

CHEMICAL BONDING

(2019)

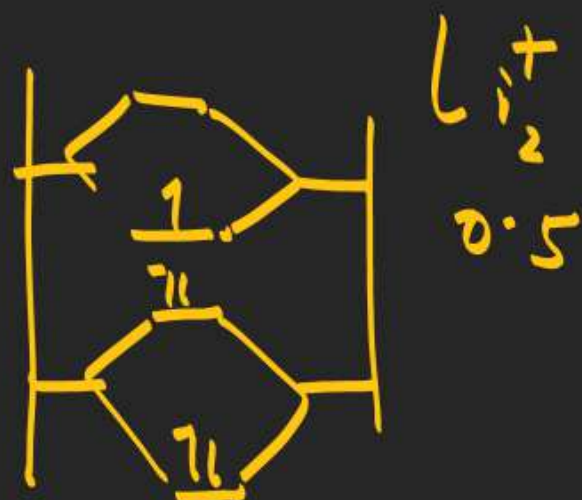
1. According to molecular orbital theory, which of the following is true with respect to Li_2^+ and Li_2^- ?

(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



H
He
Li

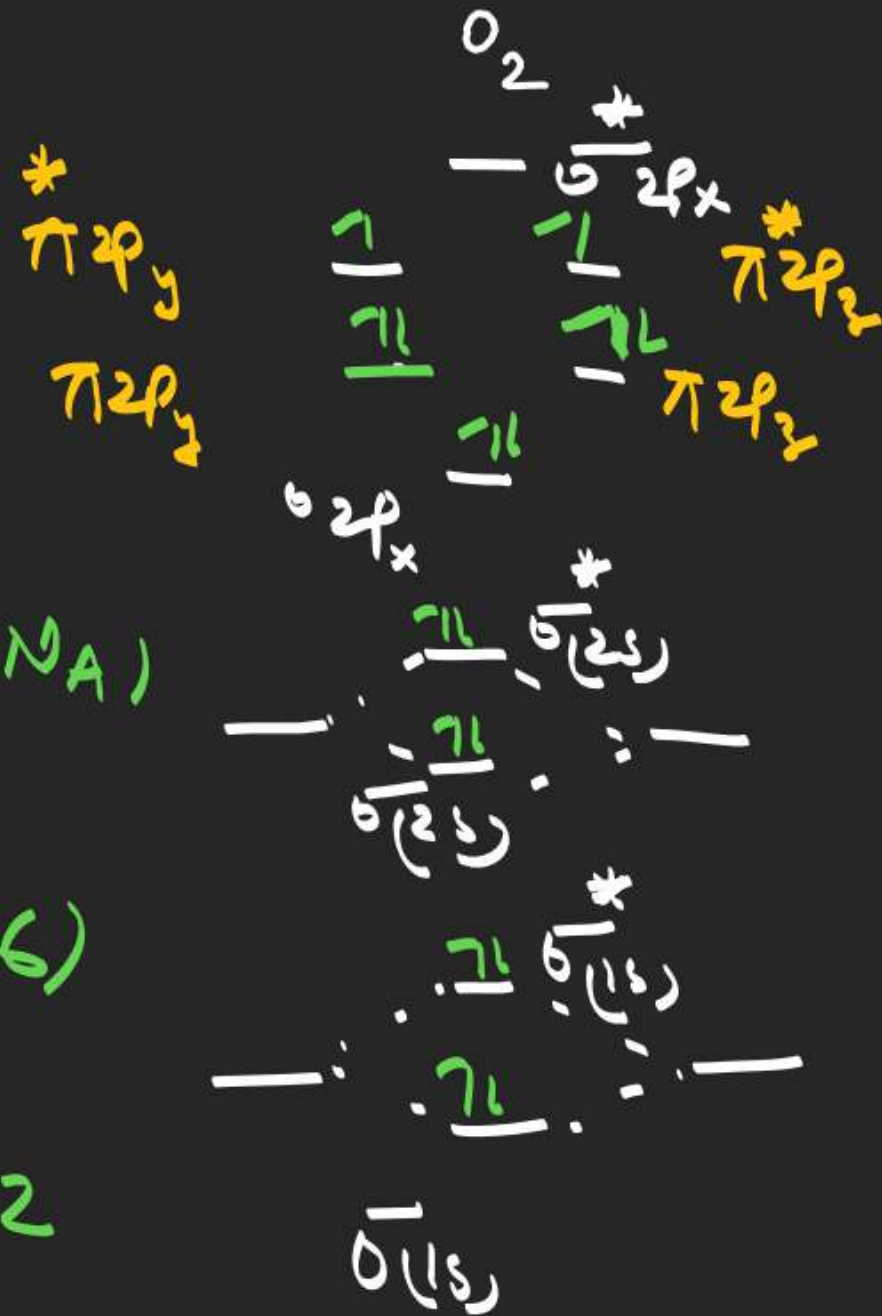
$$\text{B.O} = \underline{0}$$



$$\text{B.O} = 0$$

molecule do not exist

MOT

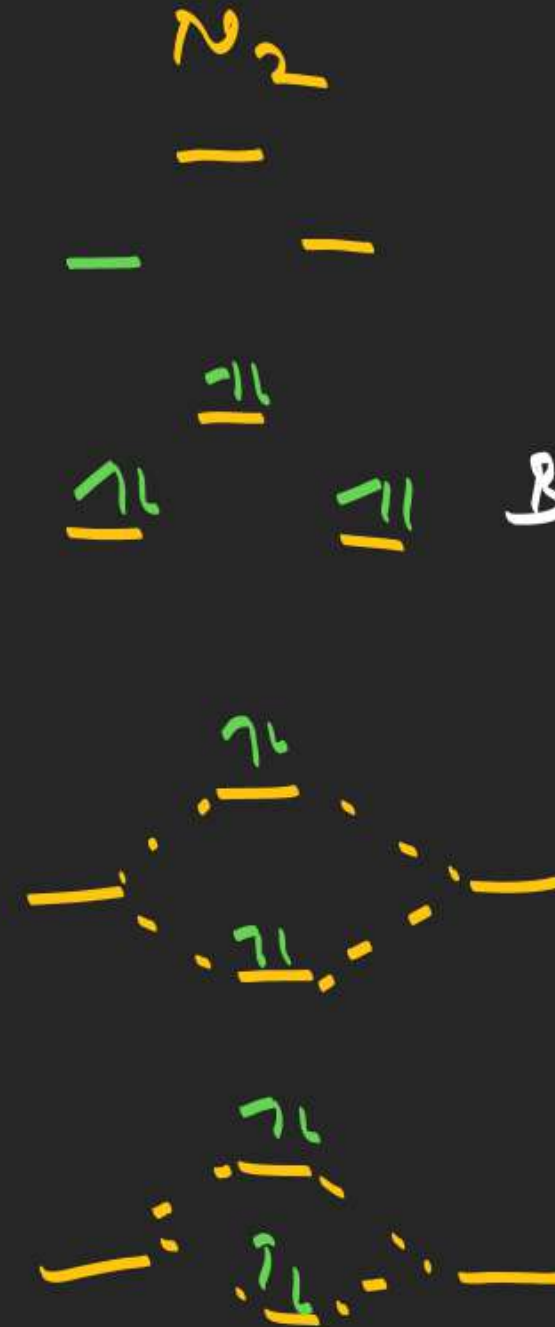


$$B.O = \frac{1}{2} (N_B - N_A)$$

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

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

