RACE # 03

Single Correct :

1. **Ans.(B)**

2. **Ans.(C)**

3. **Ans.(C)**

4. **Ans.(A)**

More than one may be correct :

5. **Ans.(A, B)**

6. **Ans.(A, D)**

Paragraph Q. 7 to Q. 9

7. **Ans.(C)**

8. **Ans.(D)**

9. **Ans.(D)**

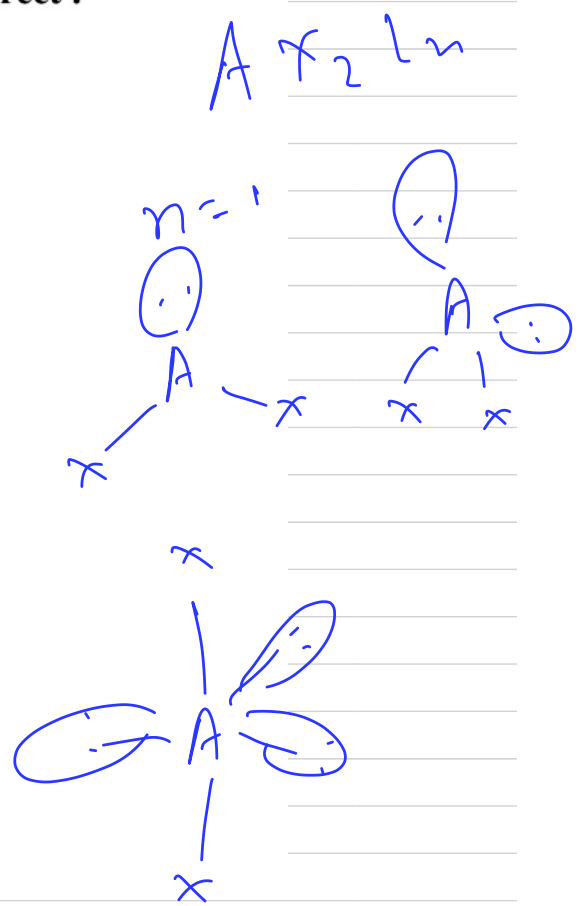
10. **Ans.(B)**

INTEGER

11. **Ans.(4)**

12. **Ans.(4)**

13. **Ans.(4)**



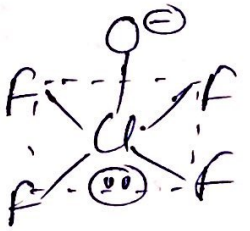
Solution of Page-3.

Leader :- // Solution of Race No (1) Sinha (1)

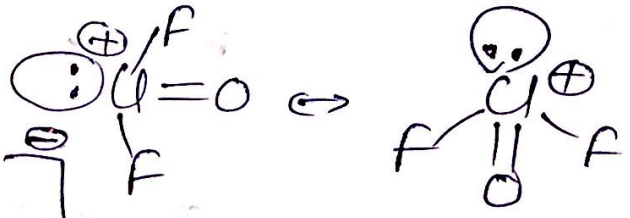
Qu: (1) :- [Ans :- 2]

Solution :

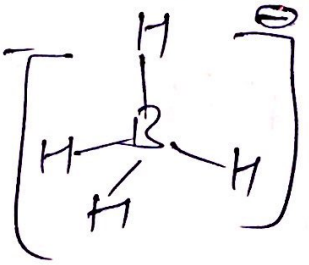
(A) $ClOF_4^{\ominus}$:-



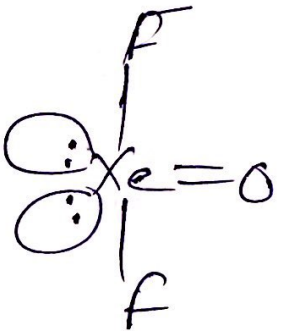
(B) $ClOF_2^{\oplus}$:-



(C) $BH_4^{\ominus}$:-



(D) $XeOF_2$:-



⇒ Here maximum no. l.p. on central atom in optica

No. (2)

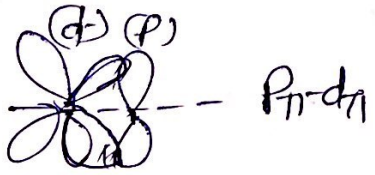
Qu: (2) [Ans :- "C"]

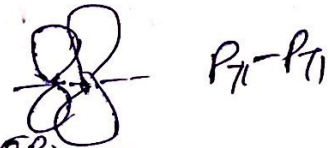
Solution : If Y-axis is approaching axis b/w two atoms then σ-bond is formed at y-axis. by overlapping (P_y-P_y) and π-bond will be at P_x-P_x or P_3-P_3 while rest overlapping will be producing non bonding.

