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VIDYAPEETH

BATCH CODE: 19-PJ301EA 2025

SUBJECT NAME: CHEMISTRY

CHAPTER NAME:

Chemical bonding and molecular structure

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Lecture No. 05

By – Swapnil Sir

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Today's Goal

Subtopic

Bond Character , Bond Order

→ Resonance

→ Backbonding

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Hybridisation in Solid State ⇒

#1 $PCl_5 \Rightarrow [PCl_4]^+[PCl_6]^-$

T O

$PBr_5 \Rightarrow [PBr_4]^+Br^-$

$N_2O_5 \Rightarrow [NO_2^+][NO_3^-]$

$Cl_2O_6 \Rightarrow [ClO_2^+][ClO_4^-]$

$N_2O_4 \Rightarrow [NO^+][NO_3^-]$

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$XeF_6 \rightleftharpoons [XeF_5^+]F^-$

$I_2Cl_6 \rightleftharpoons [ICl_2^+][ICl_4^-]$

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Bond Character → Resonance → Back bonding

Bond Order

Resonance

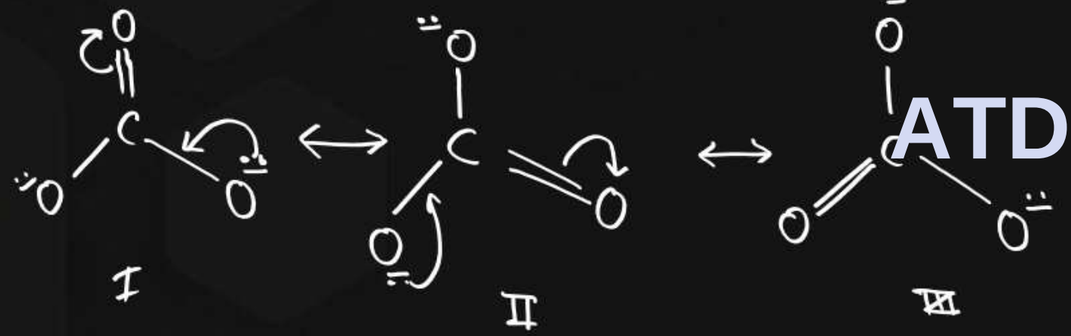
CO_3^{-2}

$\frac{1}{2}[4+2] = sp^2$

Conjugation → delocalisation

Resulting different structures of same molecule

{none of the structure is the actual structure}



I ⟷ II ⟷ III ≡ Resonance hybrid structure

Bond Order

Bonds basis {different structures}

$\Rightarrow CO_2$

$B.O. = \frac{2+1+1}{3} = 4/3$

$= \frac{1+2+1}{3} = 4/3$

$= \frac{1+1+2}{3} = 4/3$

$B.O. \propto B.S. \propto \frac{1}{B.L.}$

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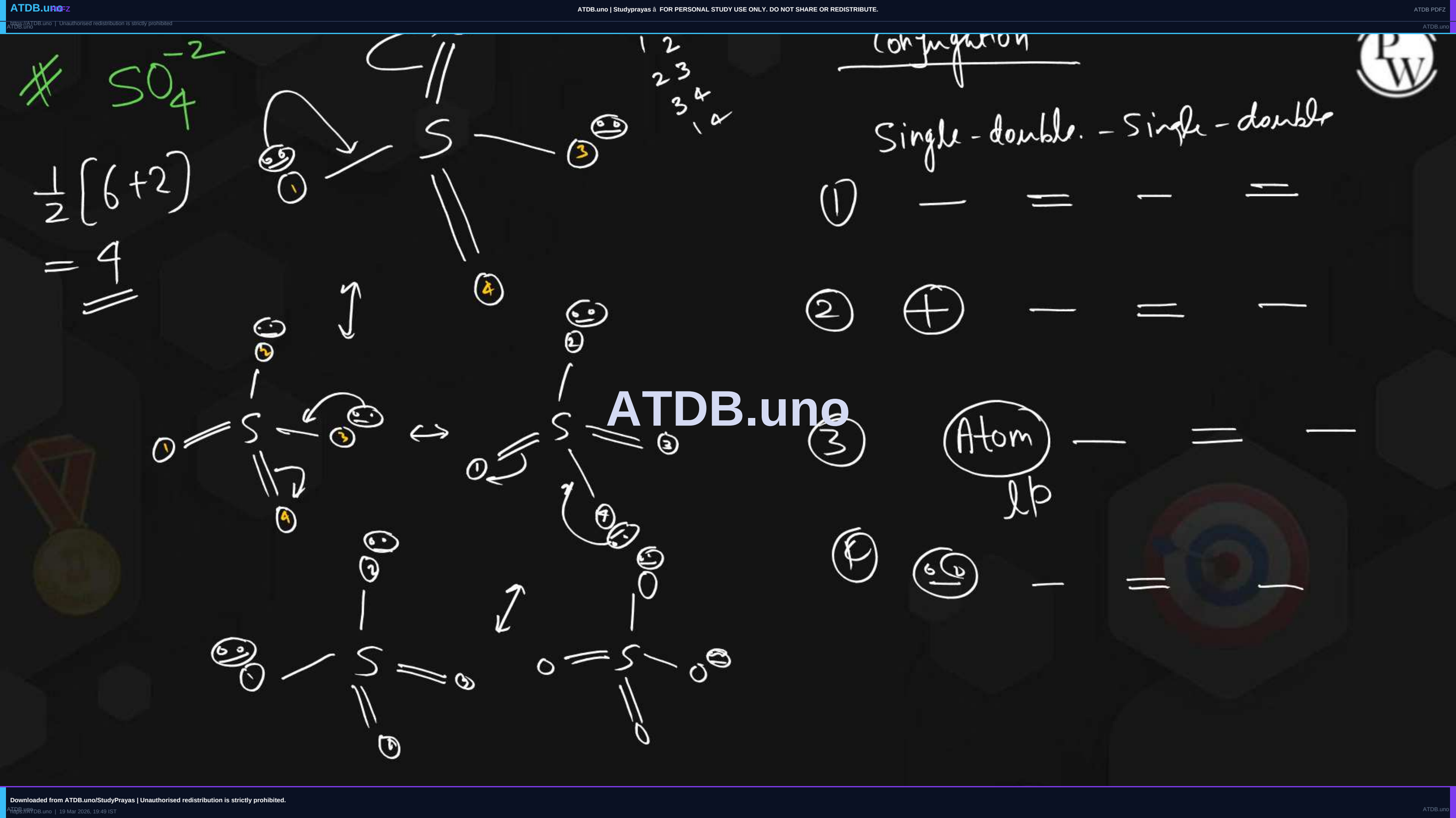

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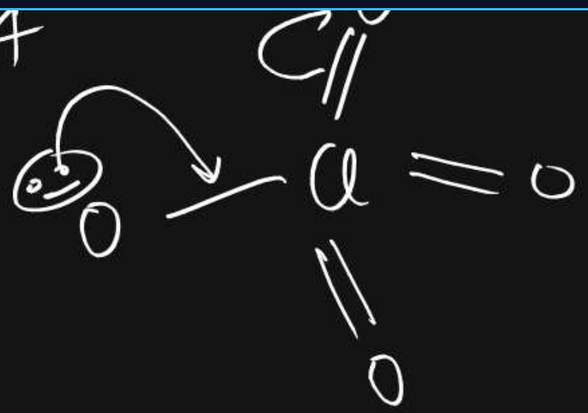
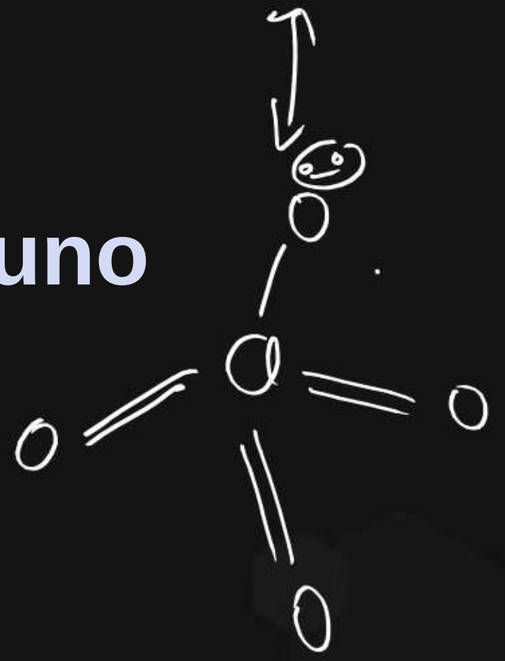
$HClO_4 \rightleftharpoons H^+ + ClO_4^-$