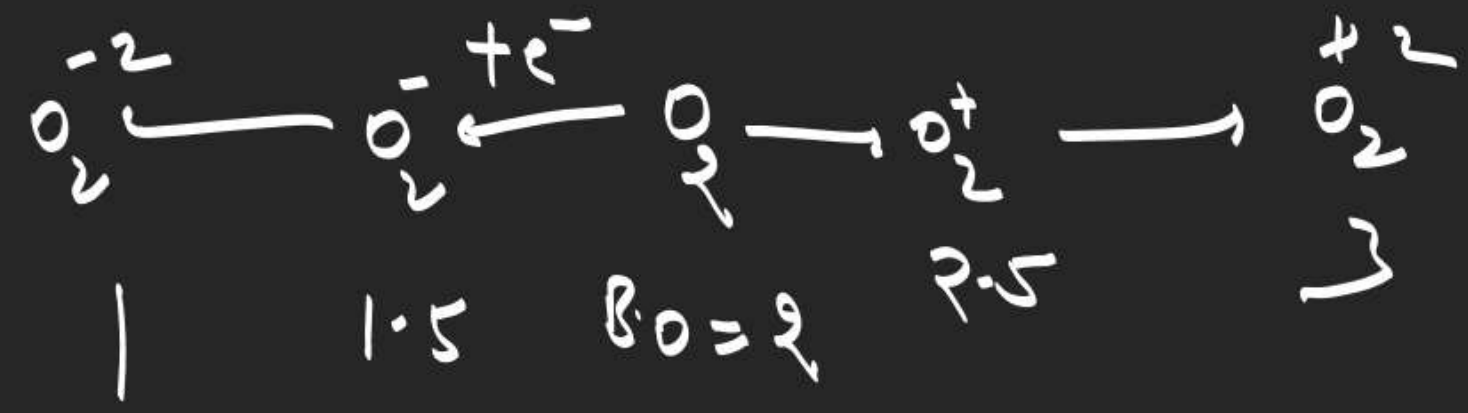
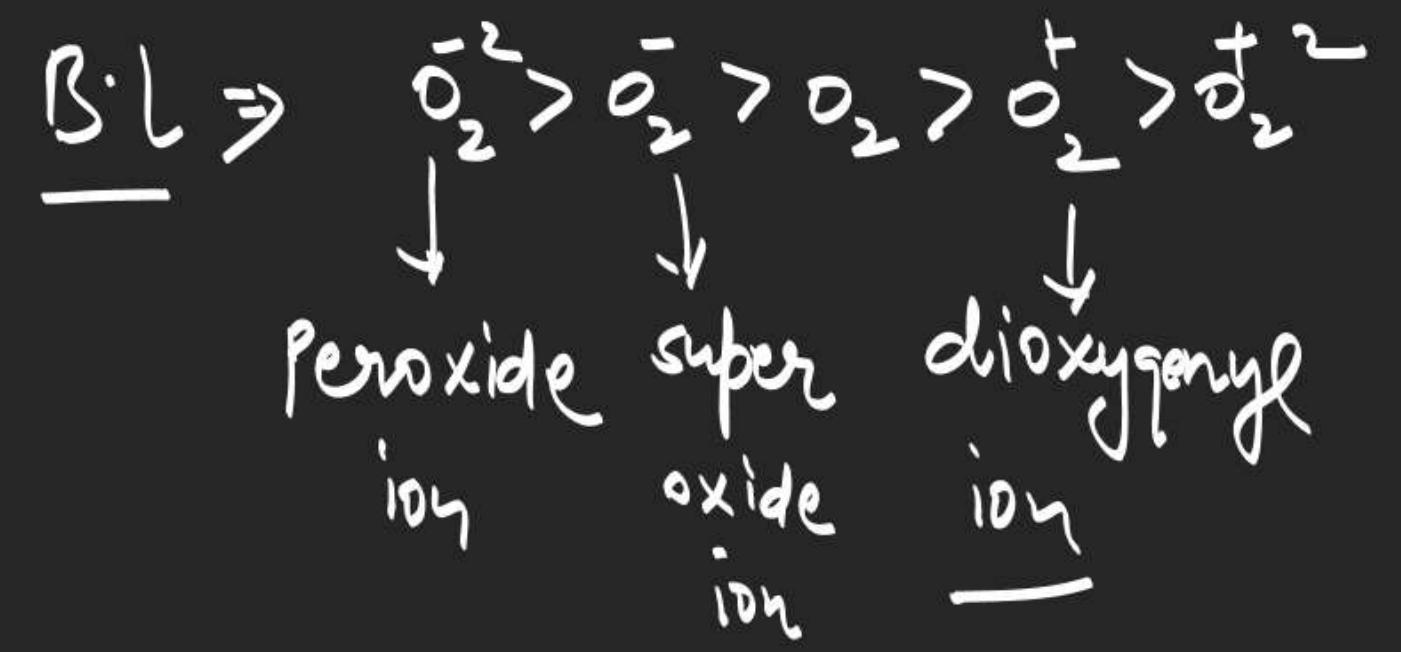
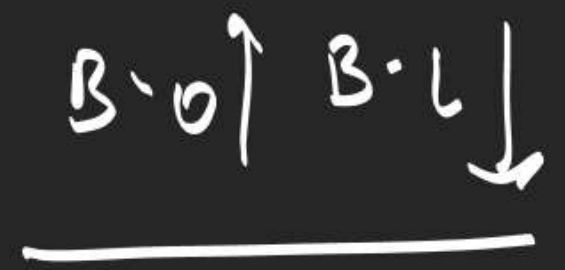
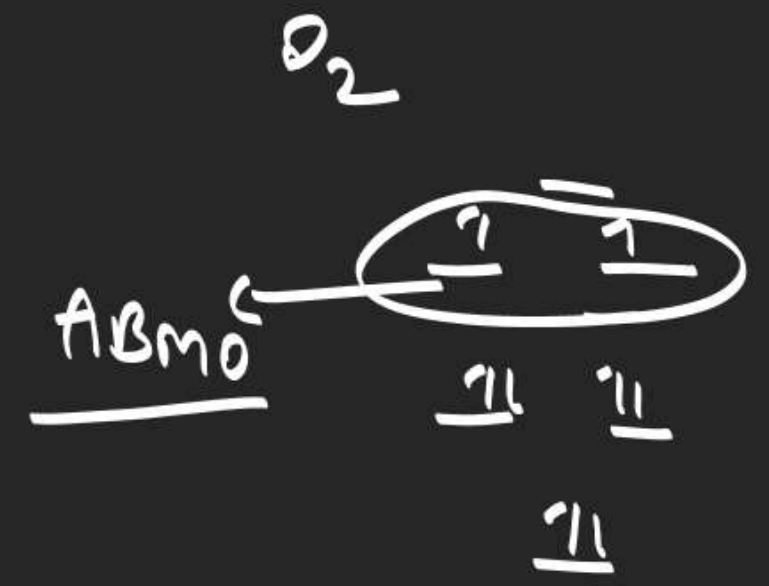
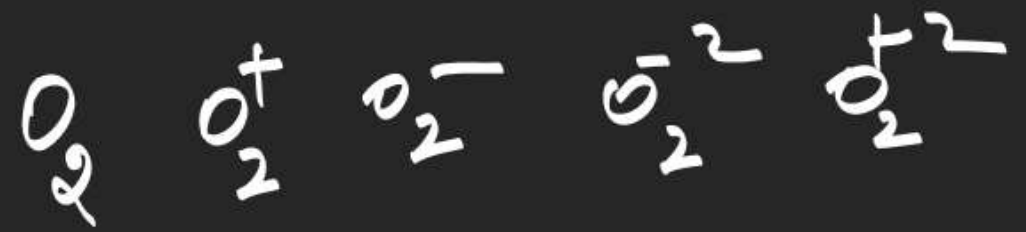
Paramag



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

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

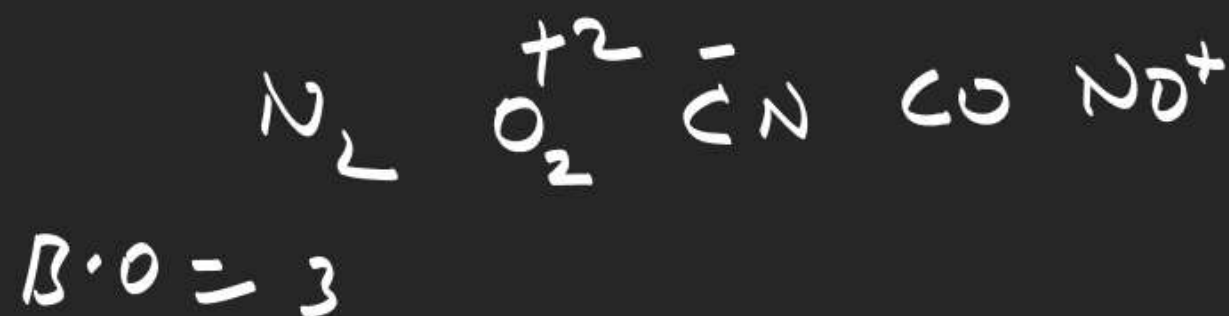
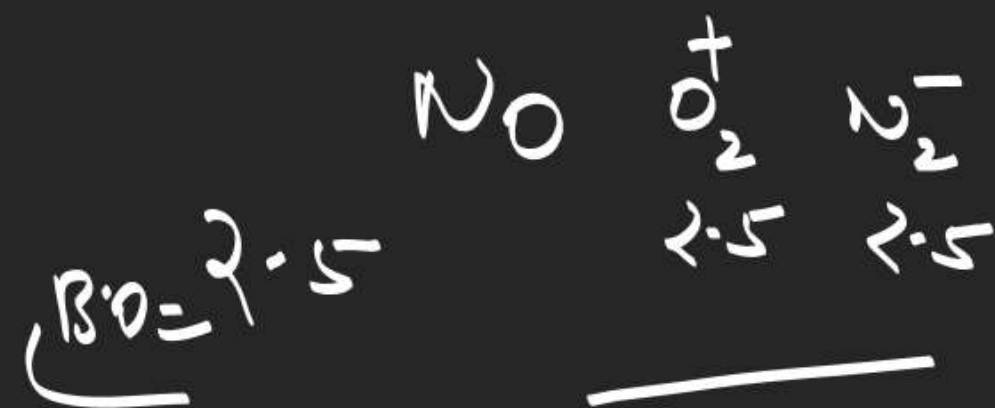
Dia.



Key point

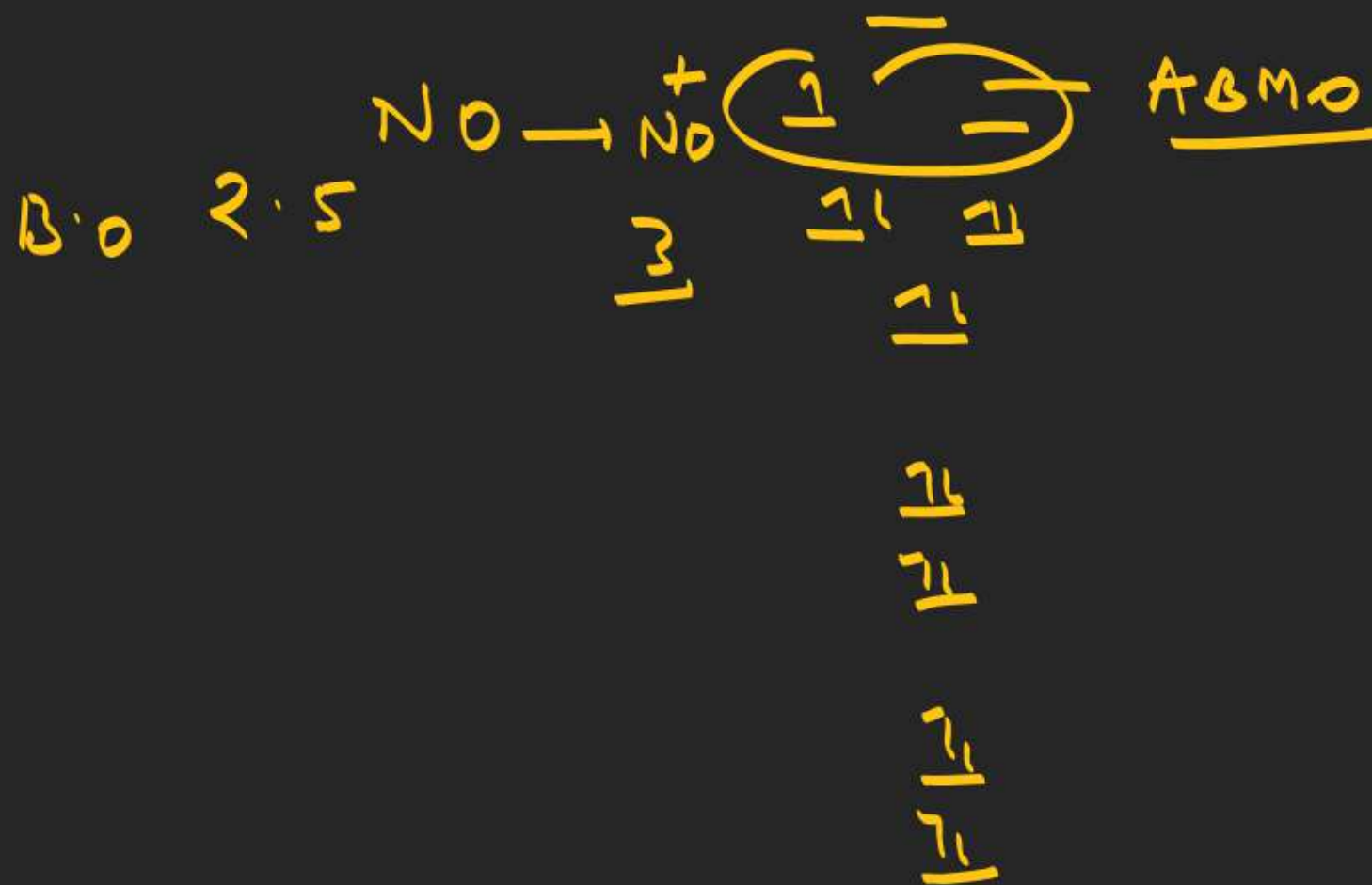
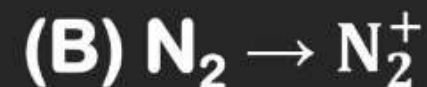
iso electronic

