LIVE

CHEMICAL BONDING

ONE SHOT & PYQs

for JEE-MAIN

One Shot

9:00 PM Tonight 🔥

By VJ Sir

Nishant Jindal

When total no of $e^- > 14$

O_2

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

$= \frac{1}{2} \times 4$

$= 2$, (Paramag)

$1e^-$ ↓ in ABMO then B.O ↑ by 0.5

Key point

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

N_B = no of e^- in B.M.O

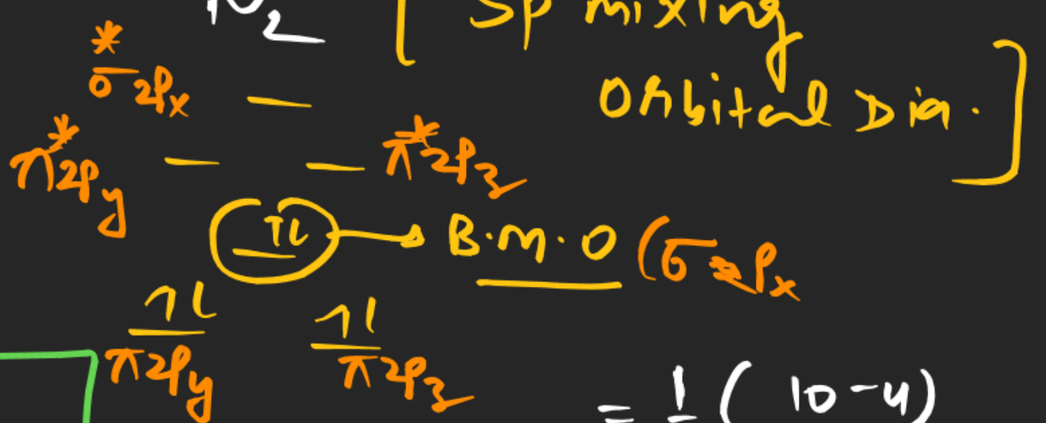
N_A = no of e^- in ABMO e^-

$1e^-$ ↑ in B.M.O then B.O ↑ by 0.5

$1e^-$ ↓ in B.M.O then B.O ↓ by 0.5

$1e^-$ ↑ in ABMO then B.O ↓ by 0.5

N_2 [Sp mixing Orbital Dia.]



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

$= \frac{1}{2} \times 6 = 3$, Dia

When total e^- < 14 e^-

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	O_2	O_2^+	O_2^-	O_2^{-2}	O_2^{+2}
B.O	2	2.5	1.5	1	3

B.O ↑ B.L ↓

Order of B.L

$O_2^{-2} > O_2^- > O_2 > O_2^+ > O_2^{+2}$

(O_2^{-2} : Peroxide) (O_2^- : Superoxide) (O_2^+ : dioxygenyl ion)

B.O = 0 molecule dono+ exist

He_2 Ne_2 Be_2

dono+ exist

Keypoint

Iso electronic molecule Have same bondorder

CO N_2 CN^- O_2^{+2} NO^+

B.O = 3 3 3 3 3

O_2^{-2} N_2^{-2} NO^-

B.O = 2 2 2

NO O^+ N_2^-

2.5 2.5 2.5

$NO \xrightarrow{-e} NO^+$

2.5 3

$\pi^*_{2p_y}$ 1 $\sigma^*_{2p_x}$

π_{2p_y} 1 1 $\pi^*_{2p_y}$

π_{2p_z} 1 1

σ_{2p_x} 1

$\frac{1}{2}(10-5) = 2.5$

$\sigma^*_{(2s)}$ 1

$\sigma_{(2s)}$ 1

$\sigma^*_{(1s)}$ 1

$\sigma_{(1s)}$ 1

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(2019)

1. According to molecular orbital theory, which of the following is true with respect to Li_2^+ and Li_2^-?

(A) Li_2^+ is unstable and Li_2^- is stable

(B) Li_2^+ is stable and Li_2^- unstable

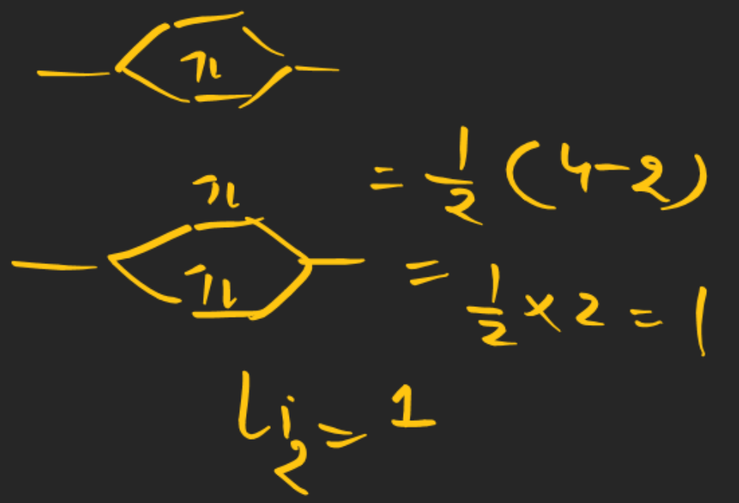
(C) Both are stable

(D) Both are unstable

$L.i_2 = 6$

$L.i_2^+ = 0.5$

$L.i_2^- = 0.5$



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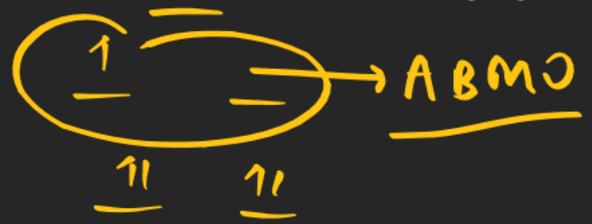
2. In which of the following processes, the bond order has increased and paramagnetic character has changed to diamagnetic?