$\frac{1}{2}[7+1] = 4$





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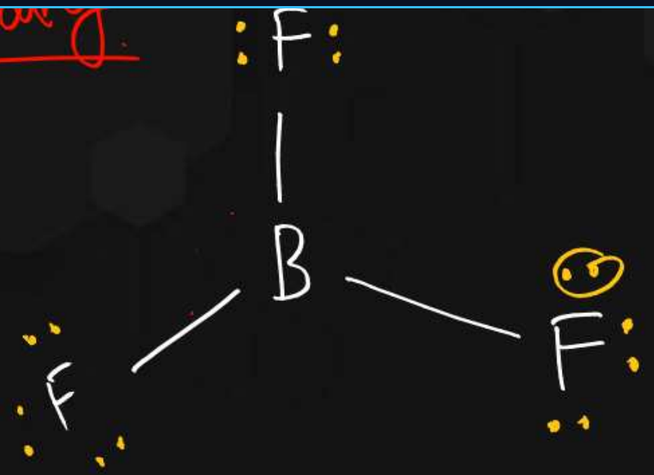
Back donation

BF_3

C.A. S.A.

$H = \frac{1}{2}[3+3]$

$= 3 = sp^2$



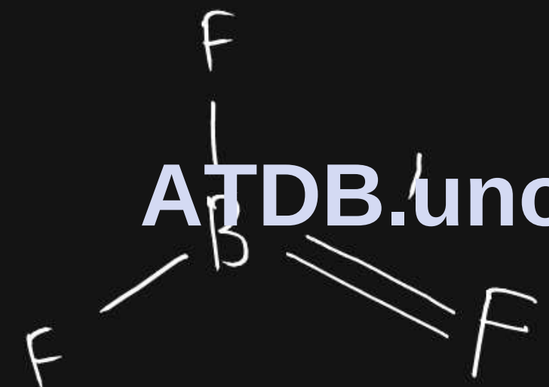
$B(5) = 1s^2, 2s^1, 2p^1$

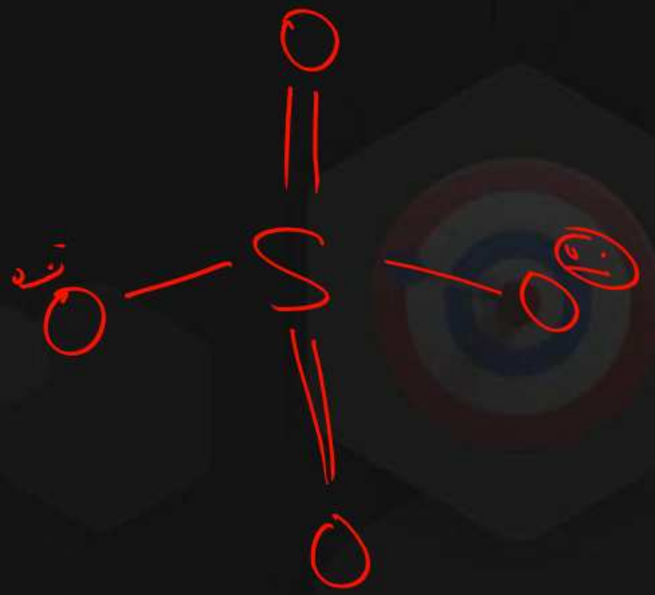
=

Back donation

C.A. ⇒ ① Vacant Orbital

② S.A. must have lp





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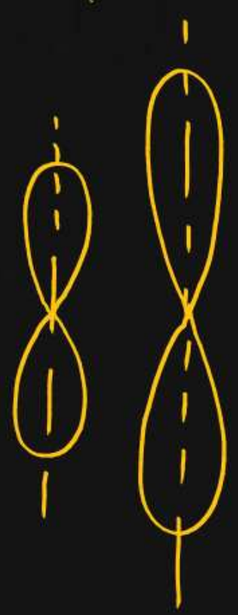
BF_3 < BCl_3 < BBr_3

Order of acidic strength (Lewis acid)