molecules have same l.o



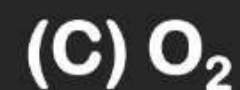
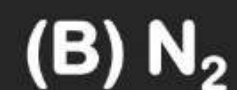
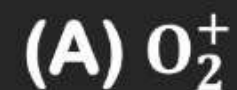
CHEMICAL BONDING

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



CHEMICAL BONDING

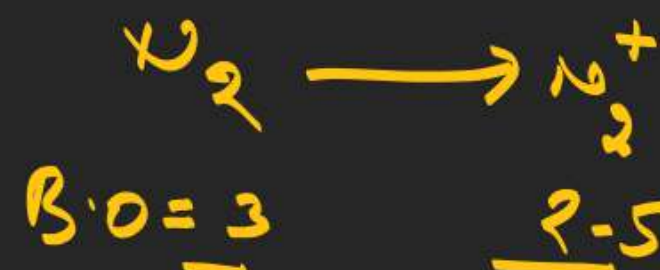
3. **Two pi** and **half sigma bonds** are present in:

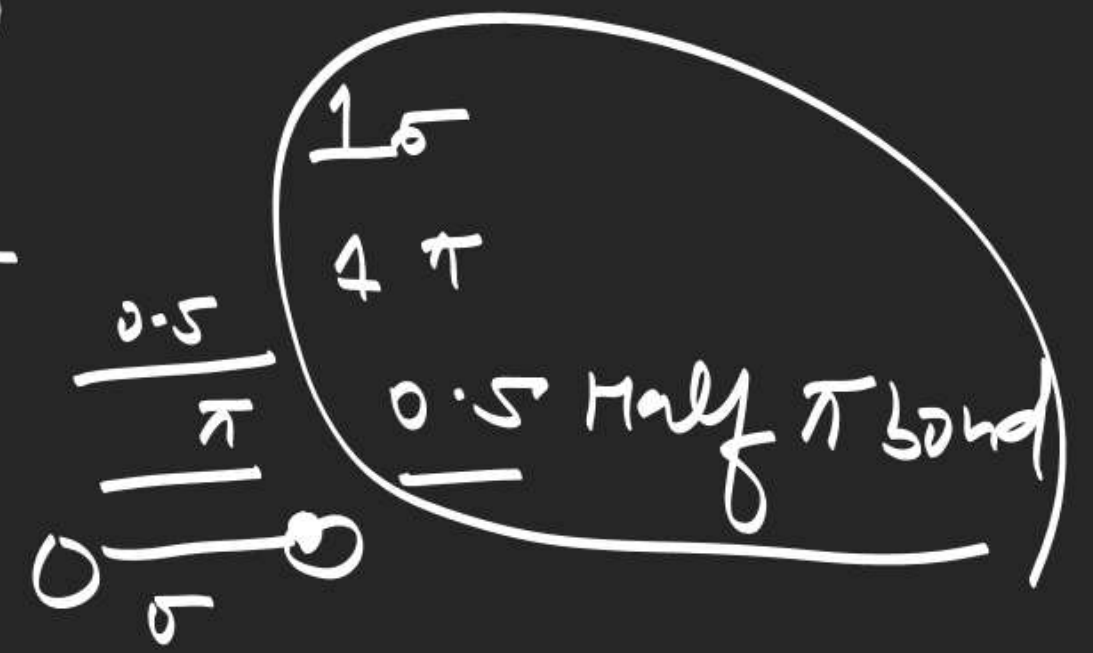
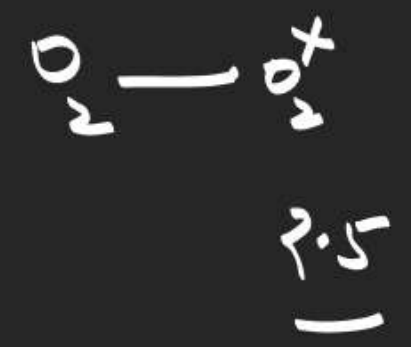


$$= \frac{1}{2} (6 - 0) \quad \left\{ \begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \end{array} \right\}$$

$$= \frac{1}{2} \times 6$$

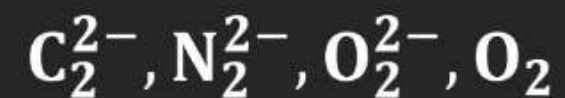
$$= 3$$





CHEMICAL BONDING

4. Among the following molecules/ions,



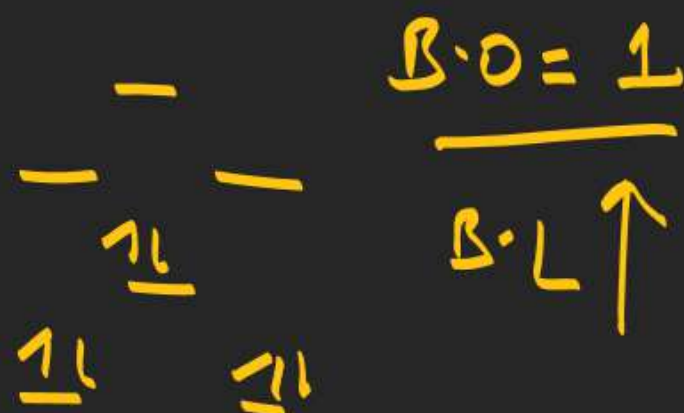
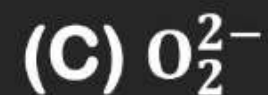
Which one is diamagnetic and has the shortest bond length?



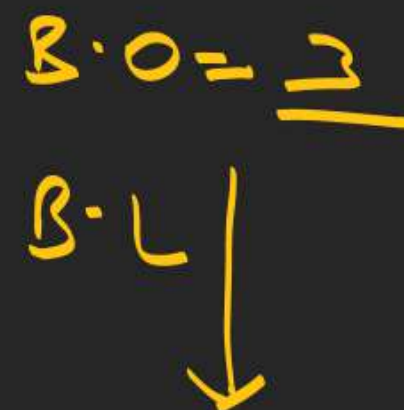
X



X



↑ ↑ ↑ ↑



CHEMICAL BONDING

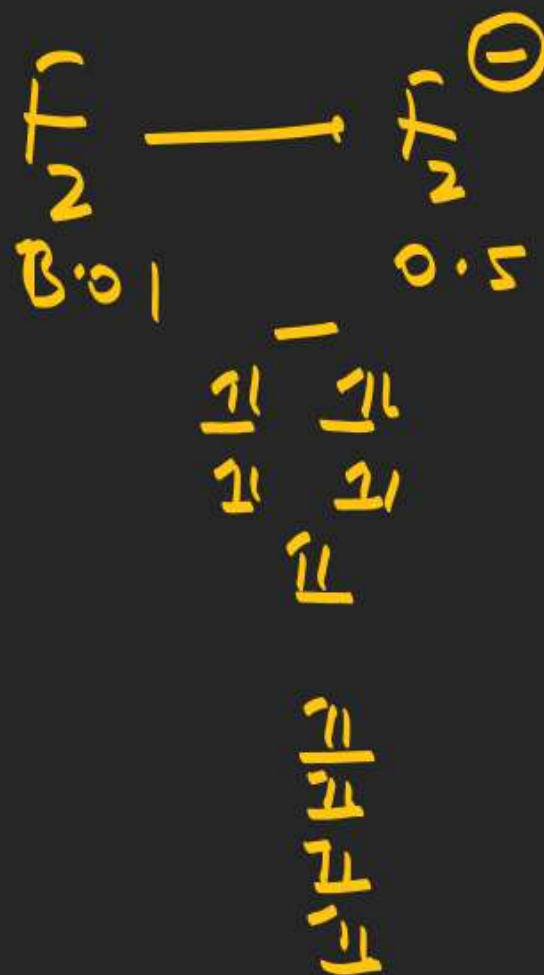
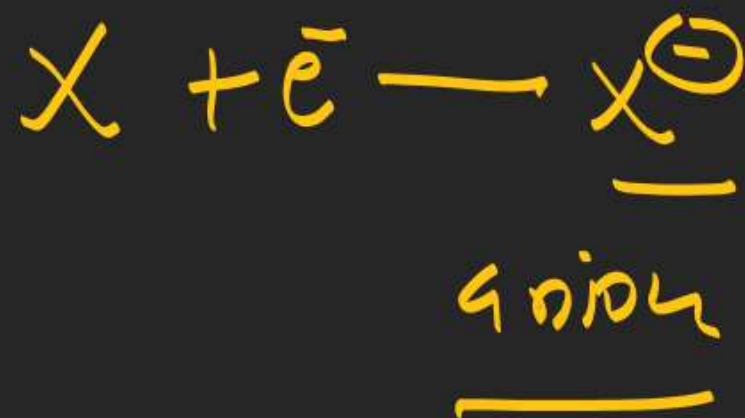
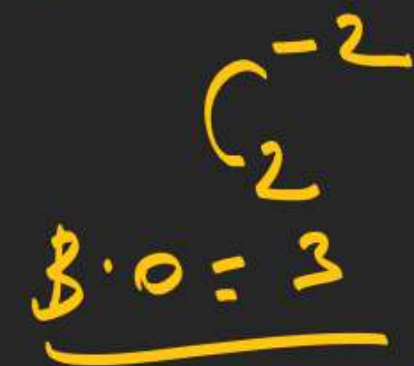
5. Among the following, the molecule expected to be stabilized by anion formation is: C_2, O_2, NO, F_2