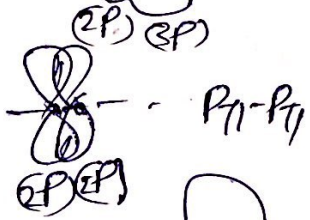
Qu:③ :- [Ans:- B]

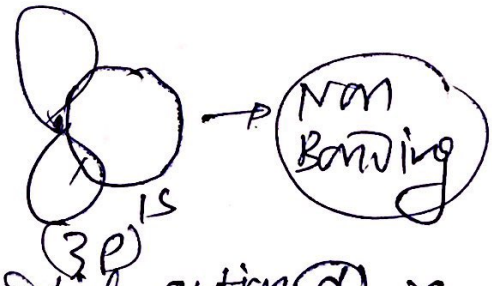
Soln: Maximum no. of π- bonds = 2 and one σ- bond i.e. 3-Bonds B/w two atoms. i.e. $-C\overset{\sigma}{\underset{\pi}{\overset{\pi}{\equiv}}}C-$ / $-C\overset{\sigma}{\underset{\pi}{\overset{\pi}{\equiv}}}N$ etc.

Qu:④ :- [Ans:- D]

Soln: (A) - 3d - 2p → 

(B) 2p - 3p → 

(C) 2p 2p → 

(D) 3p-1s → 

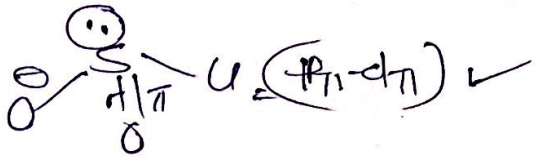
options (A), (B) & (C) produces π-bonds while option (d) is producing non bonding. (Zero overlapping)

Qu:⑤ :- [Ans:- C]

Soln: The ratio of No. of σ- bond to π- bond in "N_2" and "CO" molecule is:

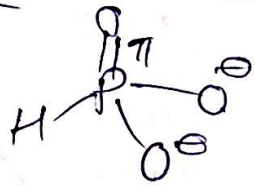
$:N\overset{\sigma}{\underset{\pi}{\overset{\pi}{\equiv}}}N:$ $\quad$ $:\overset{\ominus}{C}\overset{\sigma}{\underset{\pi}{\overset{\pi}{\equiv}}}\overset{\oplus}{O}:$

Qu:⑥ i [Ans:- B] ⑤

Soln (A) $SO_2Cl^{\ominus}$ =  $(p_\pi - d_\pi)$ ✓

(B) $NO_2^{\oplus}$ =  $(p_\pi - p_\pi)$ ✓

(C)  = $\begin{bmatrix} p_\pi - p_\pi = 1 \\ p_\pi - d_\pi = 1 \end{bmatrix}$ ✓

(D) $HPO_3^{2\ominus}$ ⇒  = $(p_\pi d_\pi = 1)$

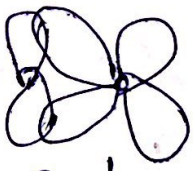
Here $p_\pi - d_\pi$ bond is not present in option (B)

Qu:⑦ [Ans:- A,C]

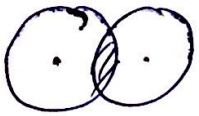
Solution - s-orbital is only spherical in size so it can form σ-bond only.