BF_3: 2p 2p

2p – 2p

BCl_3: 2p 3p



BBr_3: 2p 4p

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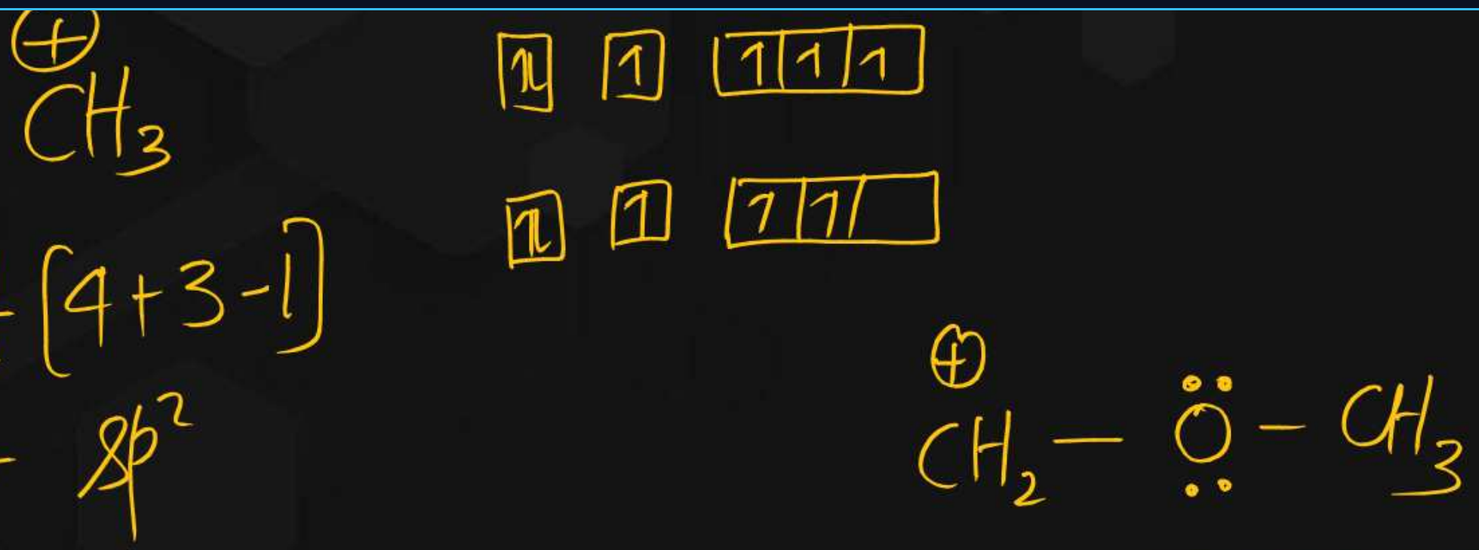

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Covalent ⇒ $\overset{\delta+}{A} \rightarrow \overset{\delta-}{B}$ due to difference in E.N. of bonded atoms.

Covalent bond Character ⟶ Ionic Character

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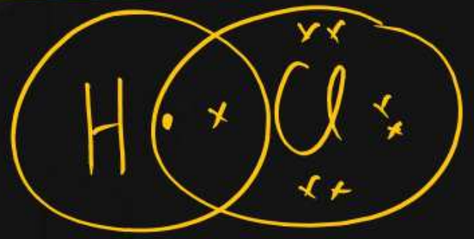
Change of Covalent character to Ionic character

