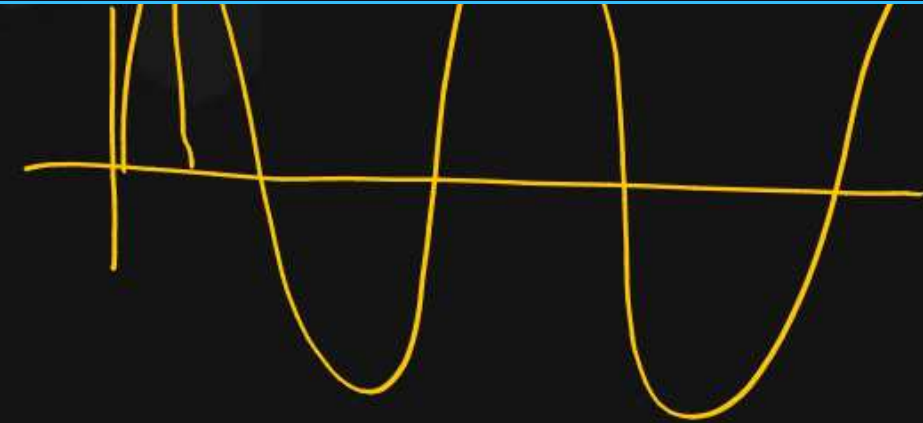
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Superposition

Atomic orbital

in same phase
M.O.

in opposite phase
M.O.



amplitudes adds

B + M = O

A - B = M = O

amplitude subtract

$\psi_1 + \psi_2 = (a_1 + a_2)$

$\psi_1 - \psi_2 = (a_1 - a_2)$

$\psi_1^2 + \psi_2^2 < (\psi_1 + \psi_2)^2$

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Atomic orbital of
same energy or
nearly same energy