(A) $NO \rightarrow NO^+$

(B) $N_2 \rightarrow N_2^+$

(C) $O_2 \rightarrow O_2^+$

(D) $O_2 \rightarrow O_2^{2-}$



$NO \longrightarrow NO^+$

2.5 | 3

Para | Dia

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3. Two pi and half sigma bonds are present in:

(A) O_2^+ (B) N_2 (C) O_2 (D) N_2^+

$\frac{1}{2}(4-0)$

$\frac{1}{2} \times 4 = 2$

$\frac{1}{2}(2-0)$

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

$\pi^*_{2p_y}$ — $\pi^*_{2p_z}$

σ_{2p_x} — BMO

π_{2p_y} — π_{2p_z}

$\frac{1}{2}(1-0) = 0.5$

$= \frac{1}{2}(N_B - N_A)$

$\pi \; \sigma^*_{(2s)}$

$\sigma_{(2s)}$

$1 \; \sigma^*_{(1s)}$

$\pi \; \sigma_{(1s)}$ — B.O

$N \equiv N$

$1\sigma + 2\pi$

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4. Among the following molecules/ions,

$C_2^{2-}, N_2^{2-}, O_2^{2-}, O_2$

Which one is diamagnetic and has the shortest bond length?

(A) O_2 (B) N_2^{2-} (C) O_2^{2-} (D) C_2^{2-}

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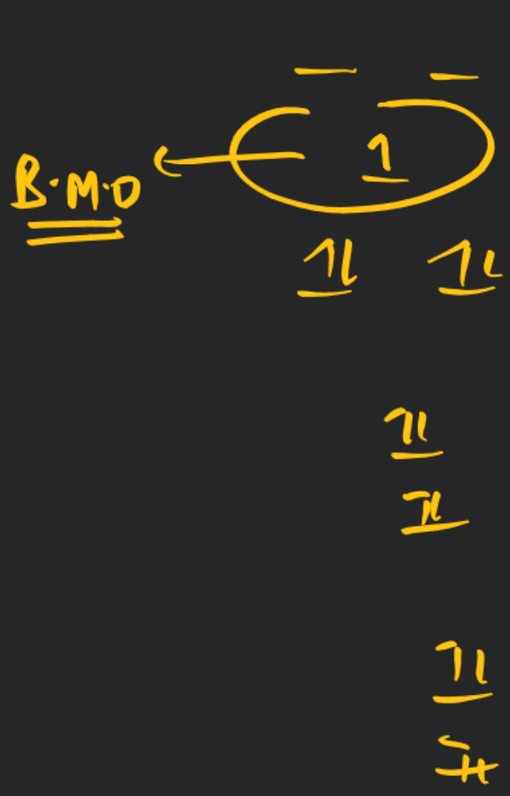
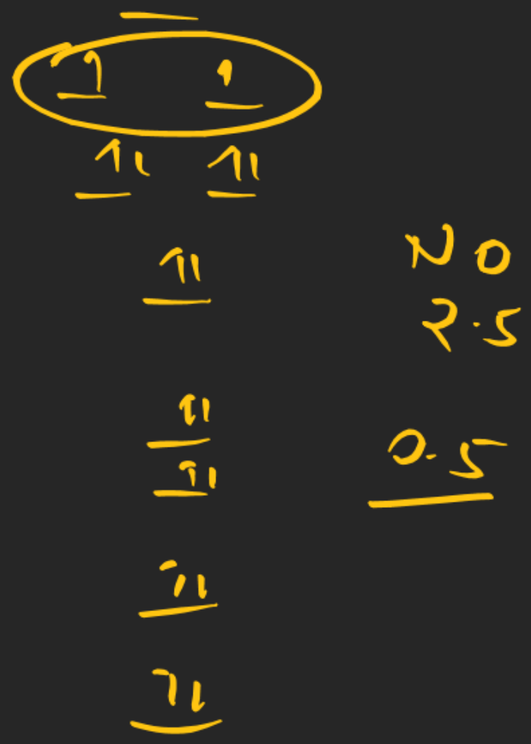
5. Among the following, the molecule expected to be stabilized by anion formation is: C_2, O_2, NO, F_2

(A) C_2 (B) F_2 (C) NO (D) O_2





NO
2.5
0.5

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6. Among the following species, the diamagnetic molecule is:

(A) NO (B) CO (C) B_2 (D) O_2

B.O = 3

N_2

Dia

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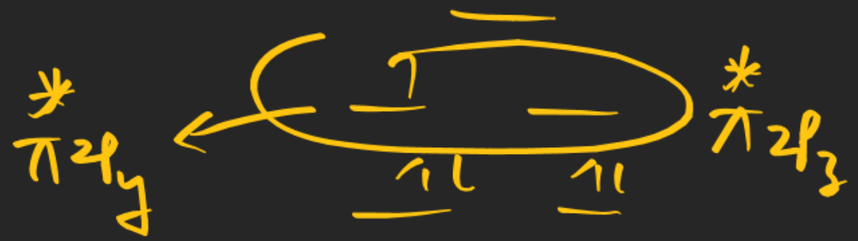
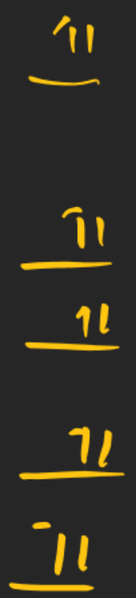
7. During the change of O_2 to O_2^- the incoming electron goes to the orbital:

(A) $\pi 2p_y$ (B) $\sigma^* 2p_z$ (C) $\pi^* 2p_x$ (D) $\pi 2p_x$





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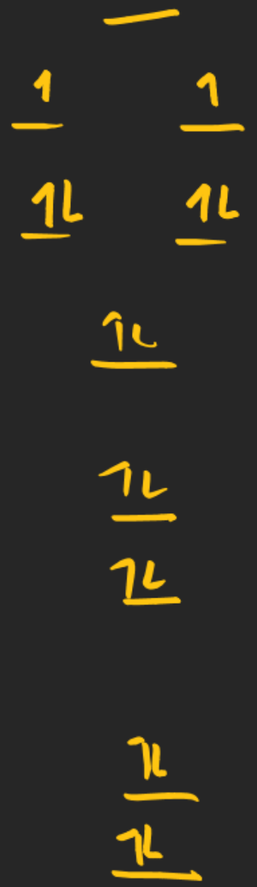
2. Bond order and magnetic nature of CN^- are respectively

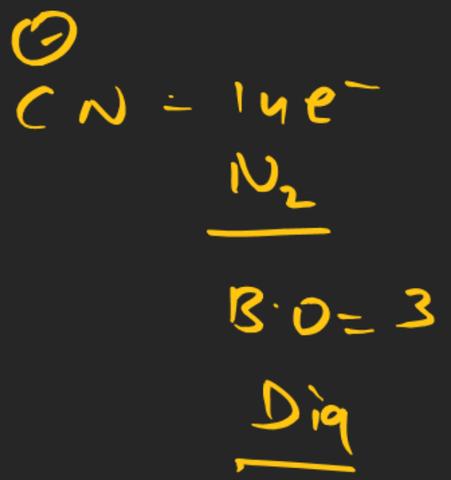
(A) 3, diamagnetic

(B) 3, paramagnetic

(C) 2.5, paramagnetic

(D) 2.5, diamagnetic





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11. Of the species, NO, NO^+, NO^{2+} and NO^-, the one with minimum bond strength is

(A) NO^- (B) NO^{2+} (C) NO^+ (D) NO

B.O Strength

NO NO^+ NO^{+2} NO^-

= 2.5 3 2.5 2

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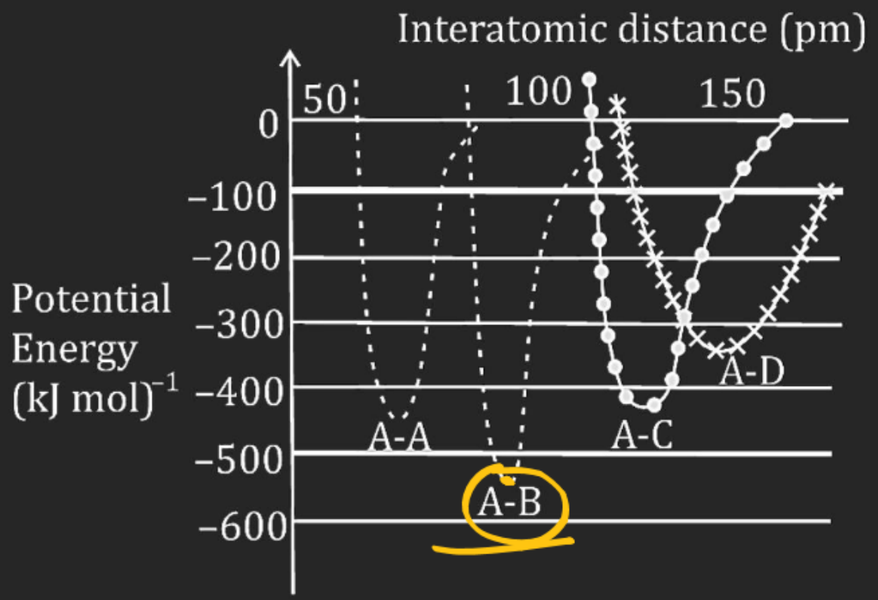
12. The intermolecular potential energy for the molecules A, B, C and D given below suggests that:



lowest (Bond formation point

(A) A– B has the stiffest bond

(B) A – D has the shortest bond length

(C) A–A has the largest bond enthalpy

(D) D is more electronegative than other atoms

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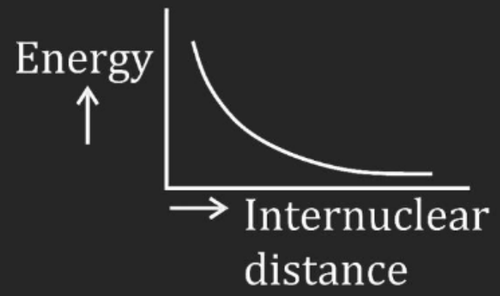
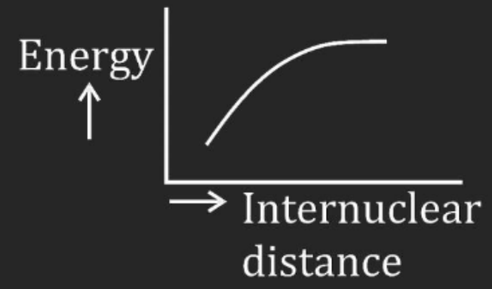
13. The potential energy curve for the H_2, molecule as a function of internuclear distance is

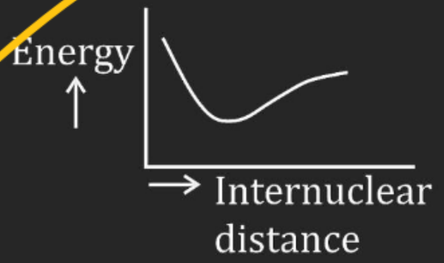
(A)