(A) C_2

(B) F_2

(C) NO^{\ominus}

(D) O_2



CHEMICAL BONDING

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

(A) NO

NO
2.5
para

~~(B) CO~~

14 e^-
Dia
 $B.O = 3$

(C) B_2

(D) O_2

CHEMICAL BONDING

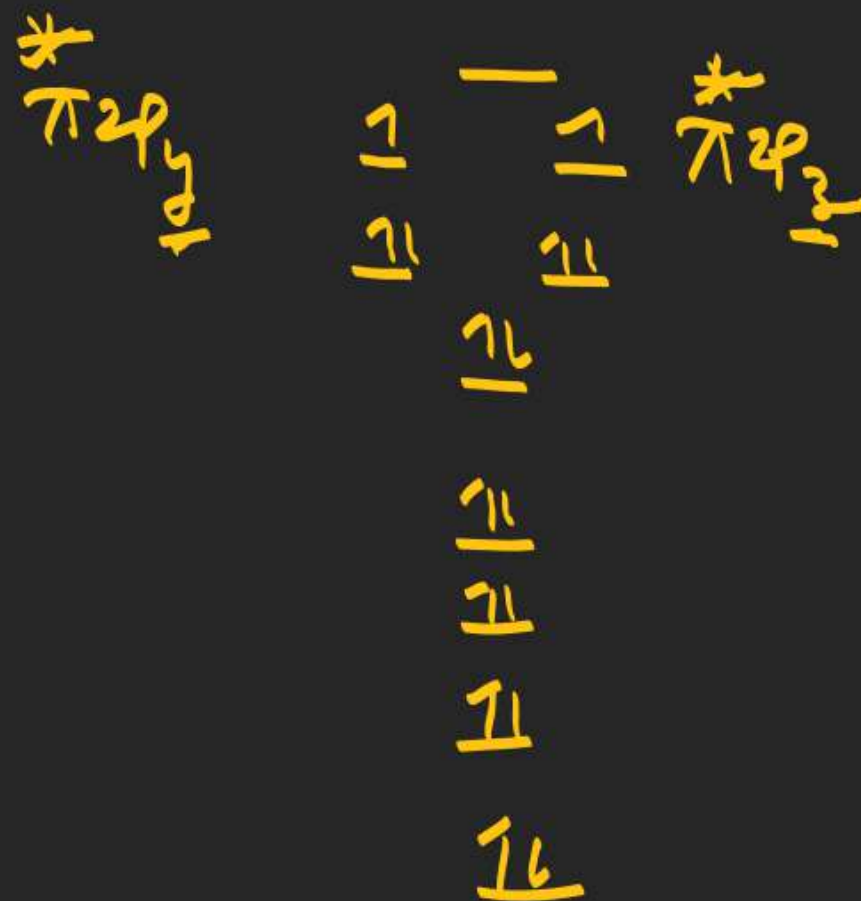
7. During the change of O_2 to O_2^- the incoming electron goes to the orbital:

(A) $\pi 2p_y$

(B) $\sigma^* 2p_z$

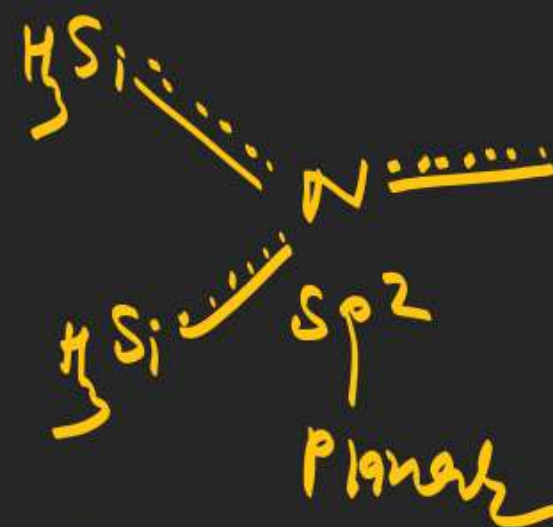
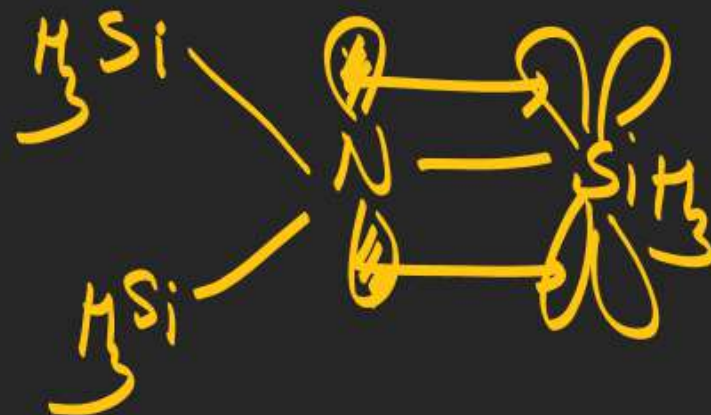
(C) $\pi^* 2p_x$

(D) $\pi 2p_x$

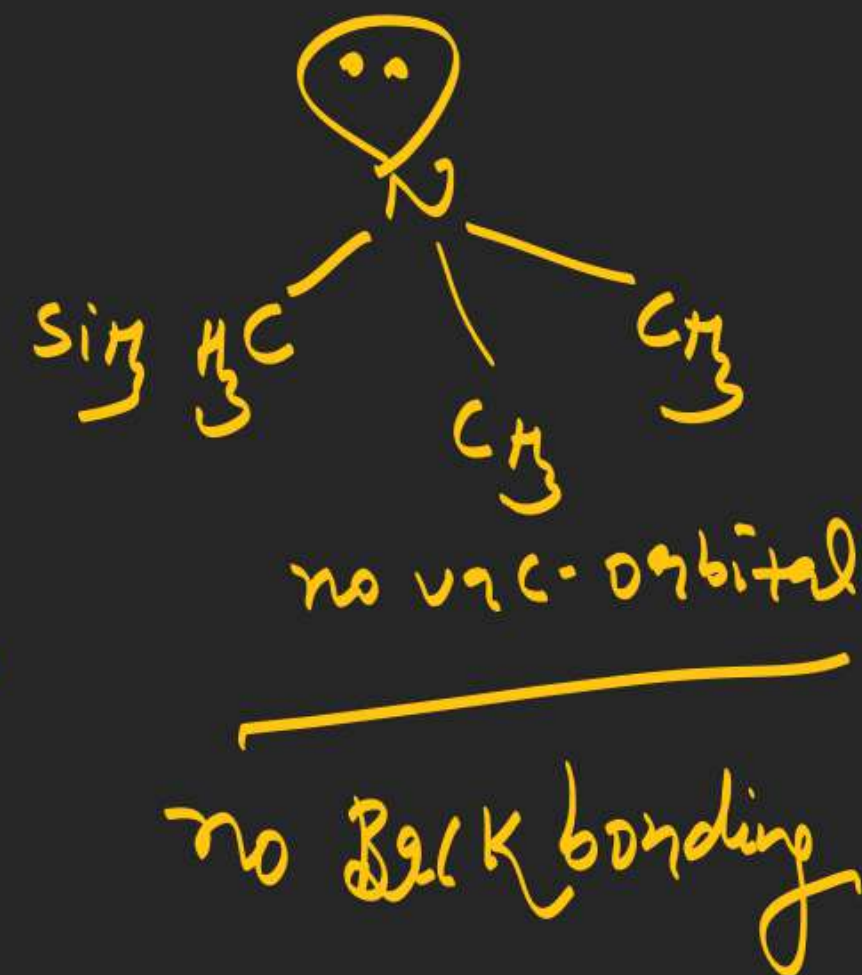


CHEMICAL BONDING

8. The correct statement among the following is:
- (A) $(\text{SiH}_3)_3\text{N}$ is planar and less basic than $(\text{CH}_3)_3\text{N}$.
 - (B) $(\text{SiH}_3)_3\text{N}$ is pyramidal and more basic than $(\text{CH}_3)_3\text{N}$.
 - (C) $(\text{SiH}_3)_3\text{N}$ is pyramidal and less basic than $(\text{CH}_3)_3\text{N}$.
 - (D) $(\text{SiH}_3)_3\text{N}$ is planar and less basic than $(\text{CH}_3)_3\text{N}$.