LCAO

constructive (in same phase) $\Rightarrow$ Bonding Molecular orbital

Destructive (in opposite phase) $\Rightarrow$ Anti Bonding MO

1s 2s X

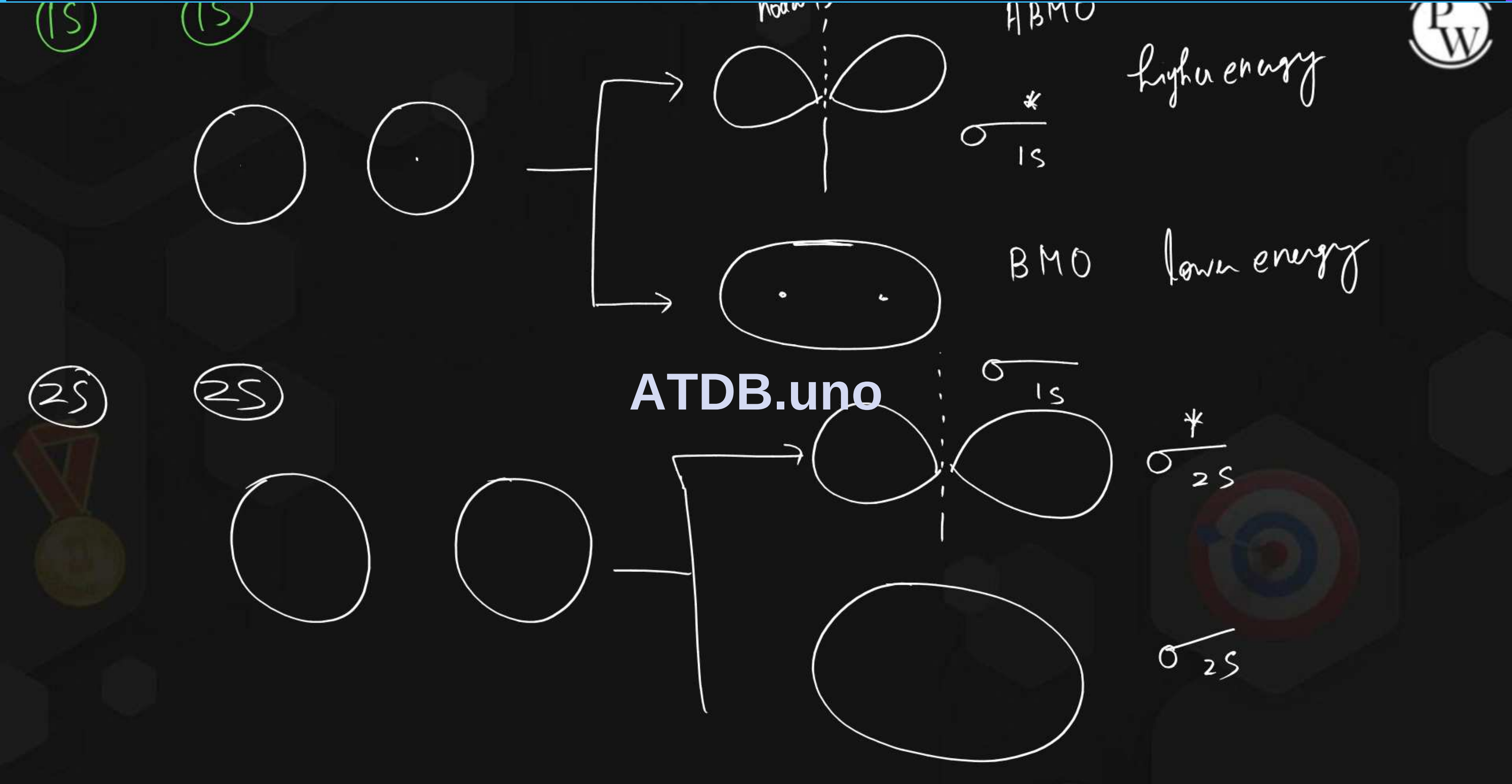
1s 1s ✓

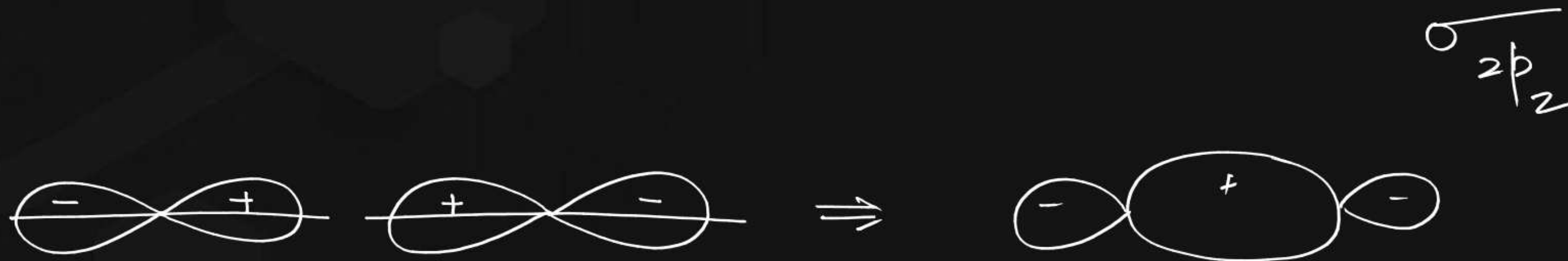
2s 2s ✓

2s, 2p ✓

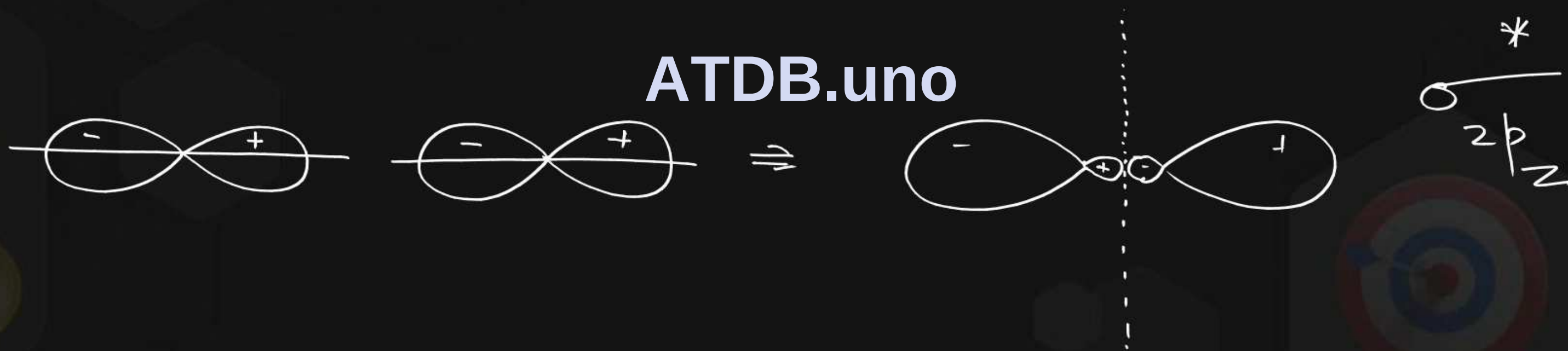
2s 2p