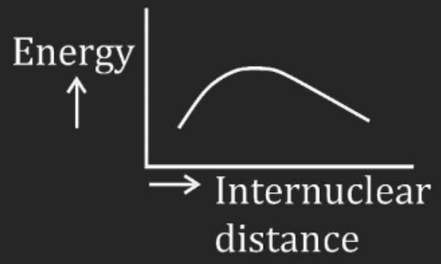
(B)



(C)



(D)



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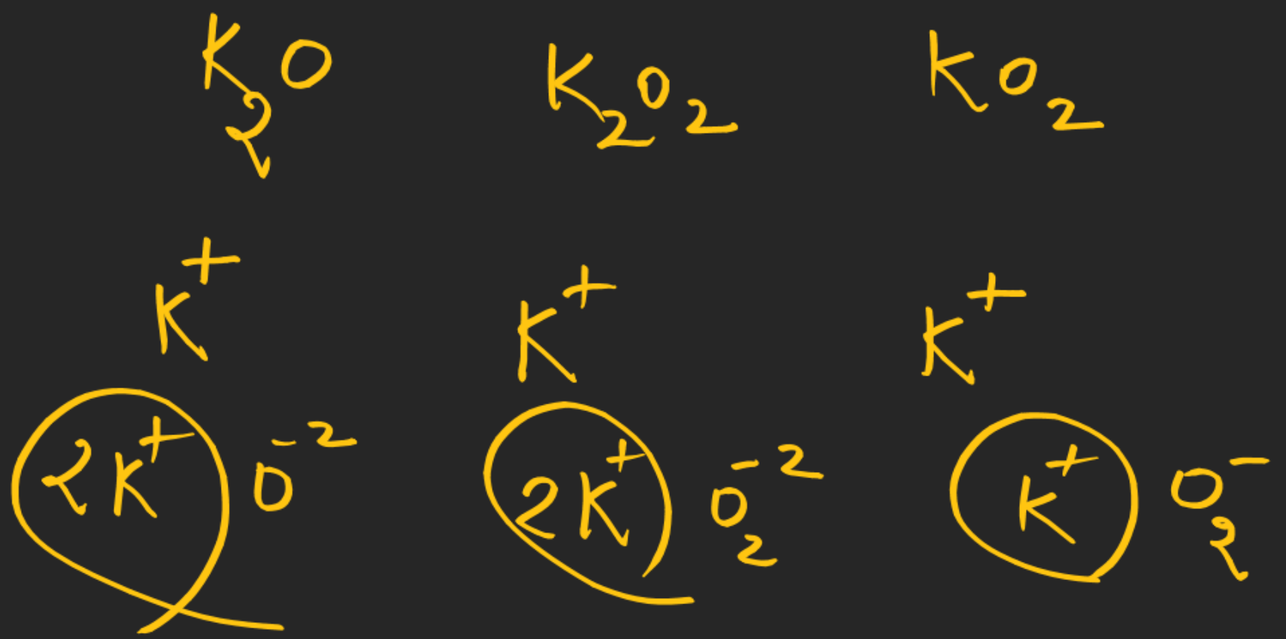
16. Oxidation number of potassium in K_2O, K_2O_2 & KO_2 respectively is

(A) +1, +1, +1

(B) +1 +2, +4

(C) +1, +2, +2

(D) +1, +4, +2



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18. Bond order and magnetic nature of CN^- are respectively

(A) 3, diamagnetic

(B) 3, paramagnetic

(C) 2.5, paramagnetic

(D) 2.5, diamagnetic

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20. If the magnetic moment of a dioxygen species is 1.73 B.M., it may be:

(A) O_2^-, or O_2^+ (B) O_2, or O_2^+ (C) O_2, or O_2^- (D) None of these

Key point

Unpaired e⁻ (u.p.e) | μ (dipole moment)

u.p.e	μ
1	1.73
2	2.80
3	3.87
4	4.90
5	5.92

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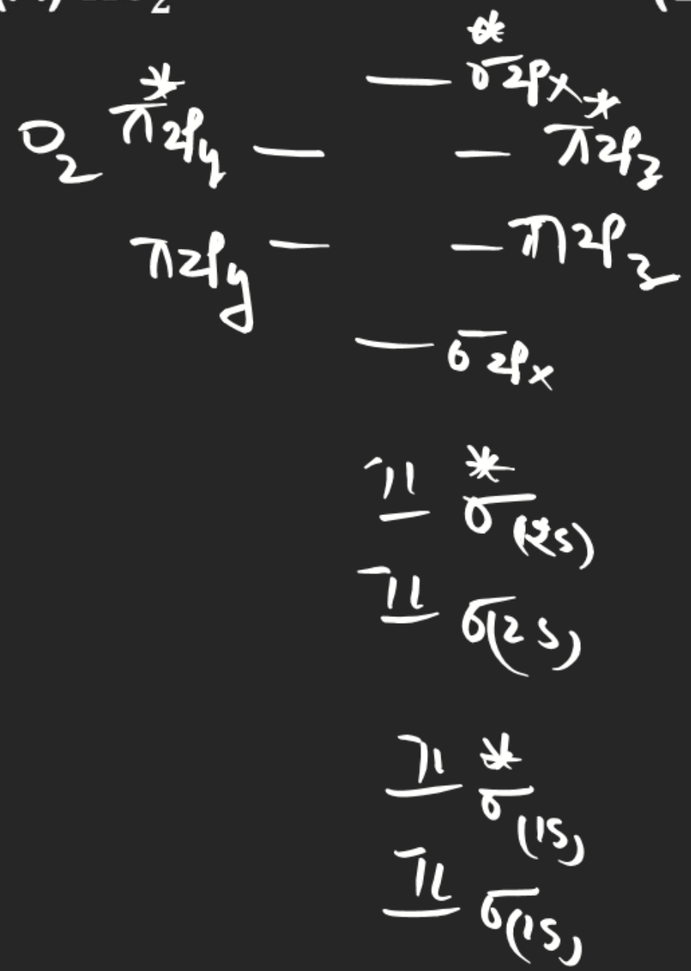
3. According to molecular orbital theory, the species among the following that does not exist is:

(A) He_2^- (B) $He_2{}_2^-$ (C) O_2^{2-} (D) Be_2



BO = 0

Be_2 Ne_2 He_2

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6. Match List-I with List-II.

