Chemical bonding

EXERCISE # 1

1. The molecule which contain same number of σ and π bonds is

(A) $(CN)_2$ (B) C_2H_2 (C) HNO_2 (D) HCN

$\sigma = 3$
$\pi = 4$

$\sigma = 3$
$\pi = 2$

$\sigma = 2$
$\pi = 1$

$\sigma = 2$
$\pi = 2$

Chemical bonding

2. Correct energy order of hybrid orbital is:

(A) $sp < sp^2 < sp^3$

(B) $sp < sp^3 < sp^2$

(C) $sp^3 < sp^2 < sp$

(D) $sp^2 < sp^3 < sp$

sp sp^2 sp^3

% of S-character 50% 33.33% 25%

S% ↑ stability ↑

$sp < sp^2 < sp^3$

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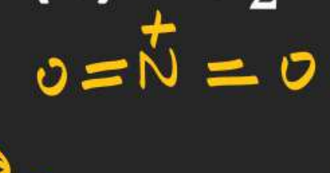
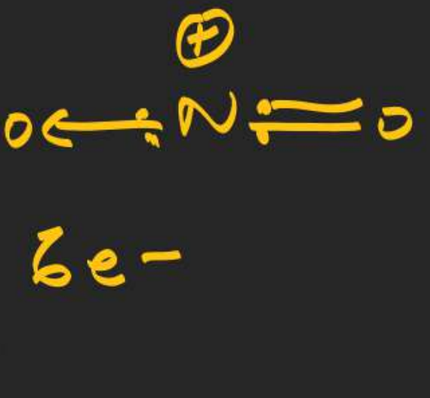
Chemical bonding

3. Which of the following is hypovalent species?

(A) ICl (B) SO_2 (C) NO_2^+ (D) NH_2^+





Hypo → less than 8e-

Hyper → hyper than 8 e-

total no of val e-	3	4	5	6	7	8
	B	C	N	O	F	Ne

Chemical bonding

4. Which one of the following element do not have tendency to form hyper valent compound ?

(A) P (B) N (C) S (D) Se

2nd period element donot expend their valency

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5. Which of the following set of species are hypovalent?