Dipole moment



H — Cl

dipole

direction

$\delta+$ H → $\delta-$ Cl

$\vec{\mu} = q \times l$ D

$\delta+$ H ⋯ $\delta-$ O $\delta-$ — $\delta+$ H

⊖ to +Ve

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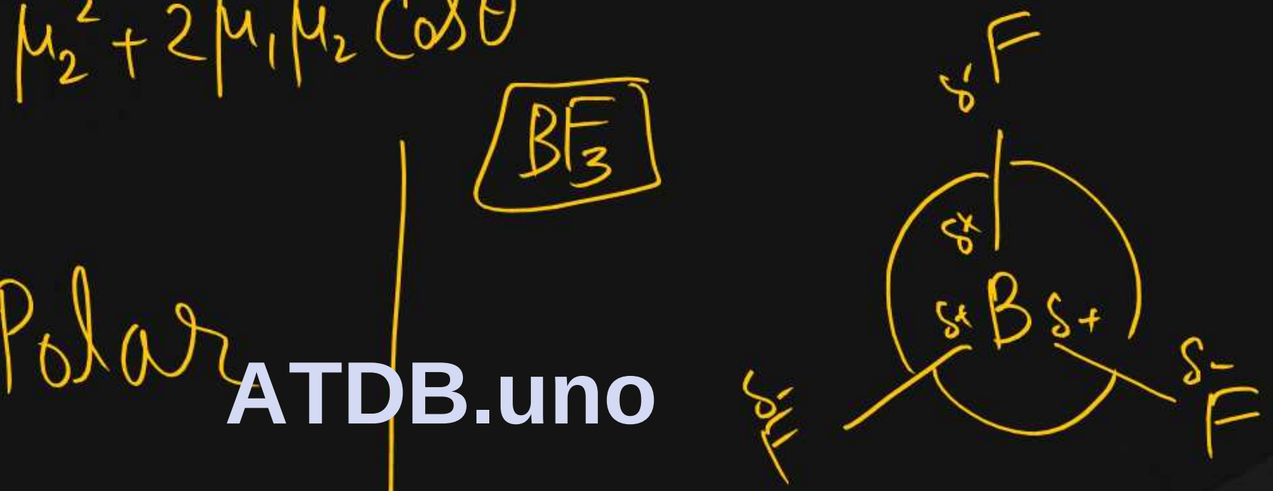
$\vec{\mu_1}$ $\vec{\mu_2}$

$$|\vec{\mu}_R| = \sqrt{\mu_1^2 + \mu_2^2 + 2\mu_1\mu_2\cos\theta}$$

$\Rightarrow$ $\mu_R \neq 0$ Polar

$\mu_R = 0$ nonPolar

BF_3



$\mu_{net} = 0$

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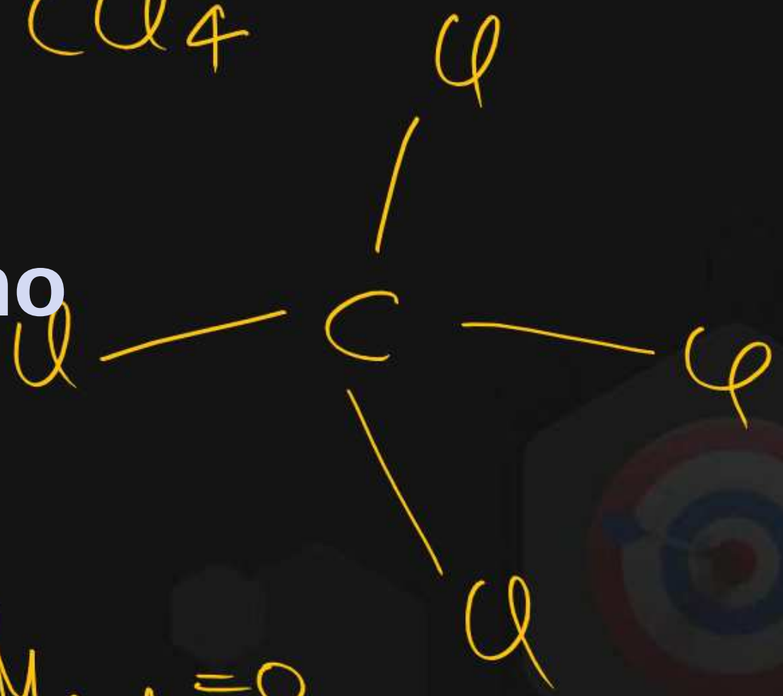
CO_2 $O=C=O$ $\mu = 0$