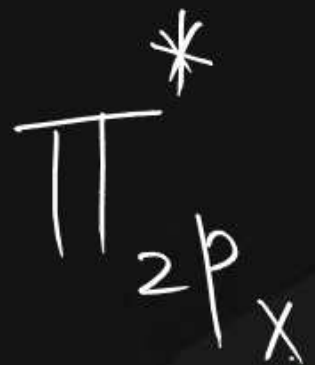
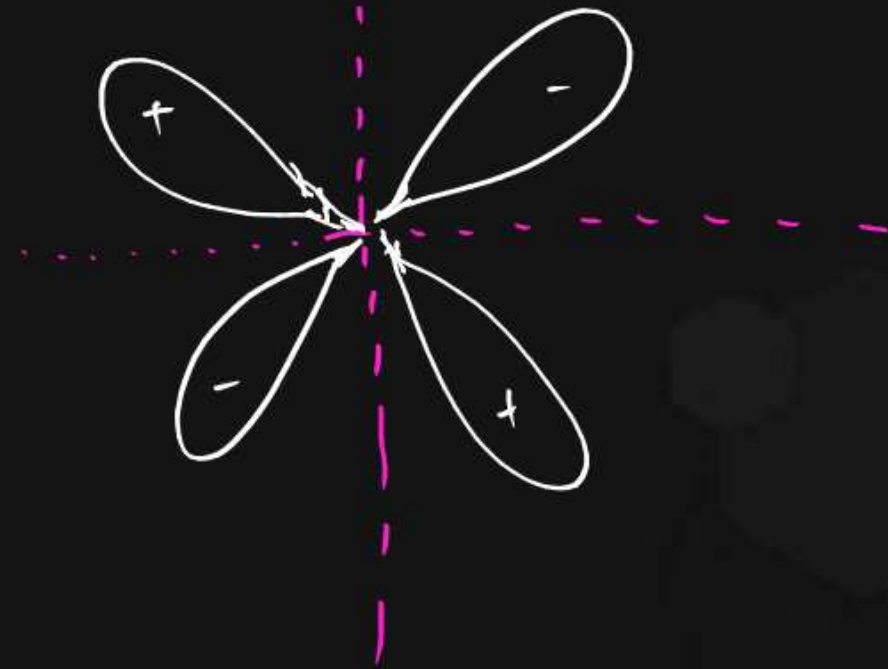
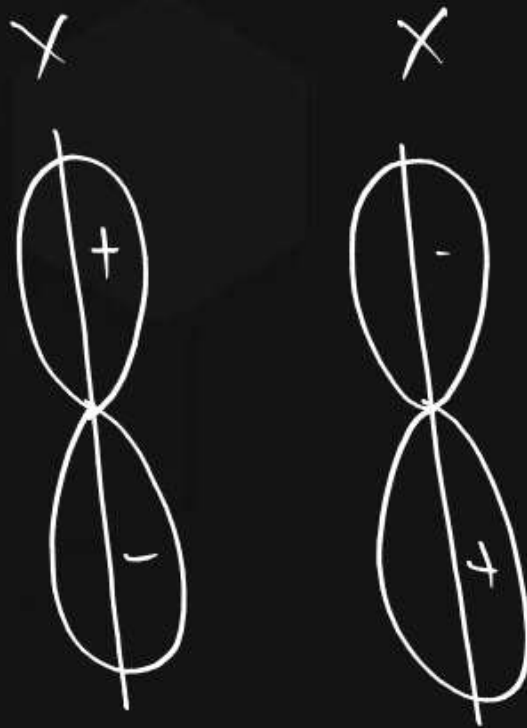
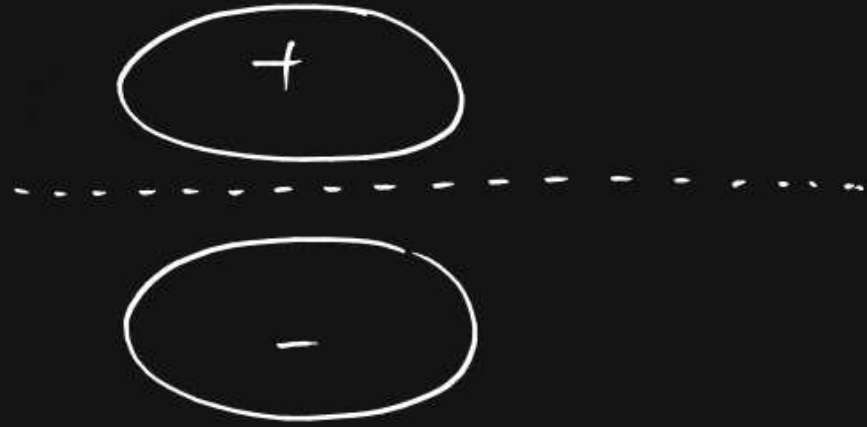