(A) NH_3, CO_2

(B) SO_2, CO_2

(C) BeH_2

(D) $BeCl_2, PCl_3$

H — Be — H

4e⁻

Chemical bonding

6. Which of the following pair of species are isostructural but not isoelectronic ?

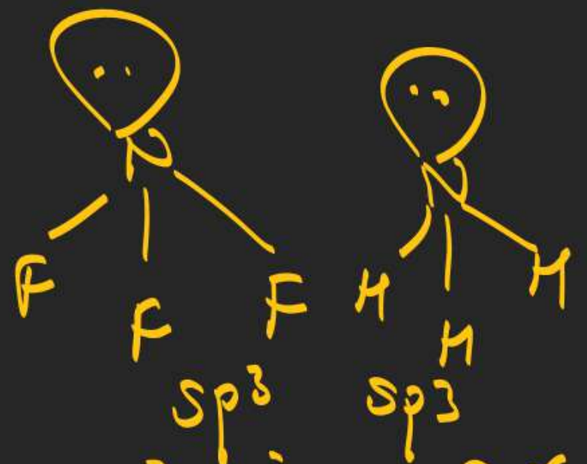
(A) N_2O and SO_2

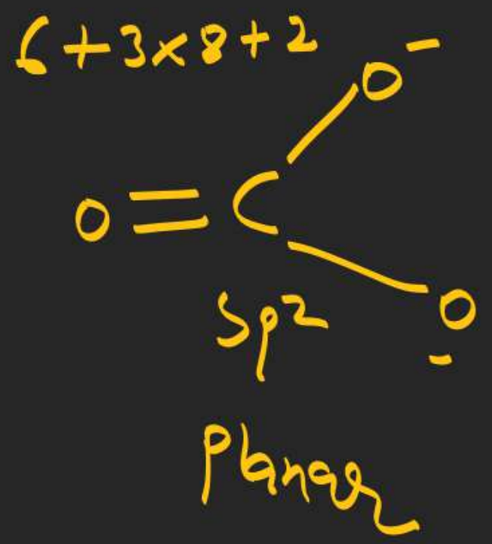
(B) CO_3^{-2} and NO_3^{-1}

(C) NF_3 and NH_3

(D) O_3 and $NO_2^{\oplus}$

Same structure



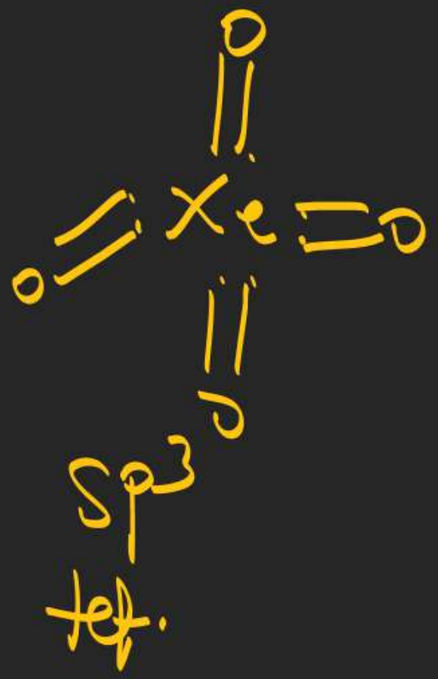


7+3×2+1

Chemical bonding

7. Which of the following xenon compound has the same number of lone pairs as in I_3^- :-

(A) XeO_4 (B) XeF_4 (C) XeF_2 (D) XeO_3



total no of Val. e⁻	3	4	5	6	7	8	
	B	C	N	O	F	Ne	
	Al	Si	P	S	Cl	Ar	

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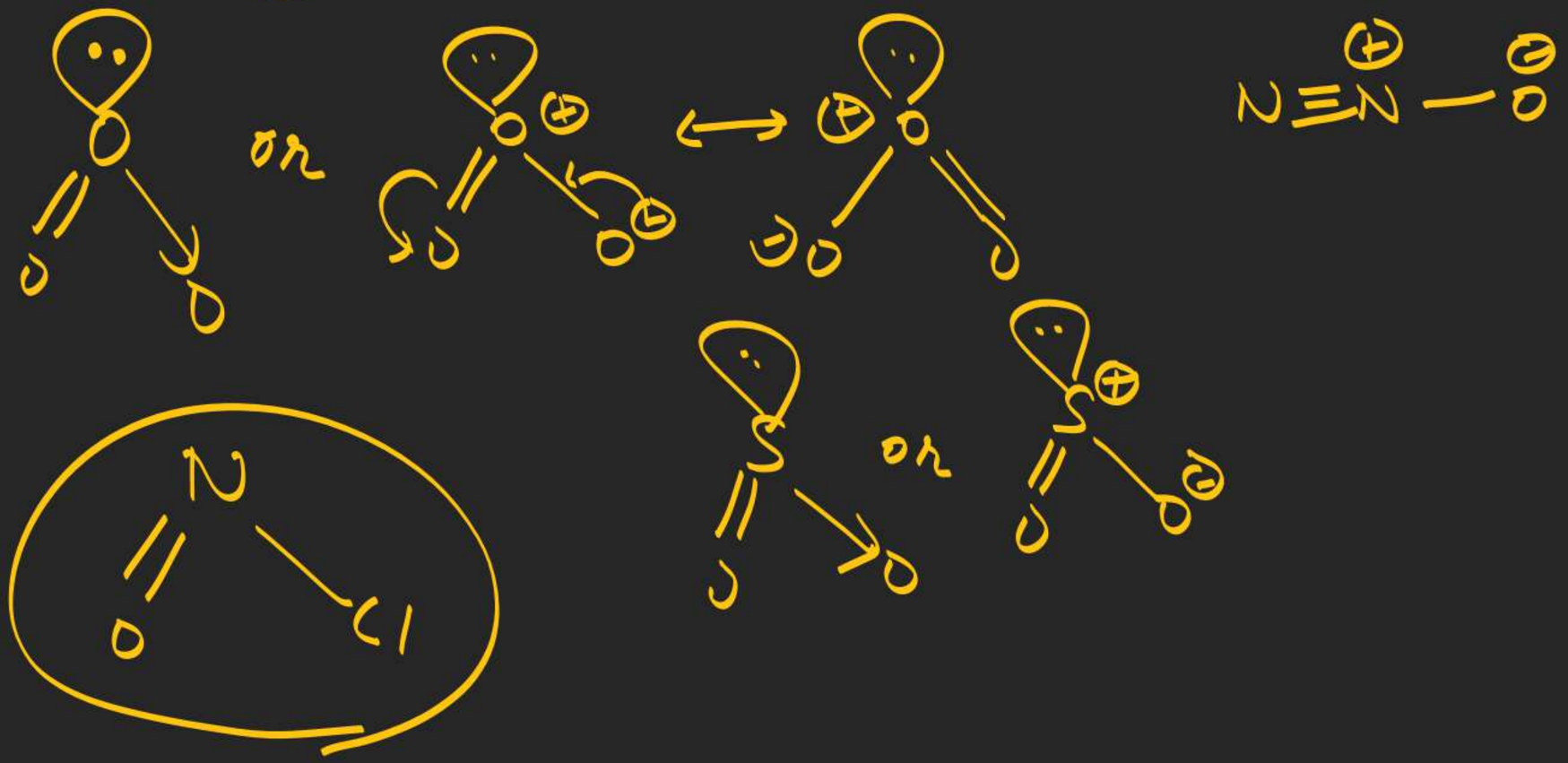
8. Which of the following molecules is adequately represented by a single Lewis structure?