CS_2 $S=C=S$

Solvent	
Polar	Polar
non Polar	non Polar

CCl_4



$\mu_{net} = 0$

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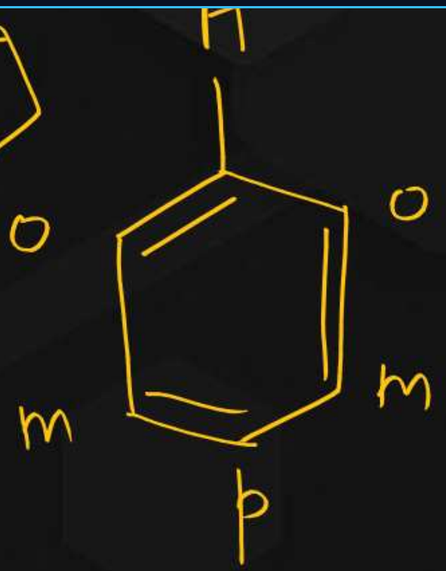
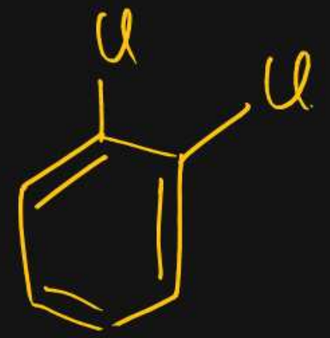
positional



ortho
meta
para



$\sqrt{\mu^2+\mu^2+2\mu\cdot\mu\cdot\frac{1}{2}} = \mu\sqrt{3}$

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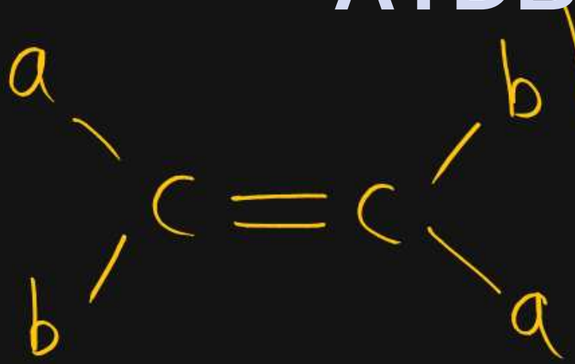
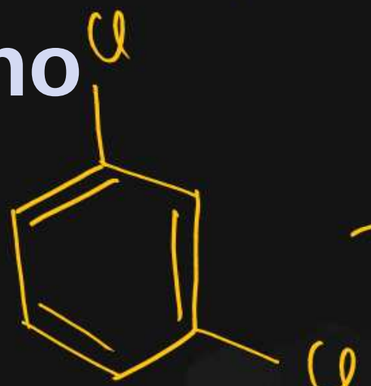
G.I.

Cis



Trans



$\sqrt{\mu^2+\mu^2-2\cdot\mu\mu\cdot\frac{1}{2}}$

$= \mu$

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$$\% \text{ Ionic character} = \frac{\mu_{obs.}}{\mu_{cal.}} \times 100$$