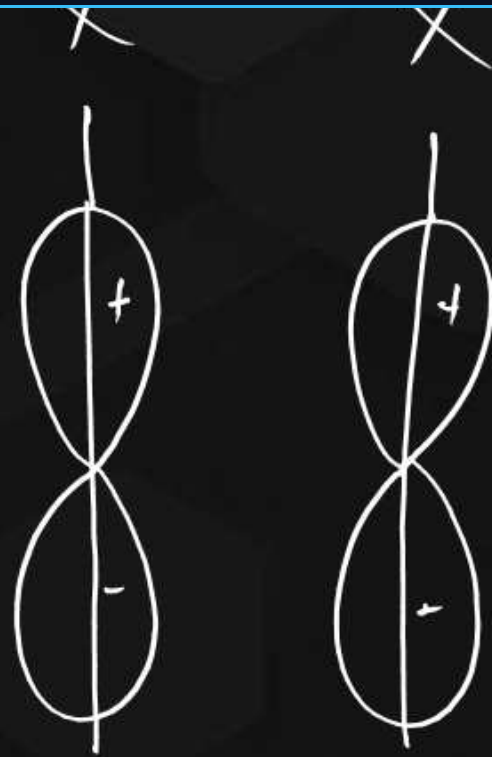
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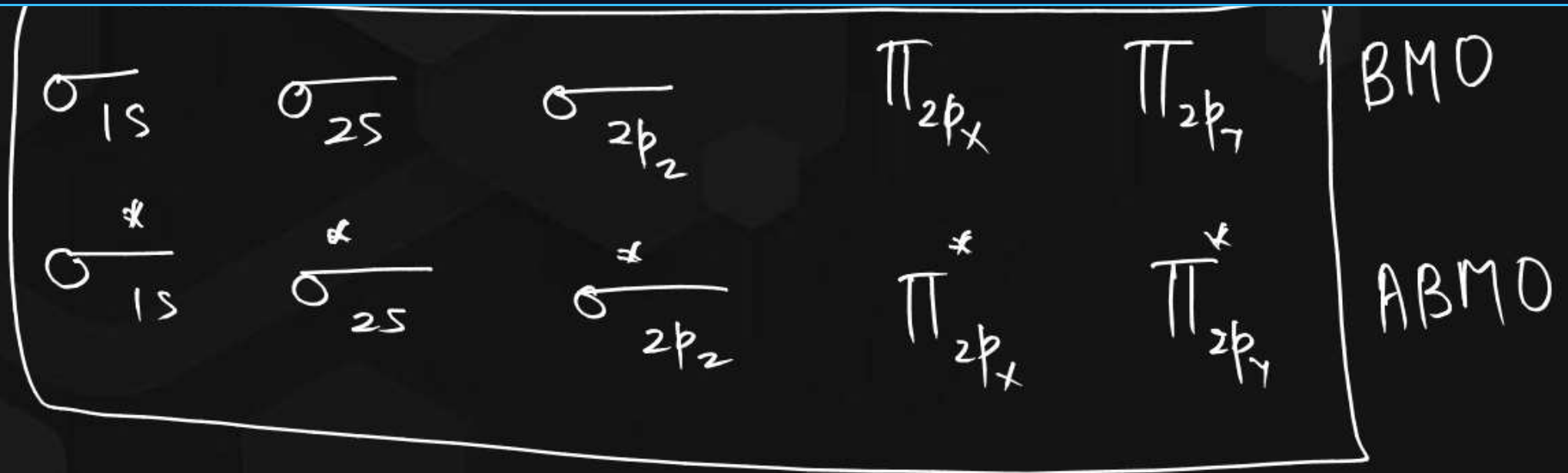