(A) O_3 (B) NOCl (C) SO_2 (D) N_2O



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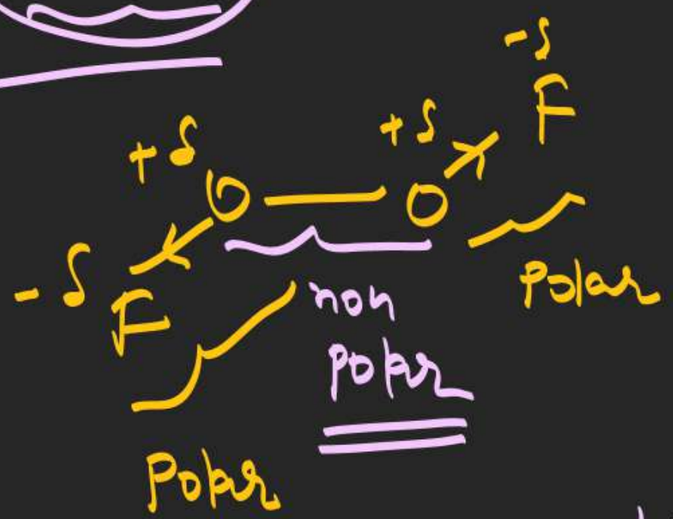
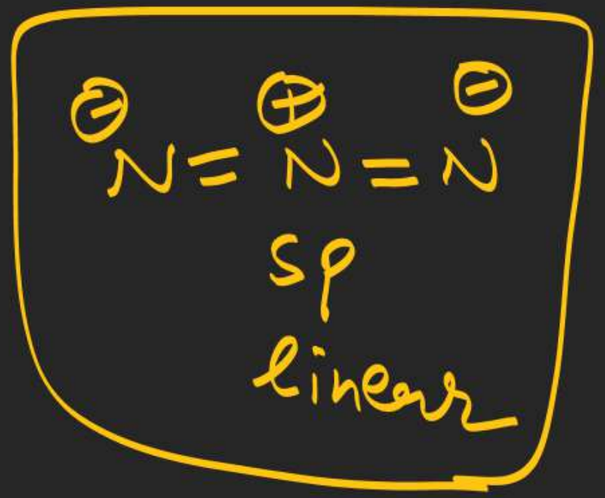
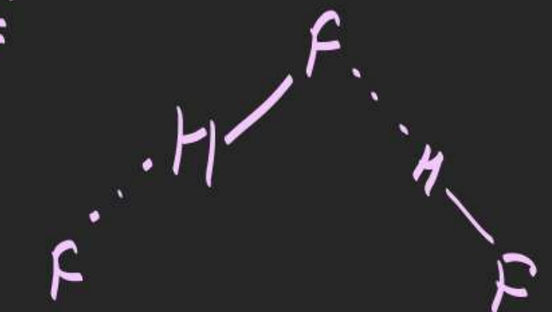
9. The molecule which contain both polar and non-polar covalent bond present in its structure?

(A) H_2F_2 (B) O_2F_2 (C) O_3 (D) All of these







Monomer HF does not exist

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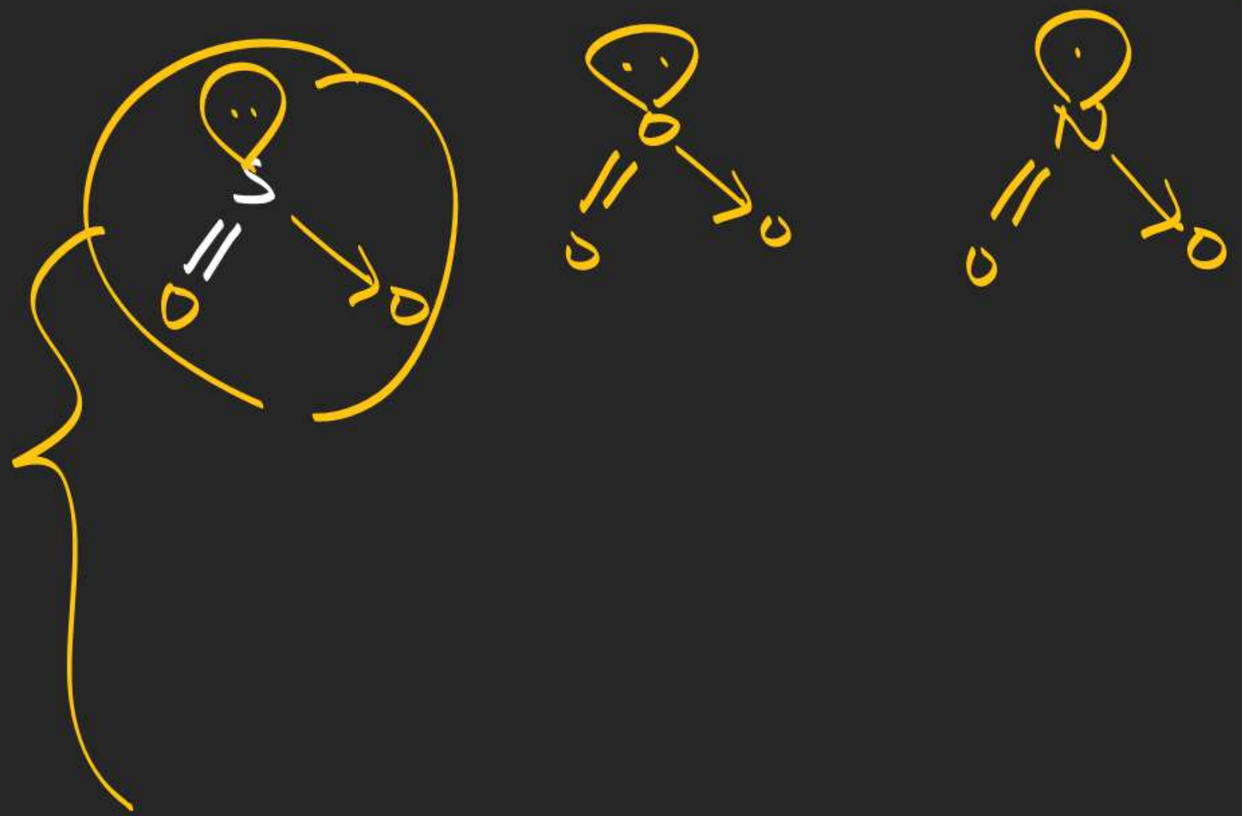
Chemical bonding