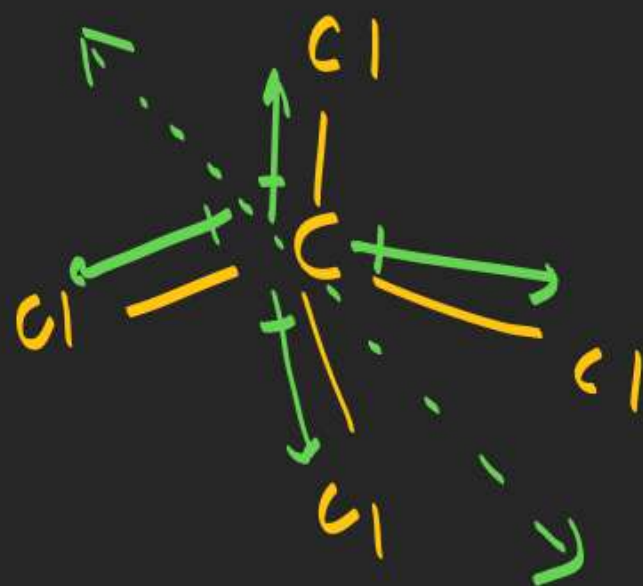
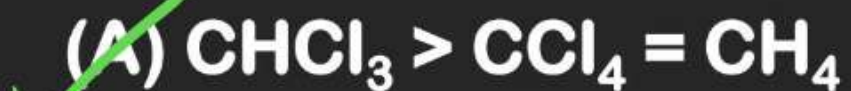
No back



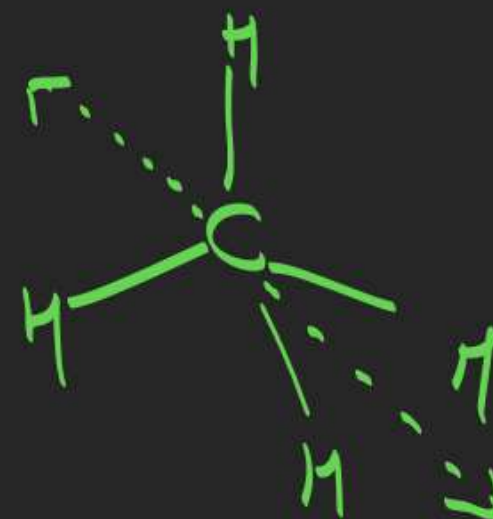
CHEMICAL BONDING

(2020)

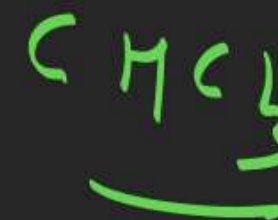
1. Decreasing order of dipole moment in CHCl_3 , CCl_4 & CH_4 is-



$\mu = 0$ non/polar

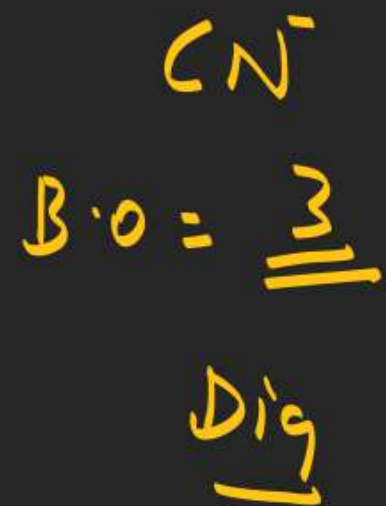


$\mu = 0$



CHEMICAL BONDING

2. Bond order and magnetic nature of CN^- are respectively
- (A) 3, diamagnetic (B) 3, paramagnetic
- (C) 2.5, paramagnetic (D) 2.5, diamagnetic



CHEMICAL BONDING

3. Following vanderwaal forces are present in ethyl acetate liquid

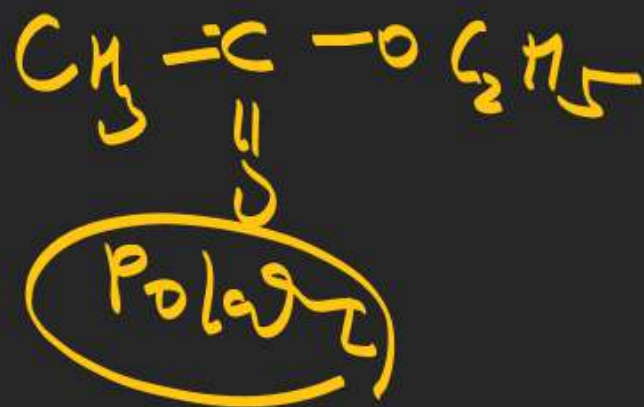
(A) H-bond, London forces.

(B) dipole-dipole interaction, H-bond

☒ (C) dipole-dipole interaction, London forces

(D) H-bond, dipole-dipole interaction, London forces

Dipole-Dipole (Keesom force).



V.V.F

① Dipole - Dipole [Keesom force] $\propto \frac{1}{r^3}$

② Dipole - induced dipole [Debye force]

③ Instantaneous Induced dipole $\propto \frac{1}{r^6}$

④ Ion - dipole $\frac{1}{r^2}$

⑤ Ion - Induced dipole $\frac{1}{r^6}$



(L.D.F)



$\frac{1}{r^6}$
V.V.F

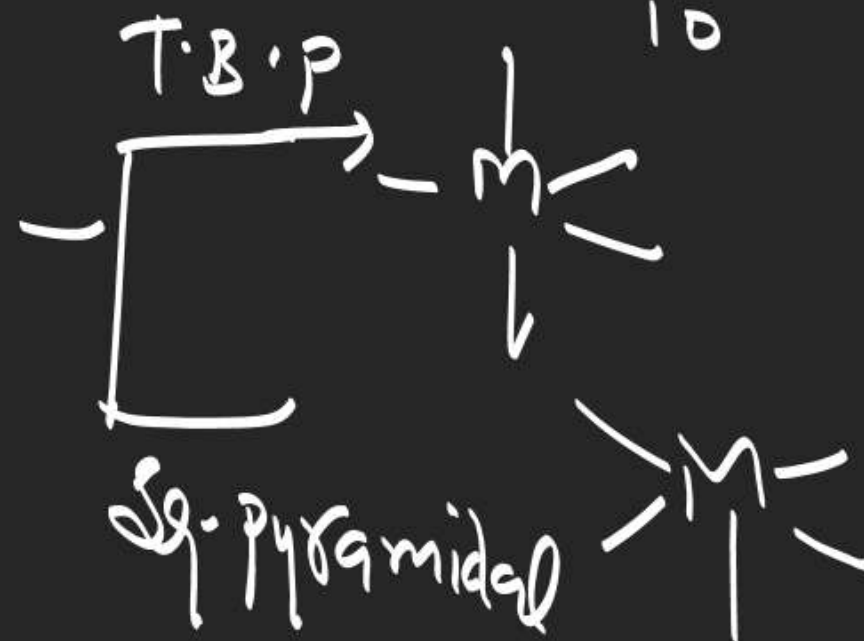
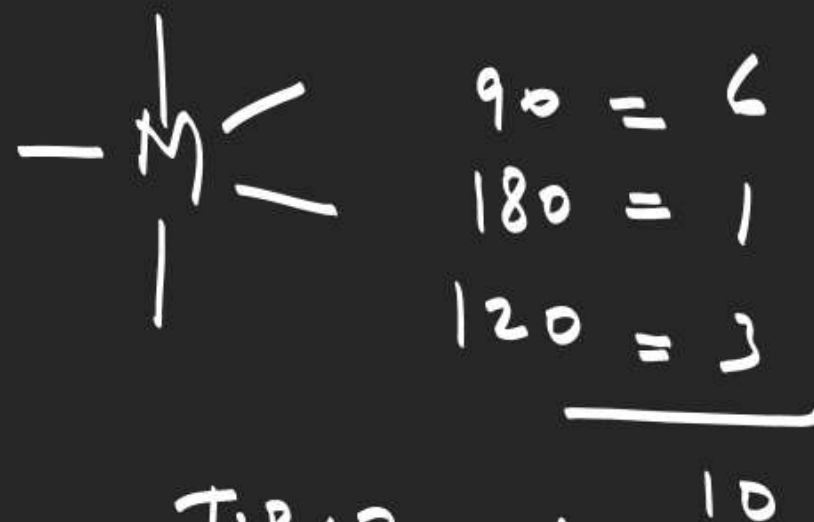
CHEMICAL BONDING

4. Correct bond energy order of following is-



CHEMICAL BONDING

5. Complex $[ML_5]$ can exhibit trigonal bipyramidal and square pyramidal geometry. Determine total number of $180^\circ, 90^\circ$ & 120° L-M-L bond angles.



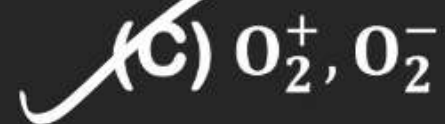
$$\begin{array}{rcl}
 90 & = & 8 \\
 120 & = & 0 \\
 180 & = & 2 \\
 \hline
 & & 10
 \end{array}$$

$$10 + 10 = 20$$



CHEMICAL BONDING

6. Which of the following species have one unpaired electron each?



CHEMICAL BONDING

7. If AB_4 molecule is a polar molecule, a possible geometry of AB_4 is

(A) Tetrahedral

(B) Rectangular planar

~~(C) Square pyramidal~~

(D) Square planar



CHEMICAL BONDING

8. Match the type of interaction in column A with distance dependence of their interaction energy in column

	A	B	
(i)	<u>ion-ion</u>	(a) $\frac{1}{r}$	$\text{Na}^+ \text{Cl}^-$ Ion-Ion $\propto \frac{1}{r}$
(ii)	dipole-dipole	(b) $\frac{1}{r^2}$	$\frac{k\mu_1\mu_2}{r^2}$
(iii)	<u>London dispersion</u>	(c) $\frac{1}{r^3}$	$\frac{1}{r^2}$
		(d) $\frac{1}{r^6}$	Ion-dipole $\propto \frac{1}{r^2}$

(A) (I) – (a), (II) – (b), (III) – (d)

(B) (I) – (b), (II) – (d), (III) – (c)

(C) (1) – (a), (II) – (b), (III) – (c)

✓ ~~(D)~~ (1) – (a), (II) – (c), (III) – (d)

CHEMICAL BONDING

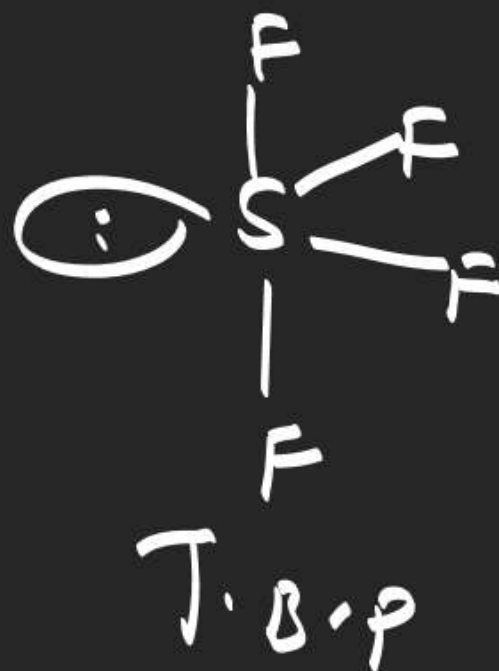
9. The molecular geometry of SF_6 is octahedral. What is the geometry of SF_4 (including lone pair(s) of electrons, is any)?