List-I (Molecule)	List-II (Bond order)
(a) Ne_2	(i) 1
(b) N_2	(ii) 2
(c) F_2	(iii) 0
(d) O_2	(iv) 3

Choose the correct answer from the options given below:

(A) (a) – (iii), (b) – (iv), (c) – (i), (d) – (iii)

(B) (a) – (i), (b) – (ii), (c) – (iii), (d) – (iv)

(C) (a) – (ii),(b) – (i),(c) – (iv),(d) – (iii)

(D) (a) – (iv),(b) – (iii),(c) – (ii),(d) – (i)

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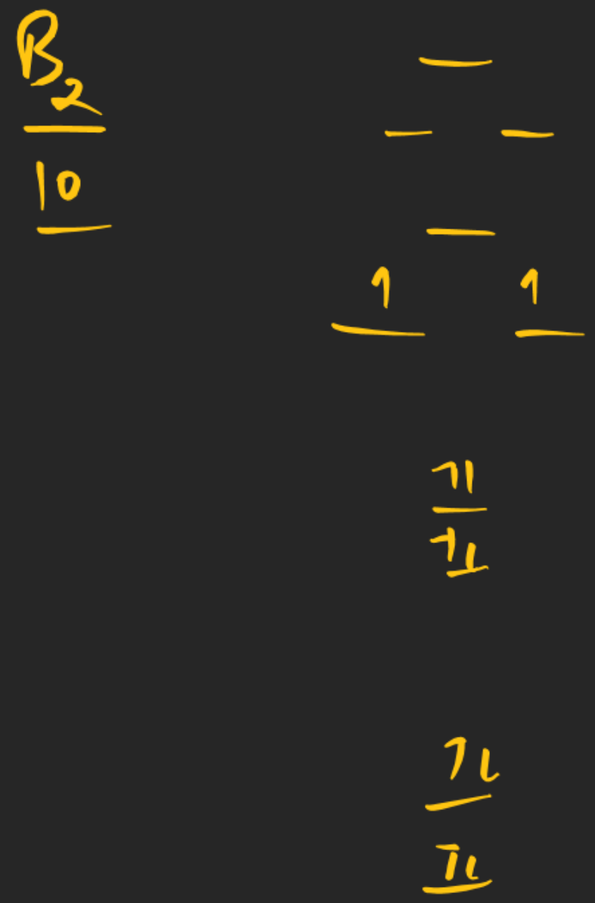
14. The spin-only magnetic moment value of B_2^+ species is $\times 10^{-2}$ B.M.(Nearest integer) [Given: $\sqrt{3} = 1.73$]



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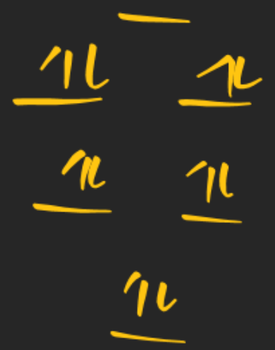
16. According to molecular orbital theory, the number of unpaired electron(s) in O_2^{2-} is :

(0)



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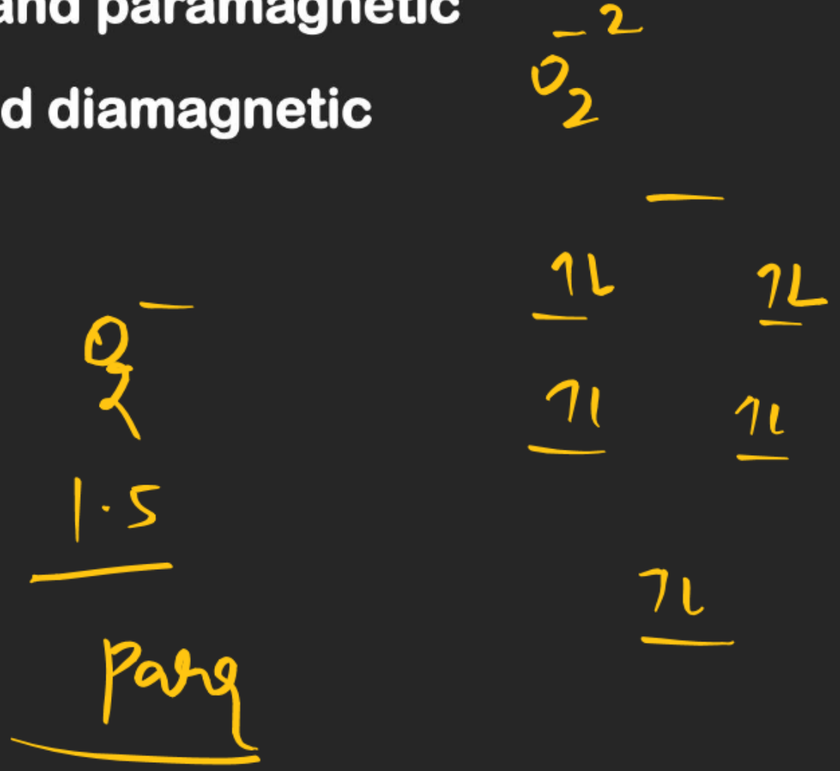
19. The bond order and magnetic behaviour of O_2^- ion are, respectively :