(A) 

σ-bond

(B) 

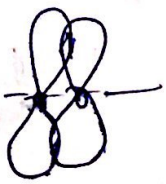
(π-bond)

(C) 

σ-bond

(D) p-p

Axial →  σ-bond

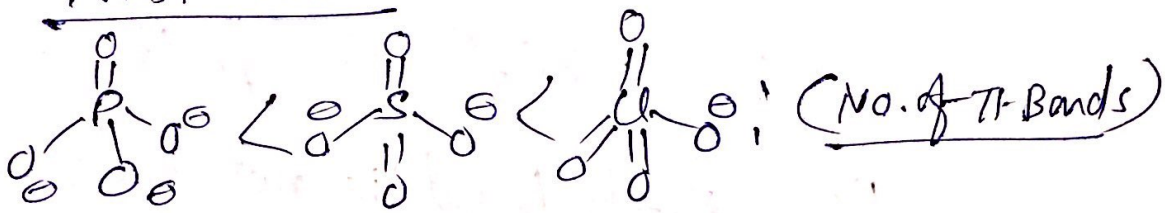
Sidewise →  π-bond

Qu:⑧ :- [Ans : A]

Solution: Bond energy order :-

[∵ σ-Bond > π-bond > Hydrogen Bond > Vander wool's force]

Qu:⑨ :- Ans: (B)

Soln (A)  (No. of π-Bonds)

(B) $Cl_2 > Br_2 > F_2 > I_2$ = (Bond energy)

(C) $2p_\pi - 2p_\pi > 3p_\pi - 2p_\pi$ = (strength of π-Bond)

(D) $HF < HCl < HBr < HI$ (Acidic strength)

According to question only (B) option is correct in the given options rest options in the questions are incorrect.

Qu:⑩ :- [Ans: (B)]

Solution: Hint: "Thermal stability $\propto \frac{1}{\text{size of centre atom}}$

[Extent of overlapping decreases with increasing size]

Thermal stability: $H_2O > H_2S > H_2Se > H_2Te$ (least stable)

Solution Race-2

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN) — Path to Success

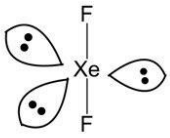
RACE — Regular Analysis through Continuous Exercise

JEE (Main + Advanced) 2021
LEADER COURSE

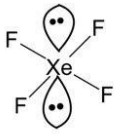
RACE # 02 | INORGANIC CHEMISTRY

M.M. : 48 | TIME : 10 Min.

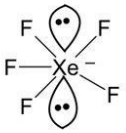
1. Write the hybridisation state of central atom and draw geometry.



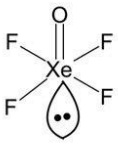
1) sp^3d



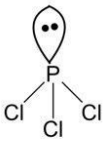
2) sp^3d^2



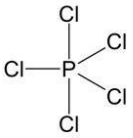
3) sp^3d^3



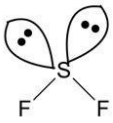
4) sp^3d^2



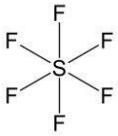
5) sp^3



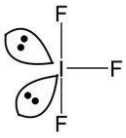
6) sp^3d



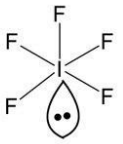
7) sp^3



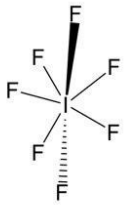
8) sp^3d^2



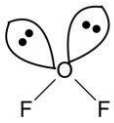
9) sp^3d



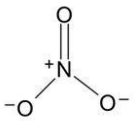
10) sp^3d^2



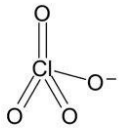
11) sp^3d^3



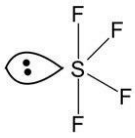
12) sp^3



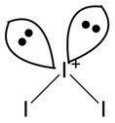
13) sp^2



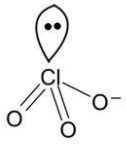
14) sp^3



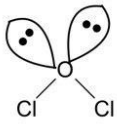
15) sp^3d



16) sp^3



17) sp^3



18) sp^3

Single Correct :

2. Find the pair of species having the same shape but different hybridisation of the central atom :- **[3]**

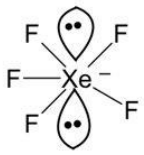
(A) XeF_5^- , BrF_5 (B) XeF_3^+ , $XeOF_2$ (C) ICl_2^- , Cl_2O (D) SO_2 , F_2O

2. वह युग्म चुनिए जिसकी स्पीशीज की आकृति समान है लेकिन केन्द्रीय परमाणु का संकरण अलग-अलग है :- **[3]**