10. Which one of the following species have coordinate bond present in its Lewis structure

(A) SO_2 (B) O_3 (C) NO_2 (D) All of them



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Co-ordinate bond :-

6 pm

↓

tommo

it is formed by unequal sharing of e⁻

A : B → (or ⊕A—B⊖)

O = $2s^2\ 2p^4$

| ⇅ | 1 | 1 |

N = $2s^2\ 2p^3$

| ⇅ | 1 | 1 | 1 |

total val. e⁻

3	4	5	6	7	8
B	C	N	O	f	Ne
			S		

BF_4^-

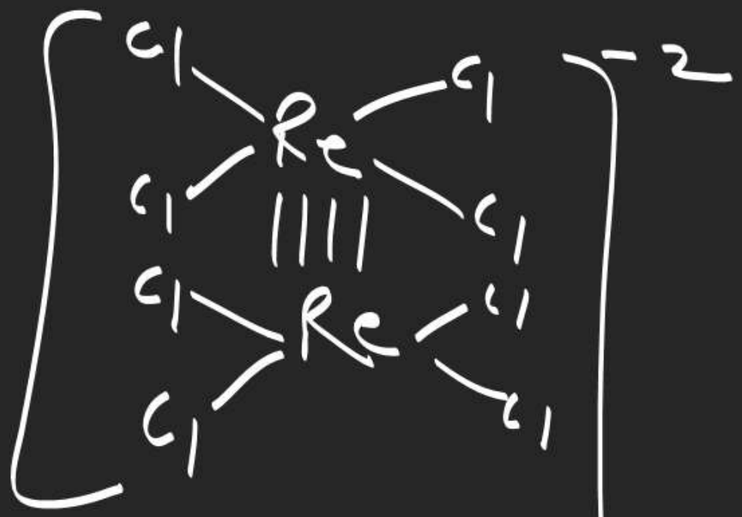
NH_4^+

H_3O^+

Chemical bonding

11. $[Re_2Cl_8]^{-2}$ molecule has

(A) only σ bond
(B) only π bond
(C) quadruple bond
(D) None of these



$1\sigma + 2\pi + 1\delta$

quadruple bond.

Chemical bonding

12. Which of the following statement is correct regarding covalent bond?

(A) Filled orbitals of two or more atoms overlap with one another.

(B) Unoccupied orbitals of two or more atoms overlap with one another

(C) Electrons are simultaneously attracted between more than one nucleus.

(D) Electrons are transferred from one atom to another atom.