(A) 1.5 and paramagnetic

(B) 1.5 and diamagnetic

(C) 2and diamagnetic

(D) 1 and paramagnetic



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Weak force

1. dipole – dipole
2. dipole - Induced dipole
3. Instantaneous dipole - Induced dipole

V·W·F

4. Ion - dipole
5. Ion - Induced dipole

① dipole-dipole (Keesom force)

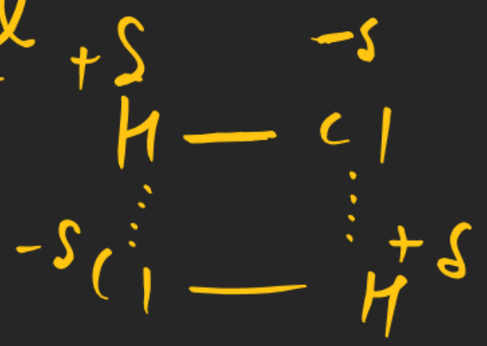
Polar molecule

$\mu \neq 0$

① Head to tail

$H - Cl \cdots H - Cl$

② Anti parallel



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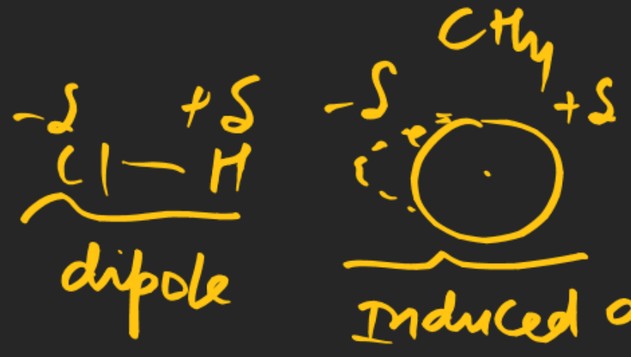
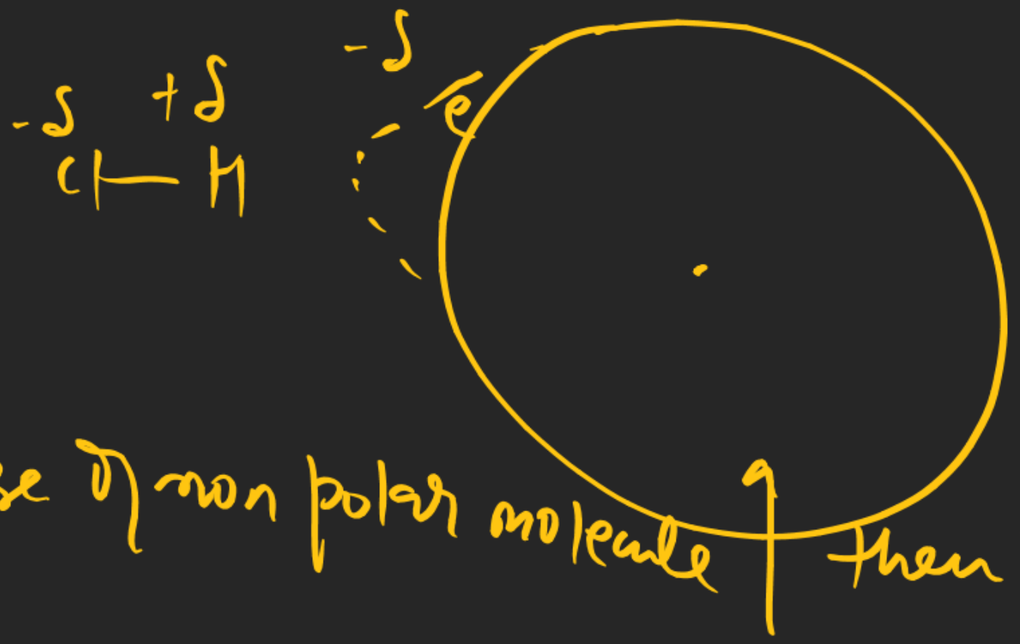
dipole - Induced dipole (Debye force)