(A) Tetrahedral

~~(B) Trigonal bipyramidal~~

(C) Square planar

(D) Pyramidal



Geo - See-saw

CHEMICAL BONDING

10. The shape/structure of $[\text{XeF}_5]^-$ and XeO_3F_2 , respectively, are

- ✓ (A) Pentagonal planar and trigonal bipyramidal
 (B) Trigonal bipyramidal and pentagonal planar
 (C) Octahedral and square pyramidal
 (D) Trigonal bipyramidal and trigonal bipyramidal



Planar



T.B.P

CHEMICAL BONDING

11. Of the species, NO, NO⁺, NO²⁺ and NO⁻, the one with minimum bond strength is

(A) NO⁻

✓ 2

(B) NO²⁺

1.5

(C) NO⁺

3

(D) NO

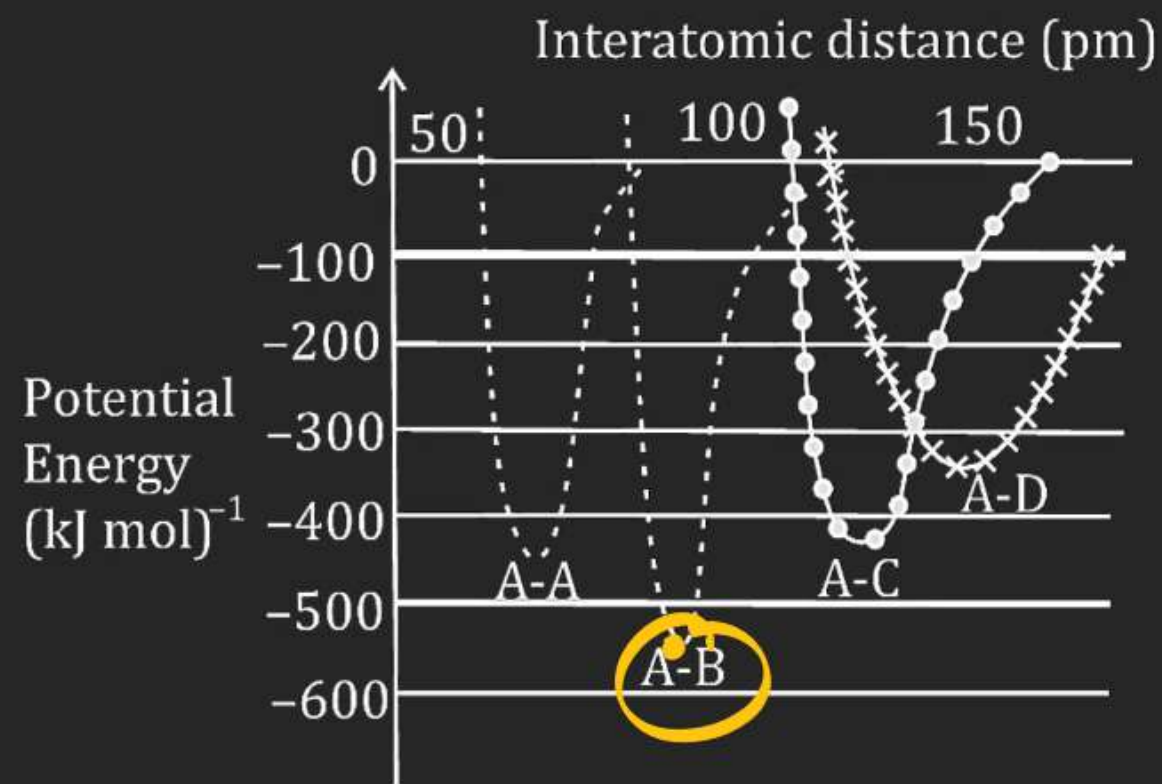
2.5

B.O ↓

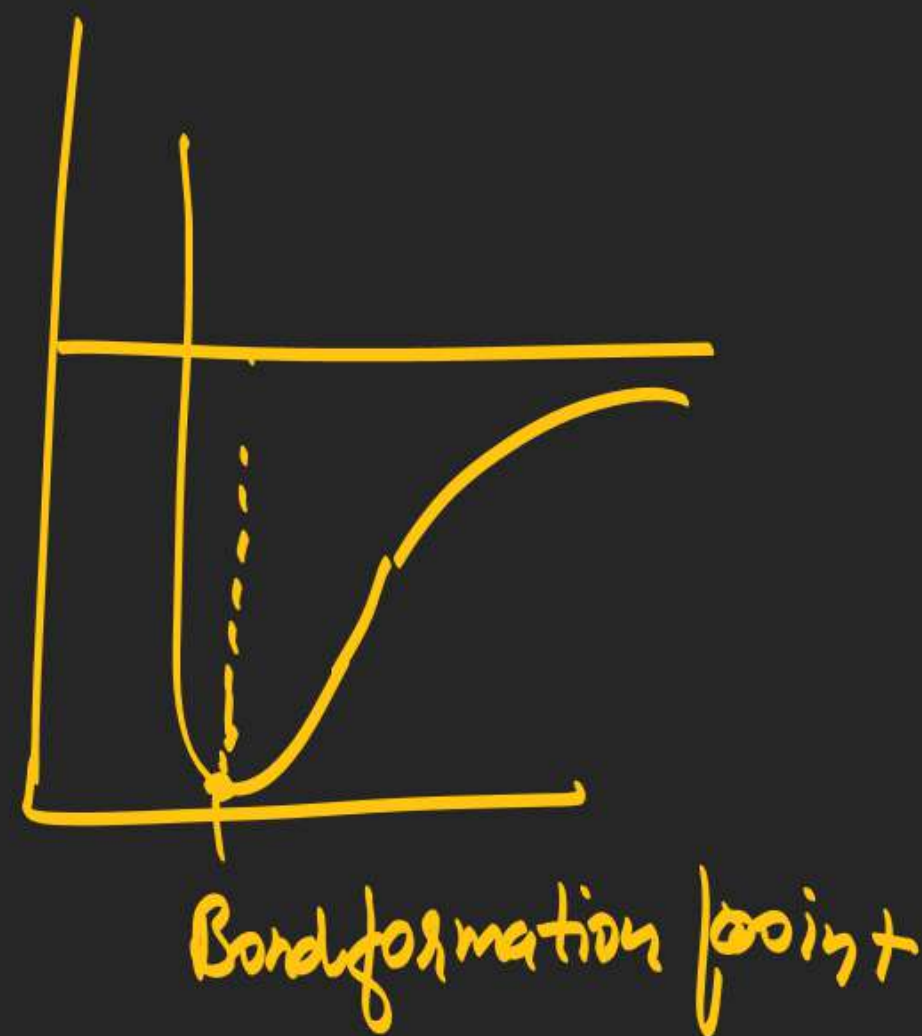


CHEMICAL BONDING

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

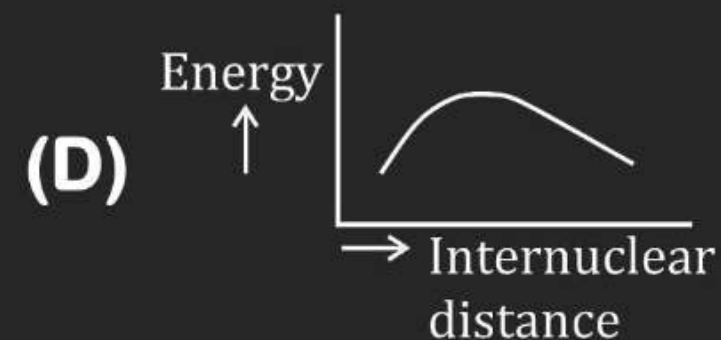
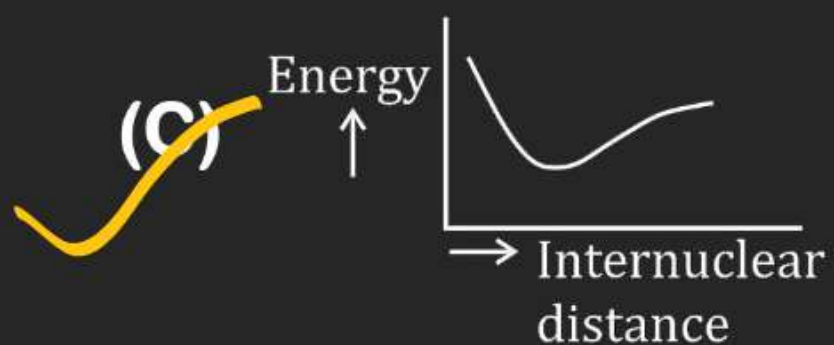
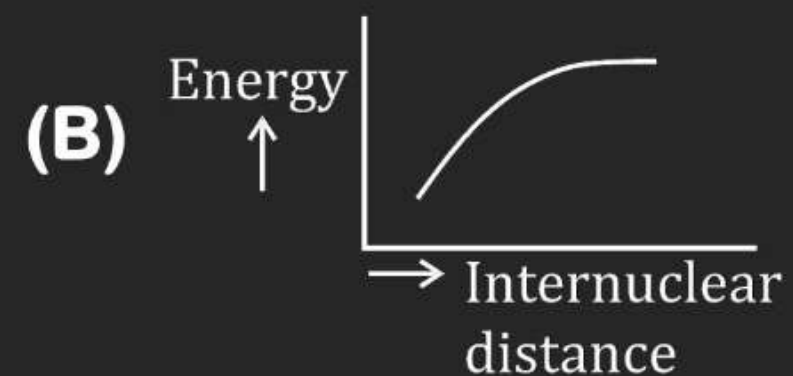
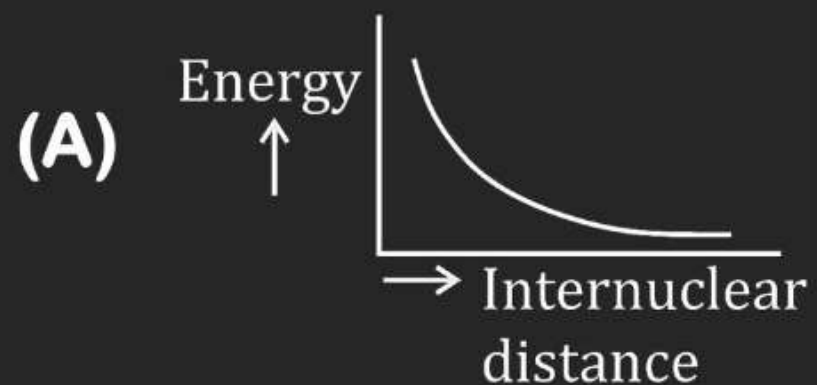