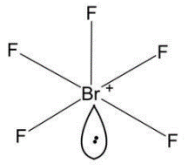
(A) XeF_5^- , BrF_5 (B) XeF_3^+ , $XeOF_2$ (C) ICl_2^- , Cl_2O (D) SO_2 , F_2O

2. Ans. (D)

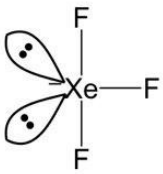
(A) sp^3d^3 , planar



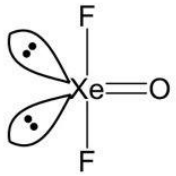
sp^3d^2 , sq pyramidal



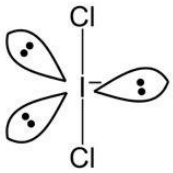
(B) sp^3d, T SHAPE



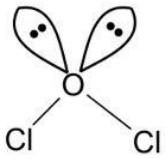
sp^3d, T SHAPE



(C)

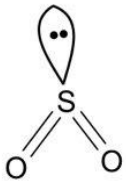


sp^3d, LINEAR

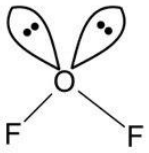


sp^3, BENT SHAPE

(D)



Sp^2, BENT SHAPE



sp^3, BENT SHAPE

3. What is the difference between bond angles in cationic species of PCl_5 and PBr_5 in solid state.

(A) 60° (B) 109°28′ (C*) 0° (D) 90° **[3]**

3. ठोस अवस्था में PCl_5 तथा PBr_5 की धनायनिक प्रजातियों के बंध कोणों में क्या अन्तर हैं -

(A) 60° (B) 109°28′ (C) 0° (D) 90° **[3]**

3. Ans. (C)

Sol. PCl_4^+ PCl_6^- PBr_4^+ Br^-

↓ ↓

109° 28′ 109° 28′ ⇒ so difference between bond angle is zero

4. All possible bond angles in anionic part of PCl_5 are. **[3]**

(A) 109° 28′ only (B*) 90°, 180° (C) 90°, 120° , 180° (D) 72°, 90°, 180°

4. PCl_5 के ऋणायनिक भाग के सभी सम्भावित बंध कोण हैं : **[3]**

(A) केवल 109°, 28′ (B) 90°, 180° (C) 90°, 120° , 180° (D) 72°, 90°, 180°

4. **Ans. (B)**

Sol. $PCl_5^- \rightarrow PCl_6^-$, PCl_4^+ | Cl, Cl, P, Cl, Cl, Cl | 90°, 180°

5. The hybridisation and shape of XeO_3F_2 molecule is **[3]**

(A) sp^3 and tetrahedral (B) sp^3d and see-saw

(C*) sp^3d and TBP (D) sp^3d^2 and octahedral

5. XeO_3F_2 अणु का संकरण तथा आकृति है : **[3]**

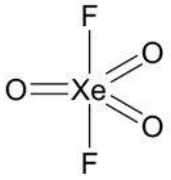
(A) sp^3 तथा चतुष्फलकीय (B) sp^3d तथा ढ़ेकुली (see-saw)

(C) sp^3d तथा TBP (D) sp^3d^2 तथा अष्टफलकीय

5. **Ans. (C)**

sp^3d

Trigonal bipyramidal



6. $XeOF_4$, XeF_2, I_3^+ , XeF_4 , PCl_3

Which of the following shape does not describe to any of the above species ? **[3]**

(A) Square pyramidal (B) Square planar

(C*) Trigonal planar (D) Linear

6. $XeOF_4$, XeF_2, I_3^+ , XeF_4 , PCl_3

उपरोक्त में से किसी भी प्रजाति को निम्न में से कौनसी आकृति निरूपित नहीं करती है ? **[3]**

(A) वर्ग पिरामिडीय (B) वर्ग समतलीय

(C) त्रिकोणीय समतलीय (D) रेखीय

6. **Ans. (C)**

Sol. $XeOF_4$ = square pyramidal I_3^+ = Angular

XeF_2 = linear XeF_4 = square planar

PCl_3 = trigonal pyramidal

7. Which of the following species does not exist? **[3]**

(A) BF_6^{3-} (B) XeF_4 (C) XeF_5^- (D) XeF_6

7. निम्न में से कौनसी प्रजाति का अस्तित्व नहीं है ? **[3]**

(A) BF_6^{3-} (B) XeF_4 (C) XeF_5^- (D) XeF_6

7. Ans. (A)

BF_6^{3-} not exist because boron can form maximum 4 bonds due to absence of low d orbitals

8. **Statement-1** : CH_4 and CH_2F_2 are having regular tetrahedron geometry. **[3]**

Statement-2 : Both are having same hybridization.