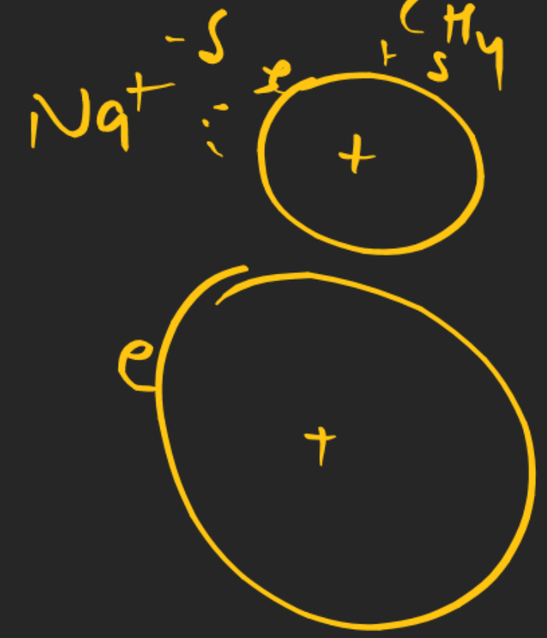




Size of non polar molecule ↑ then dipole - Induced dipole ↑

Ion-dipole

(4) Ion-Induced dipole



Size ↑ Ion-induced dipole Interaction ↑

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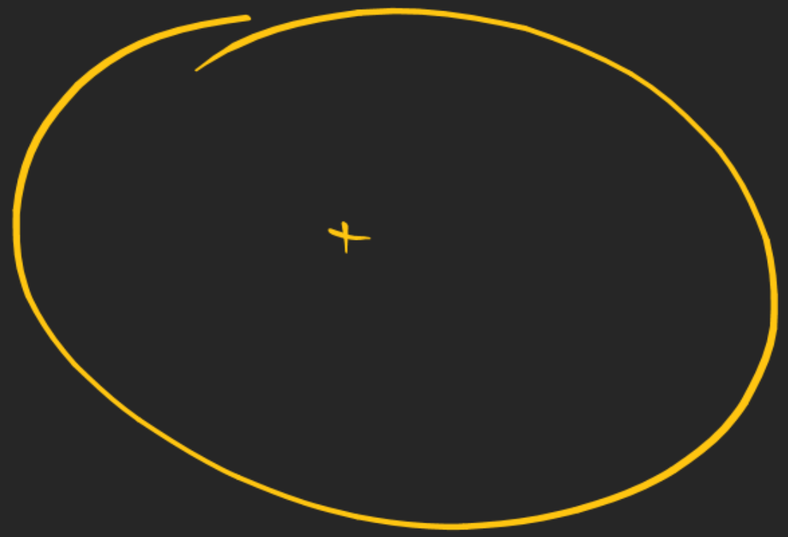
(L·D·F) Instantaneous dipole -- Induced dipole

Size ↑ L·D·F ↑



(Ionic bond)

Ion - Ion $\propto \frac{1}{r}$

Ion - dipole $\frac{1}{r^2}$

dipole - dipole $\frac{1}{r^3}$

Ion - Induced dipole $\frac{1}{r^4}$

dipole - Induced dipole $\frac{1}{r^6}$

Instantaneous dipole - Induced dipole $\frac{1}{r^6}$

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Which of the following interaction is responsible for m.p/B.p and liq. of Noble gas.

L.D.F

Noble gas — Nonpolar

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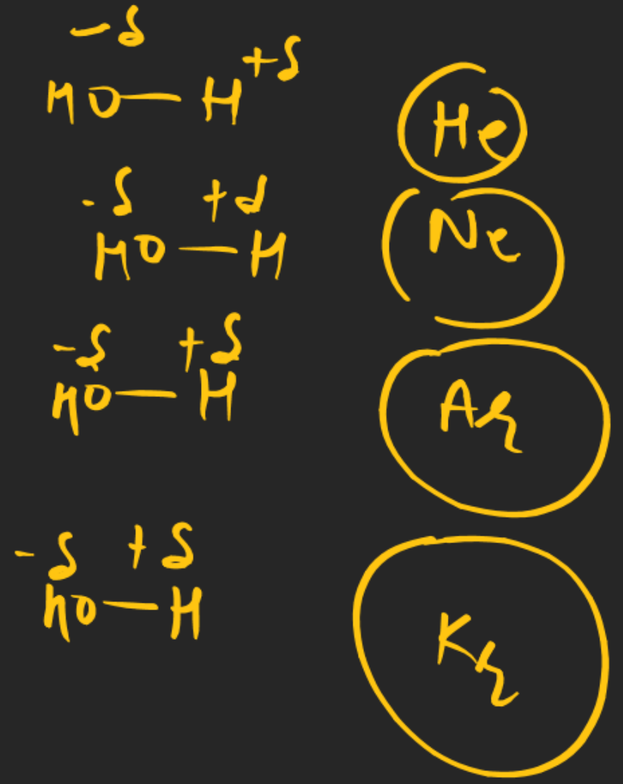
Solubility of Noble gas

Which att. is responsible

dipole - Induced dipole



Back bonding

Back bonding is a type of sideways overlapping (π bond)

1. one bonded atom must have l.p and other bonded atom must have vac. orbital
2. one bonded atom must be of 2nd period and other bonded atom must be of 2nd or 3rd period.

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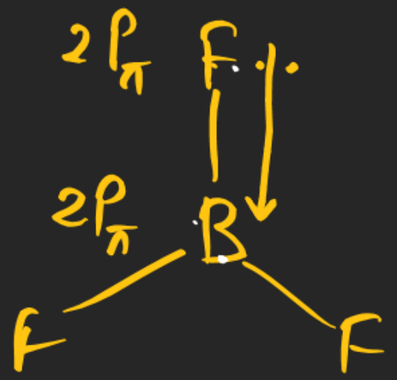
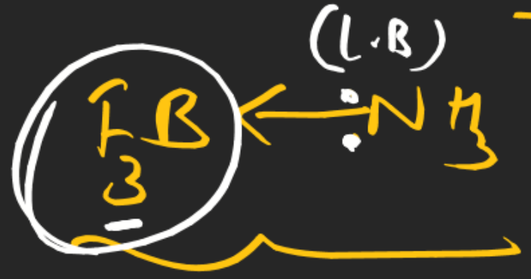