Chemical bonding

13. If x is internuclear axis, δ bond can be formed by :

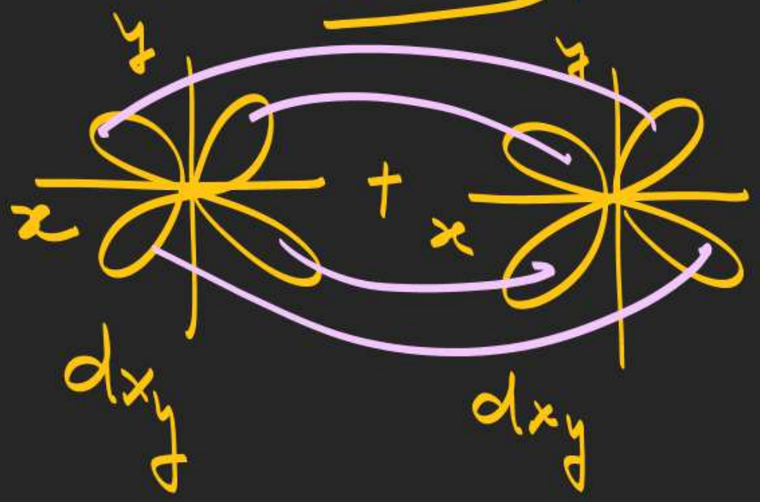
(A) $d_{x^2-y^2} + d_{x^2-y^2}$

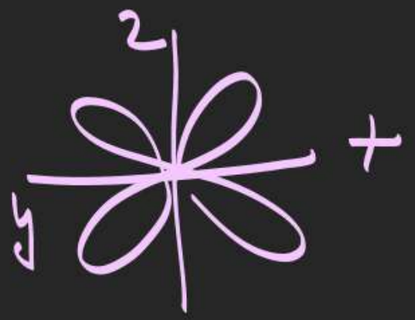
(B) $d_{xy} + d_{yz}$

(C) $d_{yz} + d_{yz}$

(D) $d_{xz} + d_{xy}$

δ-Bond — When all four lobes of d-orbital involve in bonding





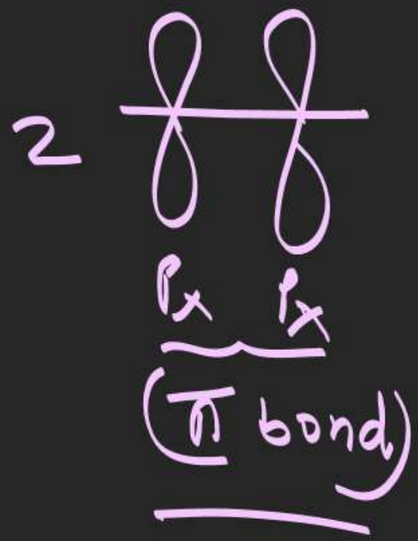
Chemical bonding

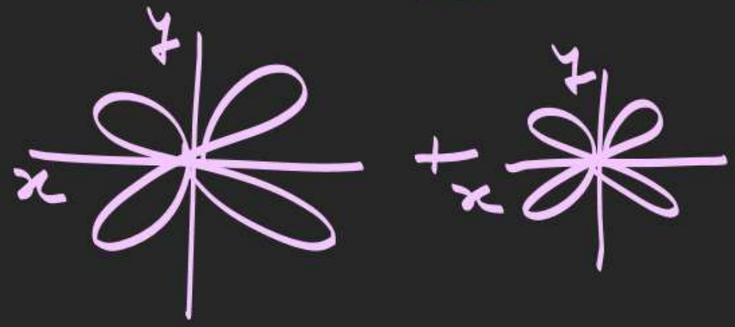
14. Which of the following leads to non-bonding on z-axis

(A) $p_x + p_x$ (B) $P_y + P_y$ (C) $d_{xy} + d_{xy}$ (D) $d_{xy} + d_{yz}$

π

δ- Bond





Chemical bonding

15. Which of the following statement is false

(A) δ-bond is a result of 4-lobe interaction between two p-orbitals.

(B) δ-bond is weaker than π-bond

(C) δ-bond & σ-bond have unequal bond strength

(D) Representative elements do not have tendency to form δ-bond.