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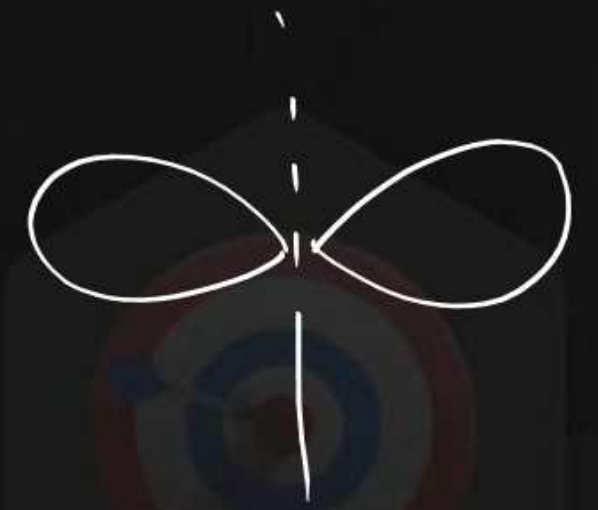
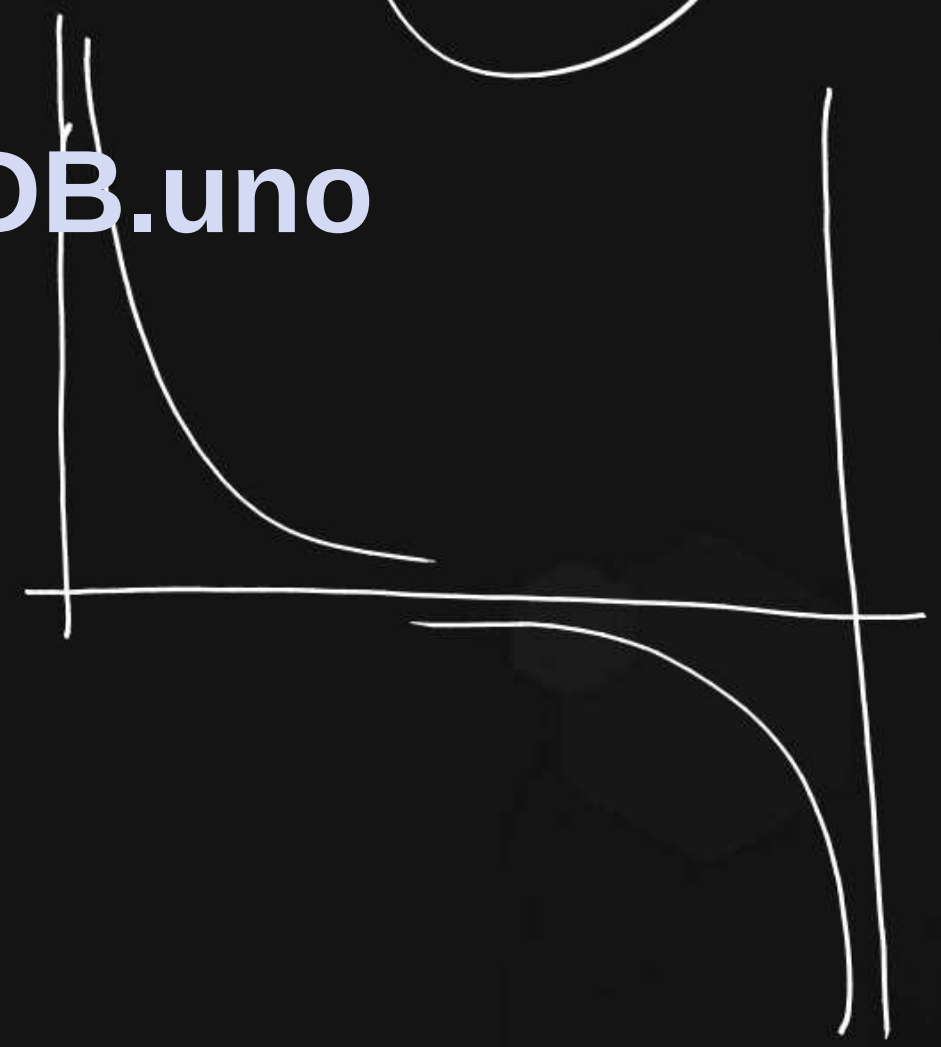
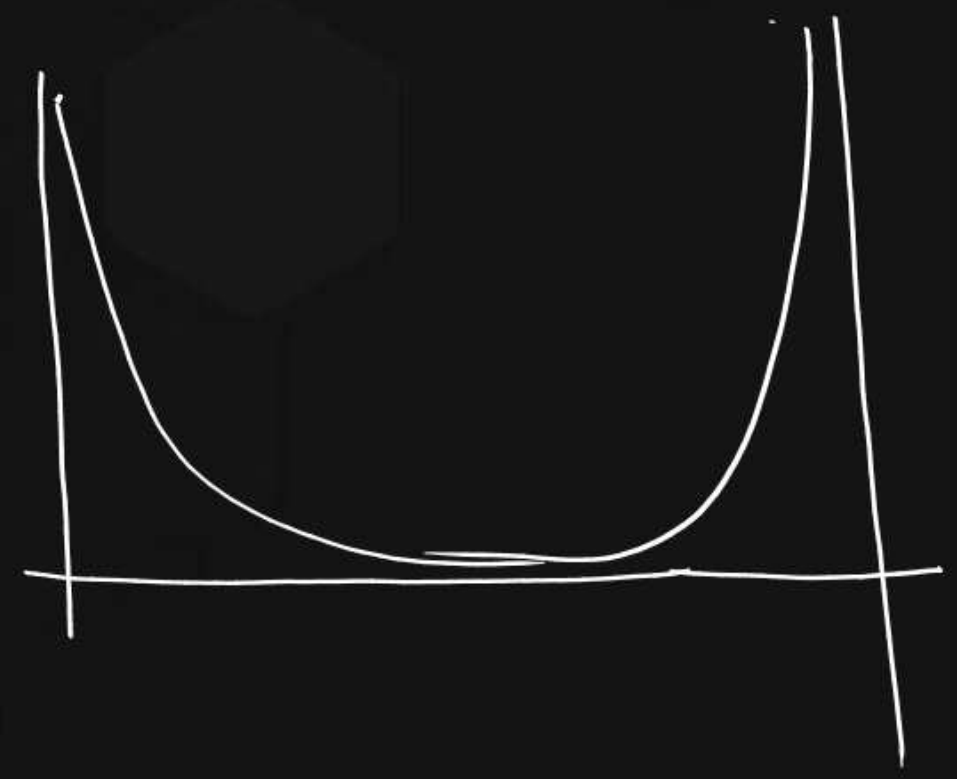
ABMO > BMO