Size ↑ Back bonding ↓

Back bonding strength

$BF_3 > BCl_3 > BBr_3 > BI_3$



order of L.A

$BF_3 < BCl_3 < BBr_3 < BI_3$

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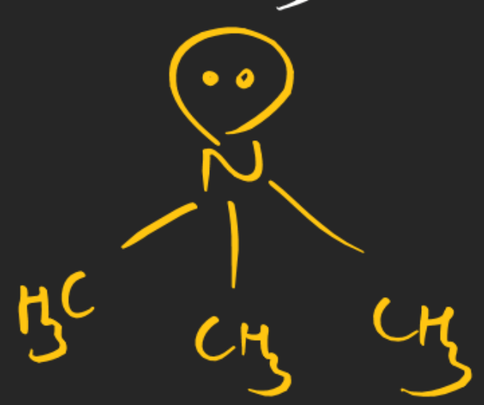
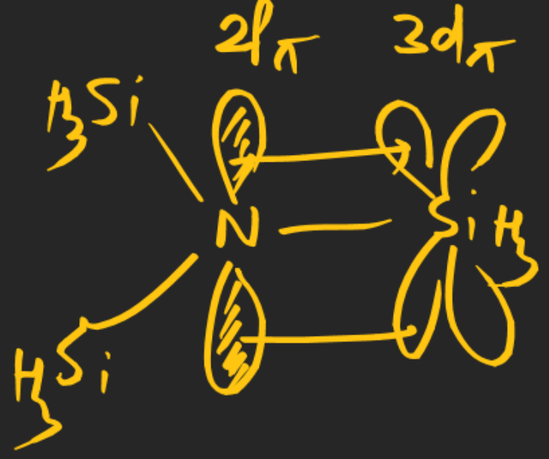
order of Lewis base

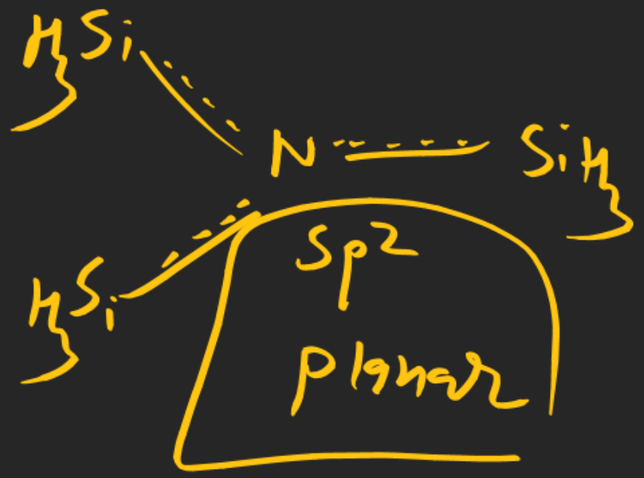
$N(Me)_3$ $N(SiH_3)_3$ $P(SiH_3)_3$



Sp3

Pyramidal





no Back bonding

Pyramidal

non planar

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order L·B

$$N(CH_3)_3 > P(SiH_3)_3 > N(SiH_3)_3$$

Bridge bonding

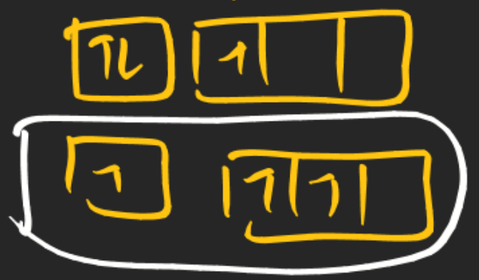
3C – 4e⁻ ⟶ when S.A has l.p

3C – 2e⁻ ⟶ when S.A has no l.p

Al_2Cl_6

B_2H_6

Al = $3s^2\ 3p^1$



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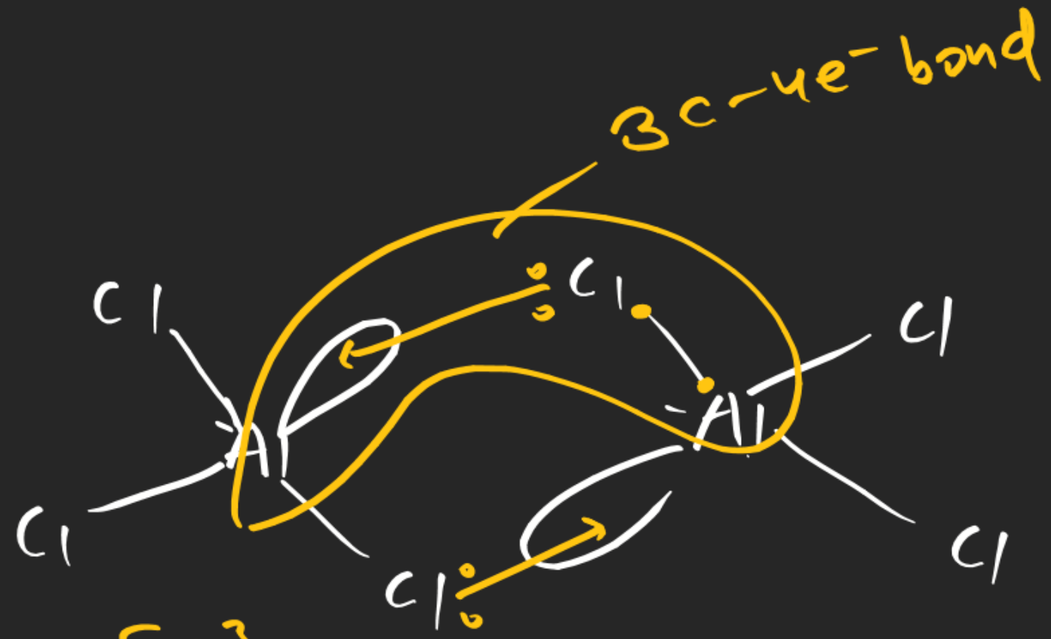

sp^3

3c-4e⁻ = two

2c-2e⁻ = four

B_2H_6

$B = 1s^2 2s^2 2p^1$

Lewis acid

non planar

Hypo val

sp^3

3c-2e⁻ bond = two

e⁻ def.

2c-2e⁻ = four