σ > π > δ

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Chemical bonding

16. Choose the incorrect order of bond strength :-

(A) $3p_\pi - 3p_\pi < 2p_\pi - 3\,d_\pi$

(B) $3p_\pi - 3p_\pi < 3\,d_\pi - 3\,d_\pi$

(C) $3p_\pi - 3\,d_\pi < 2p_\pi - 3\,d_\pi$

(D) $3p_\pi - 3\,d_\pi < 3p_\pi - 3p_\pi$

$2p_\pi - 2p_\pi < 2p_\pi - 3p_\pi < 2p_\pi - 3d_\pi$

$3p_\pi - 3p_\pi < 3p_\pi - 3d_\pi < 3d_\pi - 3d_\pi$

Chemical bonding

17. Which of the following specie does not contain $p_\pi - d_\pi$ bond(s) ?

(A) SO_2Cl_2 (B) N_2O (C) $H_2PO_3^\theta$ (D) SO_3^{2-}

Chemical bonding

18. Correct order of bond strength is:

(A) $1s - 1s > 1s - 2s > 2s - 2p$

(B) $1s - 1s < 1s - 2s < 2s - 2p$

(C) Is $-2s > 2s - 2p > 1s - 1s$

(D) None of the above

B.S $\propto \frac{1}{\text{Size}}$

$2p_\pi - 2p_\pi > 2p_\pi - 3p_\pi > 3p_\pi - 3p_\pi$

When size same then % p ↑ strength ↑

$2s - 2s < 2s - 2p < 2p - 2p$

Chemical bonding

19. If x is internuclear axis, δ bond can be formed by :

(A) $d_{x^2-y^2} + d_{x^2-y^2}$

(B) $d_{xy} + d_{yz}$

(C) $d_{yz} + d_{yz}$

(D) $d_{xz} + d_{xy}$

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Chemical bonding

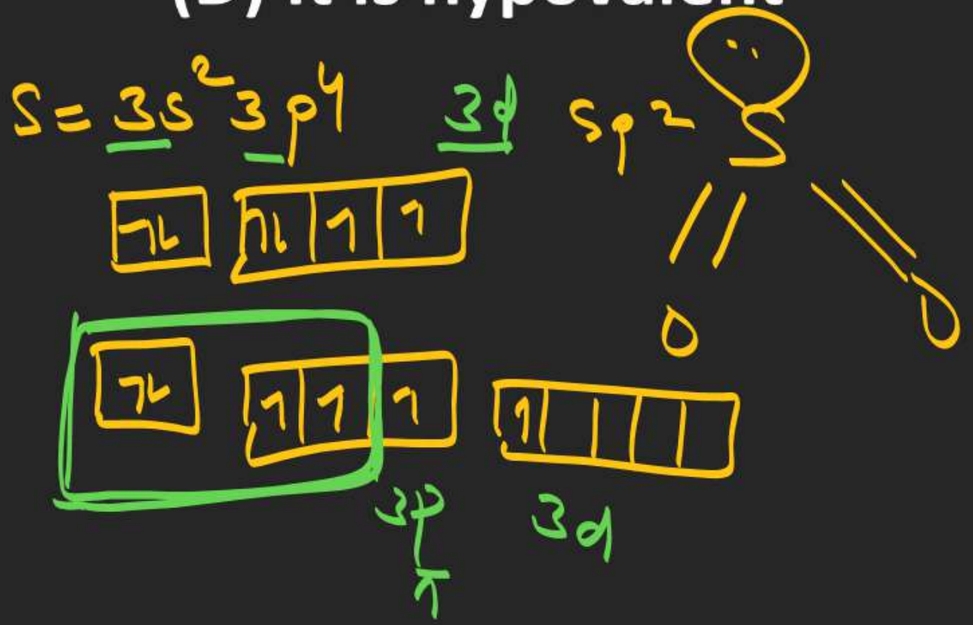
20. Choose the CORRECT statement about the structure of SO_2.

(A) Two $2p_\pi - 3\,d_\pi$ bond

(B) Two $2p_\pi - 3\,d_\pi$ bond

(C) One $2p_\pi - 3\,d_\pi$ & one $2p_\pi - 3p_\pi$ bond

(D) It is hypovalent



if Lewis structure written then

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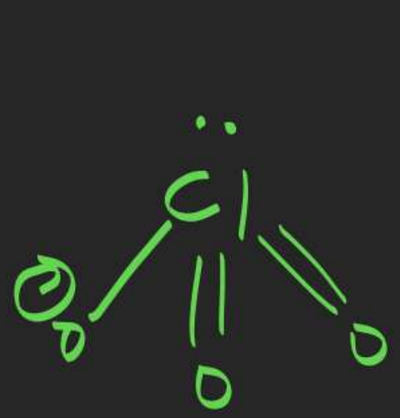
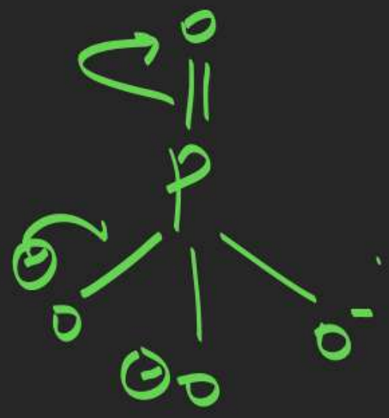
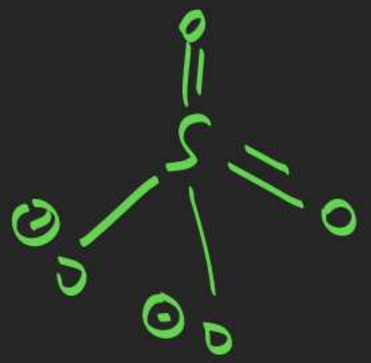
Chemical bonding