- (A) A-B has the stiffest bond
 (B) A-D has the shortest bond length
 (C) A-A has the largest bond enthalpy
 (D) D is more electronegative than other atoms



CHEMICAL BONDING

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



CHEMICAL BONDING

14. The compound that the largest $\text{H} - \text{M} - \text{H}$ bond angle ($\text{M} = \text{N}, \text{O}, \text{S}, \text{C}$) is



CHEMICAL BONDING

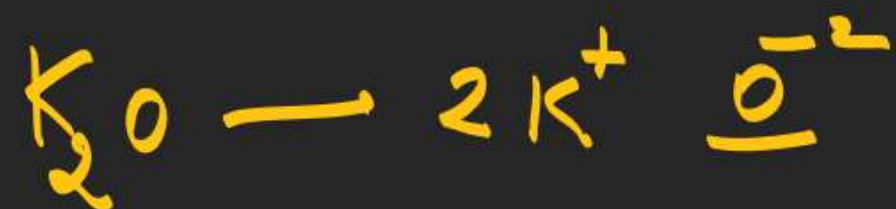
16. Oxidation number of potassium in K_2O , K_2O_2 & KO_2 respectively is

☒ (A) +1, +1, +1

(B) +1, +2, +4

(C) +1, +2, +2

(D) +1, +4, +2



CHEMICAL BONDING

17. The relative strength of interionic/intermolecular forces in decreasing order is:

(A) Dipole – Dipole > Ion – Ion > Dipole – Ion

(B) Ion – Ion > Dipole – Dipole > Dipole – Ion

(C) Dipole – Ion > Dipole – Dipole > Ion – Ion

(D) Ion – Ion > Dipole – Ion > Dipole – Dipole

CHEMICAL BONDING

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

~~(A) 3, diamagnetic~~

(B) 3, paramagnetic

(C) 2.5, paramagnetic

(D) 2.5, diamagnetic



$$\text{B.O.} = \frac{2}{2}$$

Dig

CHEMICAL BONDING

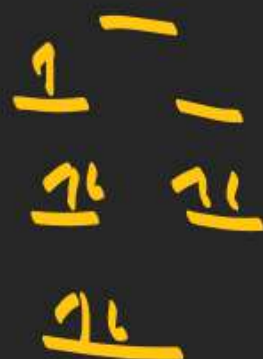
20. If the magnetic moment of a dioxygen species is 1.73 B.M., it may be:

~~(A)~~ O_2^- , or O_2^+

(B) O_2 , or O_2^+

(C) O_2 , or O_2^-

(D) None of these



CHEMICAL BONDING

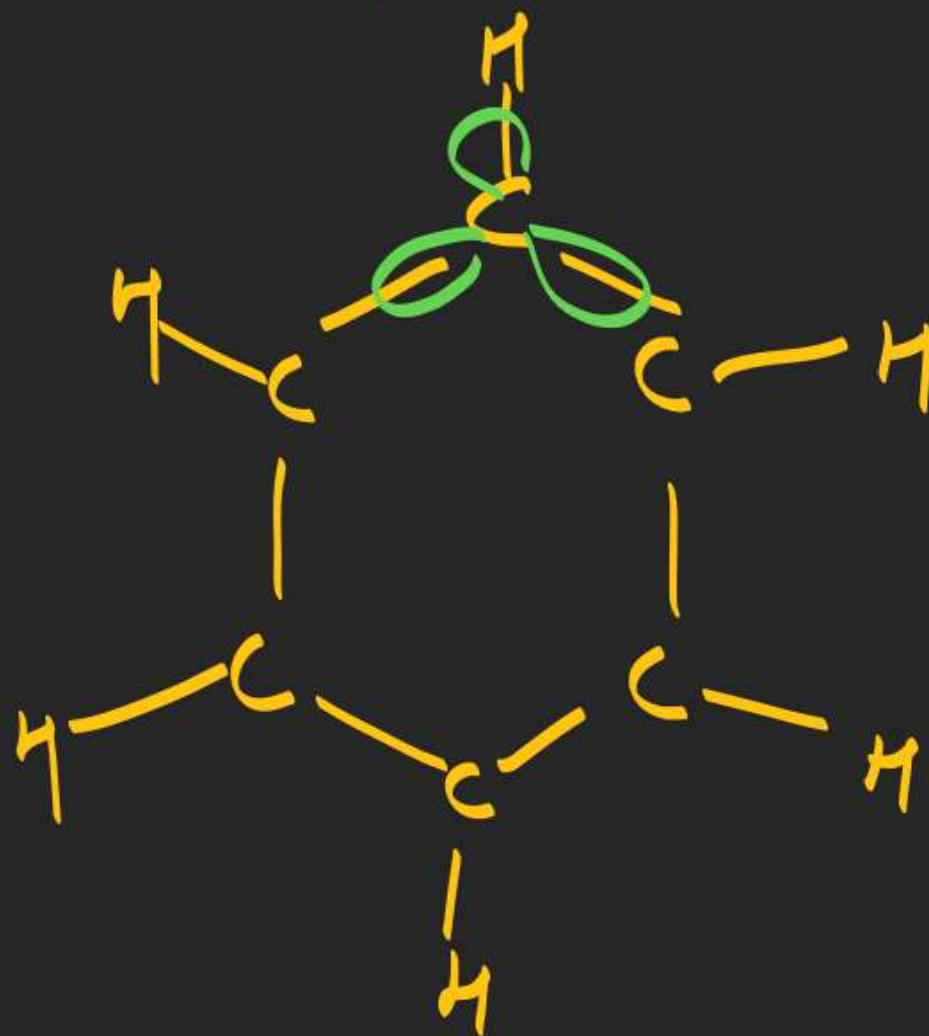
21. The number of sp^2 hybrid orbitals in a molecule of benzene is:

(A) 24

(B) 18

(C) 12

(D) 6



CHEMICAL BONDING

1. Which of the following are isostructural pairs?

(a) SO_4^{2-} and CrO_4^{2-}

(c) NH_3 and NO_3^-

(A) A and C only

(B) B and C only

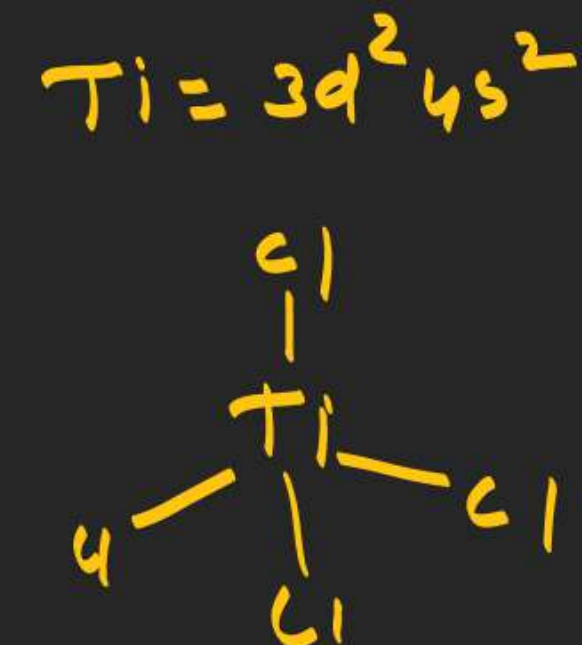
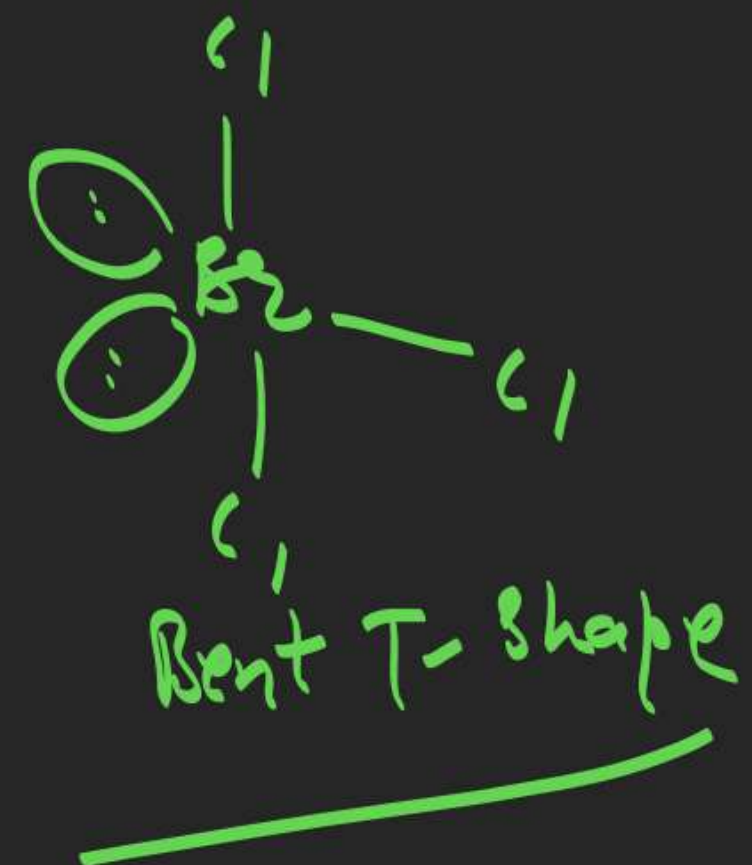
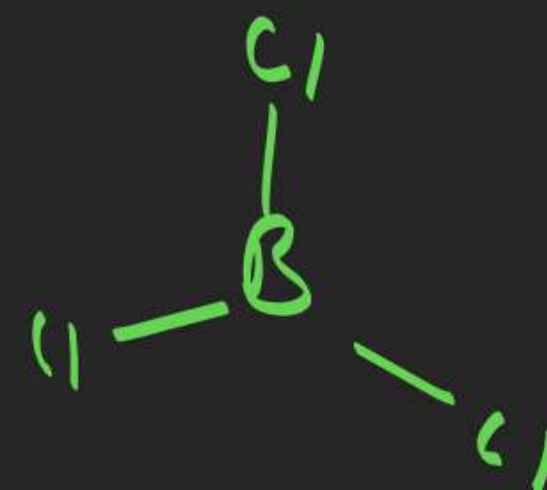
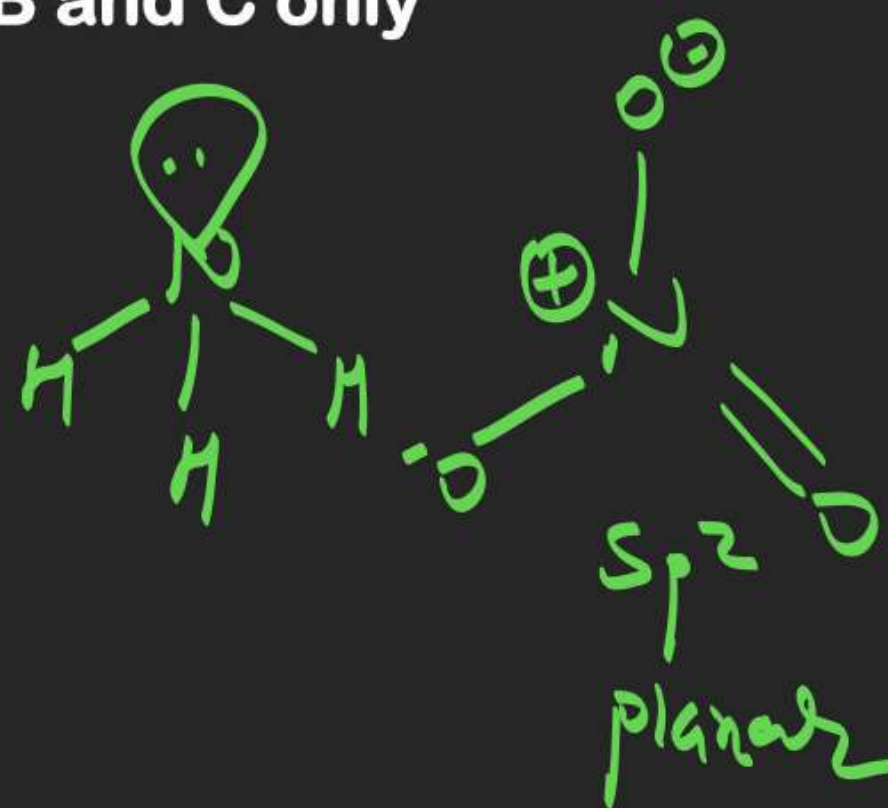
(b) SiCl_4 and TiCl_4