25 2p



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$Z \geq 8$

σ_{1s}^2
1,2

σ_{1s}^{*2}
3,4

σ_{2s}^2
5,6

σ_{2s}^{*2}
7,8

$\sigma_{2p_z}^2$
9,10

$\pi_{2p_x}^{*1} \pi_{2p_y}^{*1}$
11,13 12,14

$\pi_{2p_x}^{*1}$
15

$\sigma_{2p_z}^{*1}$
16

$Z \leq 7$

σ_{1s}^2

σ_{1s}^{*2}

σ_{2s}^2

σ_{2s}^{*2}

$\pi_{2p_x}^2$

$\sigma_{2p_z}^2$

$\pi_{2p_x}^{*1}$

$\pi_{2p_y}^{*1}$

$\sigma_{2p_z}^{*1}$

$N_2 \rightarrow N_2^+$

$N_2 \rightarrow N_2^-$

$N_2^{\oplus}$

1

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1 Bond Order $\Rightarrow$

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

$N_b = \text{no. of } e^- \text{ in BMO}$

$N_a = \text{no. of } e^- \text{ in ABMO}$



$B.O. \propto \text{Bond Strength}$
 $\propto \text{Stability}$
 $\propto \frac{1}{\text{Bond length}}$

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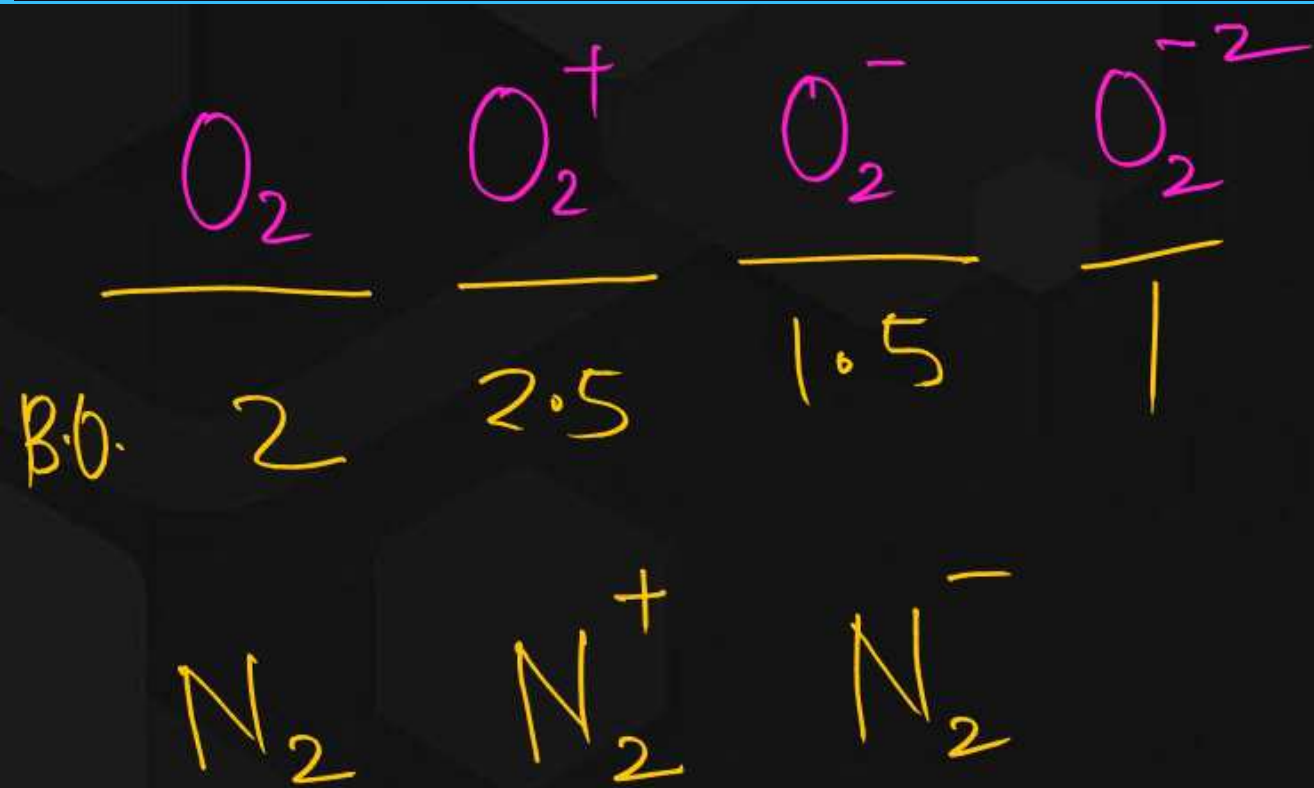
Magnetic Behaviour $\Rightarrow$

Paramagnetic $\Rightarrow$ due to presence of unpaired e^- 's

magnetic moment $= \sqrt{n(n+2)}$ B.M.
 $n = \text{no. of unpaired } e^-$'s

Diamagnetic $\Rightarrow$ Absence of unpaired e^- 's

B.O.	Inference
-ve	Species does not exist
0	
+1/2	exist but highly unstable
+1	Stable single bond
+2	Stable double bond
+3	Stable triple bond