CO_3^{-2}

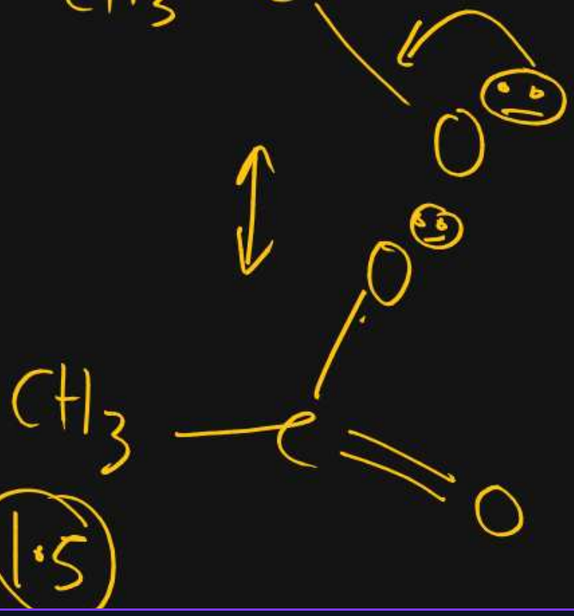
CH_3COO^-

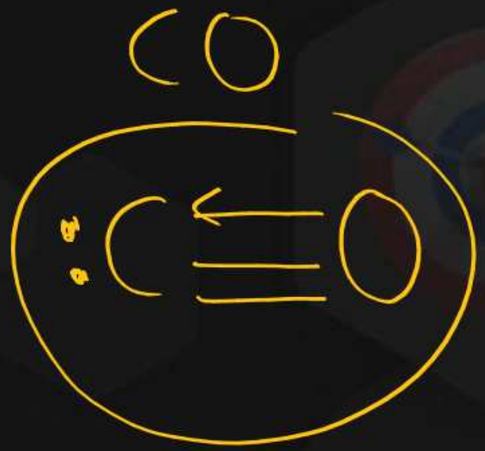
CO_2

$O=O$

$4/3$

$O=C=O$





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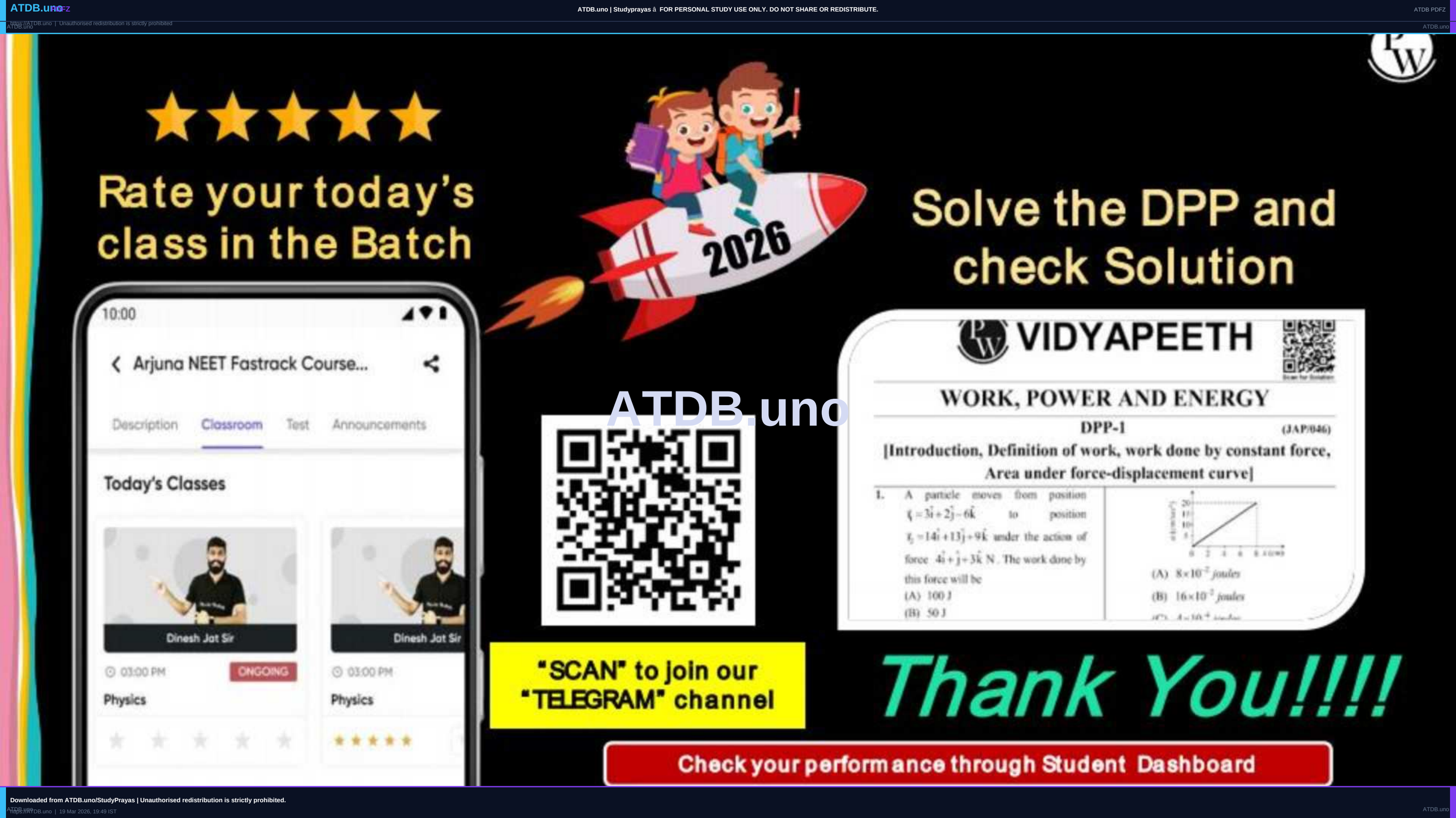

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