(d) BCl_3 and BrCl_3

(B) A and B only

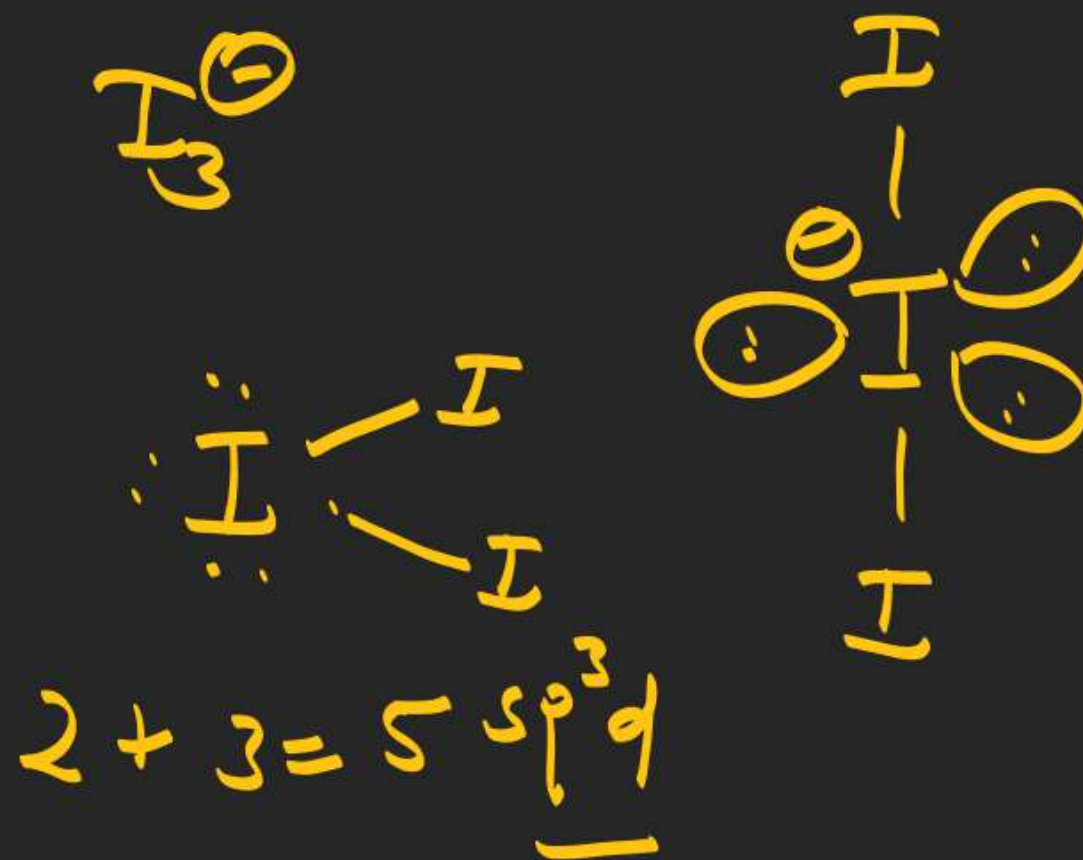
(D) C and D only

$\text{Cr} = 3d^5 4s^1$ (2021)



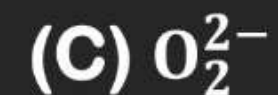
CHEMICAL BONDING

2. The correct shape and I-I-I bond angles respectively in I_3^- ion are:
- (A) Trigonal planar; 120° (B) Distorted trigonal planar, 135° and 90°
(C) Linear; 180° (D) T-shaped; 108° and 90°



CHEMICAL BONDING

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



do not exist

CHEMICAL BONDING

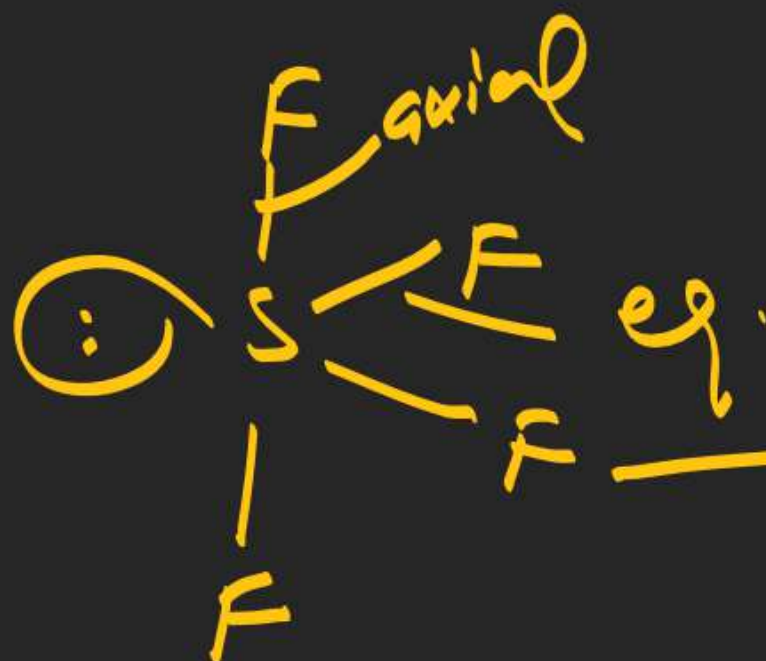
4. Which among the following species has unequal bond lengths?

(A) XeF_4

(B) SiF_4

(C) BF_4^-

(D) SF_4



CHEMICAL BONDING

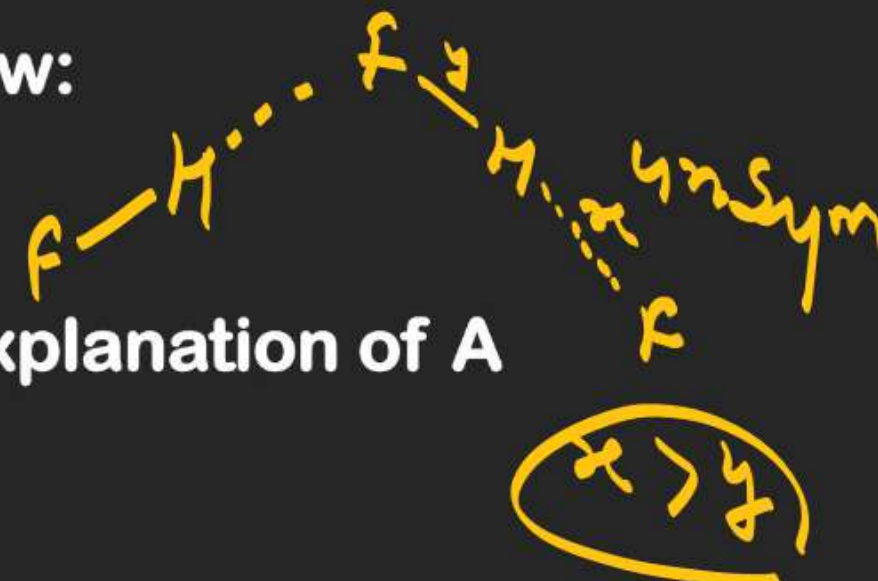
5. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Dipole-dipole interactions are the only non-covalent interactions, resulting in hydrogen bond formation

Reason R : Fluorine is the most electronegative element and hydrogen bonds in

HF are symmetrical In the light of the above statements, choose the most appropriate answer from the options given below:

- (A) A is false but R is true
 (B) Both A and R are true and R is the correct explanation of A
 (C) A is true but R is false
 (D) Both A and R are true and R is not the correct explanation of A



CHEMICAL BONDING

6. Match List-I with List-II.

List-I

(Molecule)

(a) Ne_2

(b) N_2

(c) F_2

(d) O_2

List-II

(Bond order)

(i) 1

(ii) 2

(iii) 0

(iv) 3

Choose the correct answer from the options given below:

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

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

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

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