21. The species having no $P_\pi - P_\pi$ bond but has bond order equal to that of O_2.

(A) ClO_3^- (B) PO_4^{3-} (C) SO_4^{2-} (D) XeO_3



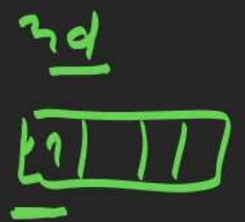




O = O

B.O = 2

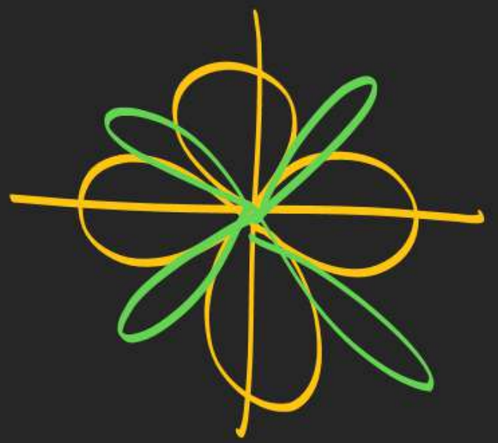
Xe = $5s^2 5p^6$ 3d



Chemical bonding

22. Which of the following orbital cannot form σ bond with d_{xy} orbital .

(A) s (B) p_x (C) $d_{x^2-y^2}$ (D) All of these



Chemical bonding

Covalent bond is directional and Ionic bond is non directional

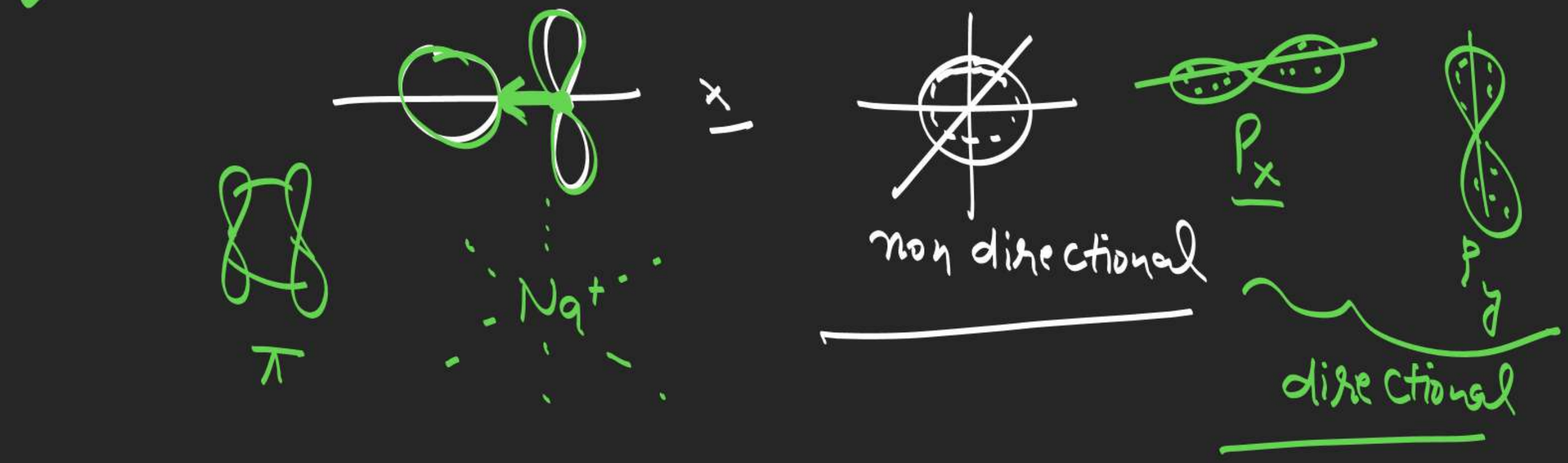
23. Which of the following statement is correct ?

(A) s-orbital always forms σ bond with p orbital

(B) s-orbital is more directional than p-orbital

(C) p-orbital always form π-bond

(D) a covalent bond is directional in nature.



Chemical bonding

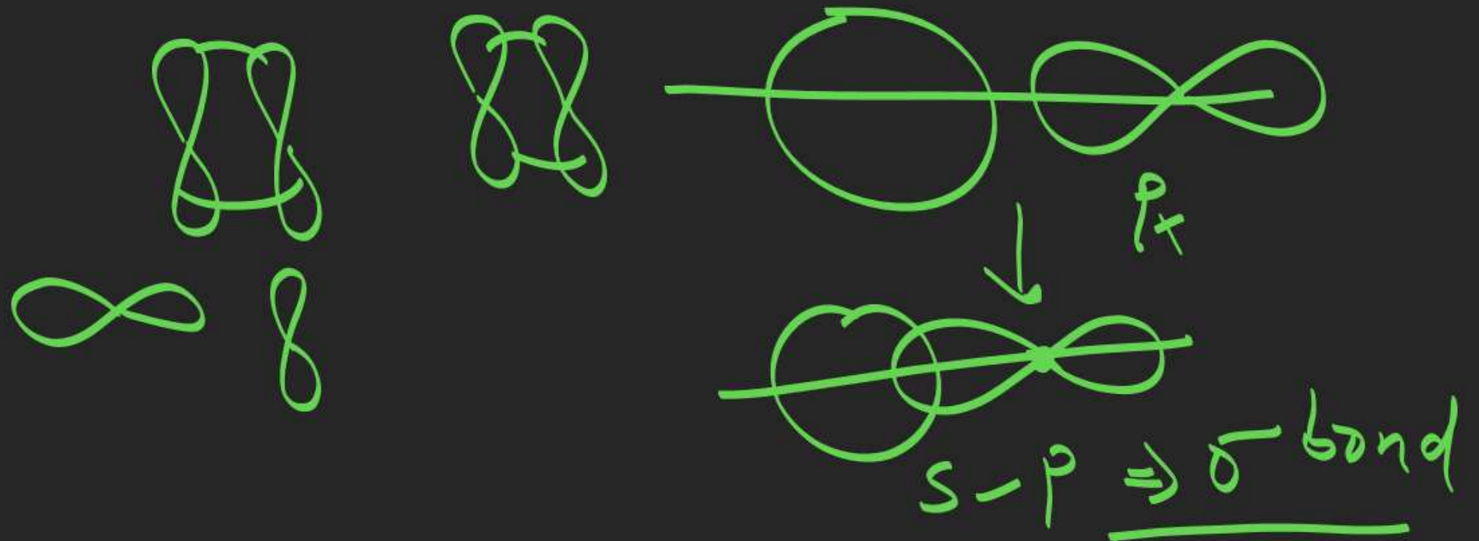
24. Which of the following overlapping is correct regarding σ-bond formation ?