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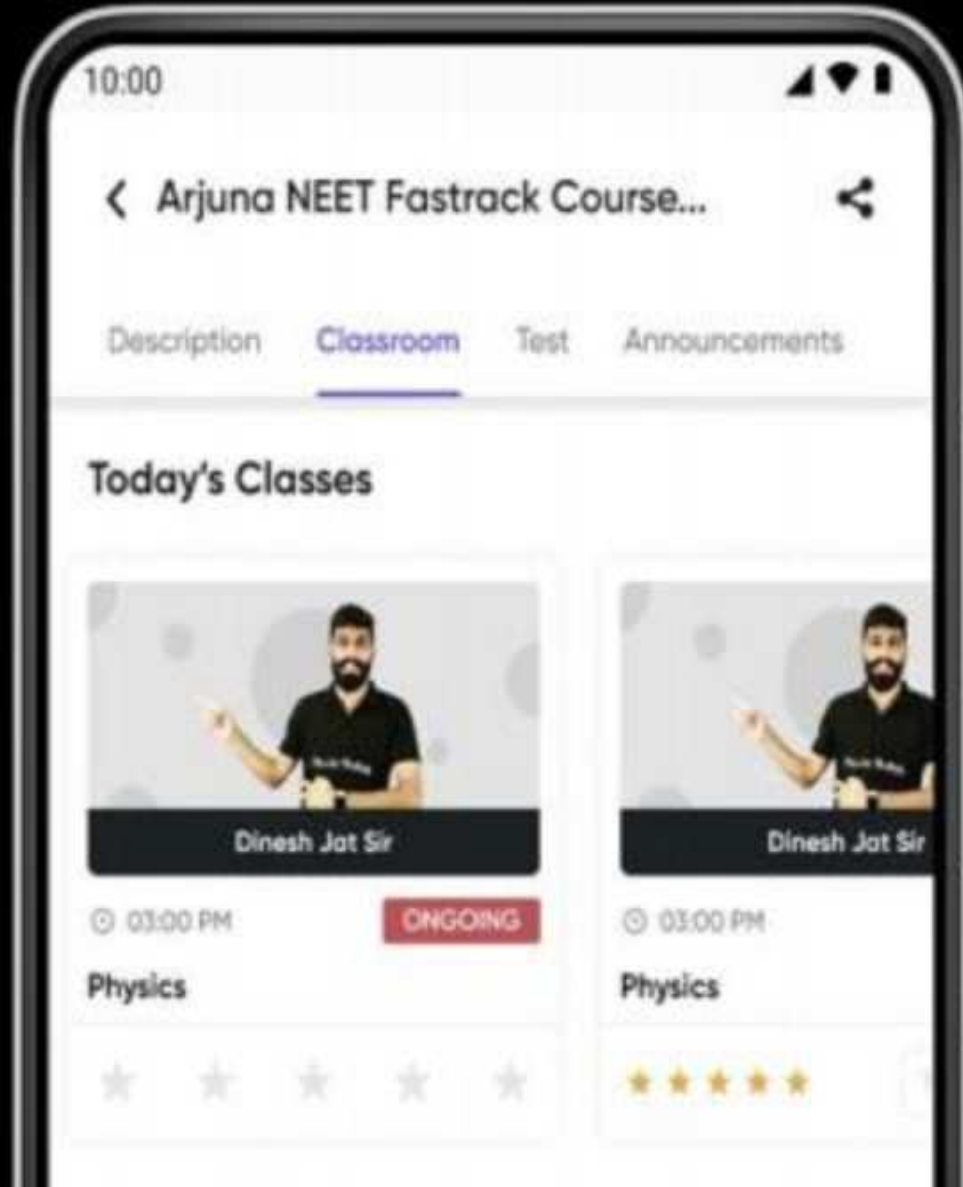




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Solve the DPP and check Solution



"SCAN" to join our "TELEGRAM" channel

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WORK, POWER AND ENERGY

DPP-1 (JAP/046)

[Introduction, Definition of work, work done by constant force, Area under force-displacement curve]

1. A particle moves from position $\vec{r}_1 = 3\hat{i} + 2\hat{j} - 6\hat{k}$ to position $\vec{r}_2 = 14\hat{i} + 13\hat{j} + 9\hat{k}$ under the action of force $-4\hat{i} + \hat{j} + 3\hat{k}$ N. The work done by this force will be

(A) 100 J
(B) 50 J

(A) 8×10^{-2} joules
(B) 16×10^{-2} joules
(C) $A = 10 \times 10^{-4}$ joules

Thank You!!!!

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