(A) $2p_x + 2p_x$, when y-axis is inter nuclear axis

(B) $1s + 2p_x$, when x - axis is inter nuclear axis

(C) $2p_y + 2p_y$, when z-axis is inter nuclear axis

(D) $2p_y + 2p_z$, when x-axis is inter nuclear axis



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Chemical bonding

25. Which of the following shows maximum covalency?

(A) F (B) I (C) S (D) O

F = $2s^2 2p^5$

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Chemical bonding

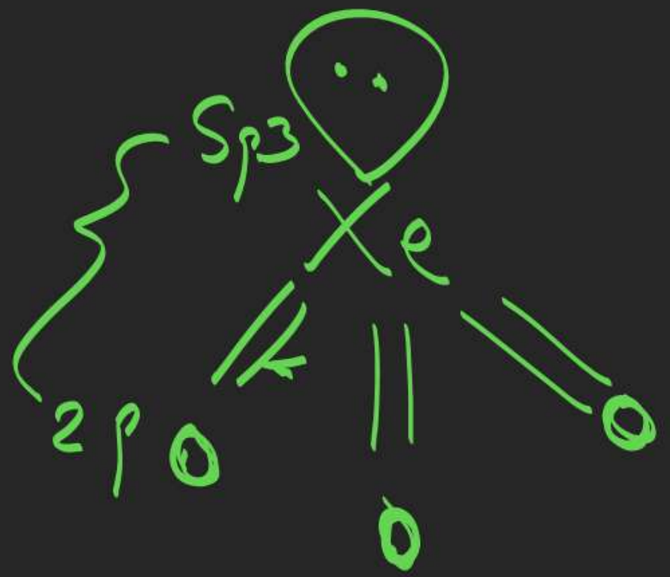
26. Which of the following overlapping is not present in XeO_3 molecule ?

(A) $sp^3 + p_x$

(B) $sp^3 + p_y$

(C) $d_{xz} + p_x$

(D) $sp^3 + s$



O = $1s^2\ 2s^2\ 2p^4$

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Chemical bonding

27. According to VBT, which of the following overlapping results π-type covalent bond in O_2 molecule formation, when Z-axis is internuclear axis?

(I) $2s - 2s$ (II) $2p_x - 2p_x$ (III) $1s - 1s$

(IV) $2p_y - 2p_y$ (V) $2p_z - 2p_z$

(A) I, III (B) III, IV (C) II, IV (D) IV, V

Chemical bonding

28. Which of the following would result in the formation of strongest π-bond if the molecular axis is x-axis?

(A) $2p_x + 2p_x$

(B) $2p_y + 2p_y$

(C) $2p_y + 3\,d_{xy}$

(D) $2p_z + 4p_z$

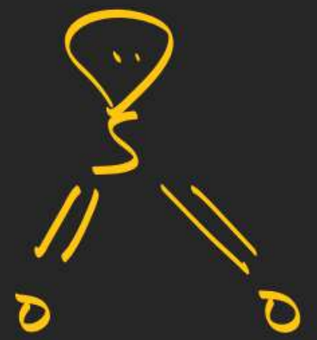
B.S $\propto \frac{1}{\text{Size}}$

Chemical bonding

29. In which of the following species $p_\pi - d_\pi$ bond is present but $p_\pi - p_\pi$ bond is absent?

(A) SiH_4 (B) CS_2 (C) SO_2 (D) SO_2Cl_2

X



$S = 3s^2 3p^4$

$C = 1s^2 2s^2 2p^2$

Chemical bonding

30. The set of planar chemical species in which d-orbital participate in hybridisation.

(A) $ClO_4^-, ClO_3^-, ClO_2^-$

(B) $XeF_5^\ominus, IF_4^\ominus, XeF_4$

(C) $XeF_5^\ominus, XeF_6, XeF_4$

(D) IF_7, ClF_3, SF_4