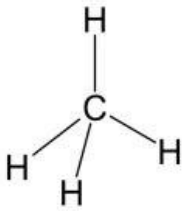
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

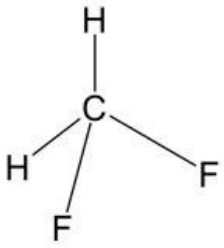
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D*) Statement-1 is false, statement-2 is true.

8. Ans. (D)





sp^3 regular tetrahedron sp^3, distorted tetrahedron(C-H AND C-F bond lengths are different)

statement 1 is false and statement 2 is ture

More than one may be correct

9. Which of following pair of species is having different hybridisation but same shape. **[3]**

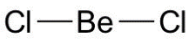
(A) $BeCl_2$ and CO_2 (B) CO_2 and SO_2 (C*) SO_2 and I_3^+ (D*) ICl_2^- and BeH_2

9. प्रजातियों के निम्न युग्मों में से कौनसे युग्म में भिन्न संकरण परन्तु आकृति समान है : **[3]**

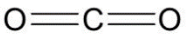
(A) $BeCl_2$ तथा CO_2 (B) CO_2 तथा SO_2 (C) SO_2 तथा I_3^+ (D) ICl_2^- तथा BeH_2

9. Ans. (C, D)

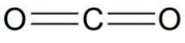
Sol.

(A) 

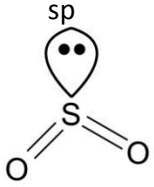
sp



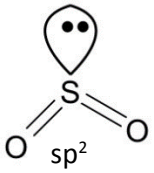
sp

(B) 

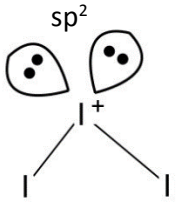
sp



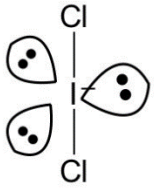
sp^2

(C) 

sp^2



sp^3

(D) 

sp^3d

sp

---

10. Indicate the wrong statement : **[3]**

*(A) A sigma bond has no free rotation along its axis

*(B) p-orbitals always have only sidewise overlapping

(C) s-orbitals never form π-bonds

*(D) There can be more than one sigma bond between two atoms

10. गलत कथन चुनिए : **[3]**

(A) एक सिग्मा बंध का, इसके अक्ष के सापेक्ष कोई मुक्त घूर्णन नहीं होता है

(B) हमेशा p-कक्षक केवल पार्श्विय अतिव्यपान ही करते हैं

(C) s-कक्षक कभी भी π-बंध नहीं बनाते हैं

(D) दो परमाणुओं के मध्य सिग्मा बंध, एक से अधिक हो सकते हैं

10. **Ans. (A, B, D)**

Sol. σ–bond allow free rolalion along its axis. p-orbital can form σ-bond by end on overlap. There can be only one σ-bond between two atoms

11. Which of the following geometry is most likely to not form from sp^3d hybridisation of the central atom.

(A) Linear (B*) Tetrahedral (C) T-Shaped (D) See-Saw

11. केन्द्रीय परमाणु के sp^3d संकरण से निम्न ज्यामिती में से कौनसी ज्यामिती सामान्यत: नहीं बनती है :

(A) रेखीय (B) चतुष्फलकीय (C) T-आकृति (D) ढ़ेकुली (See-Saw)

11. Ans. (B)

Sol. Tetrahedral - sp^3

12. The orbital is not participated in sp^3d^2 hybridisation.

(A) p_x (B*) d_{xy} (C) $d_{x^2-y^2}$ (D) p_z

12. sp^3d^2 संकरण में भाग नहीं लेने वाले कक्षक है :

(A) p_x (B) d_{xy} (C) $d_{x^2-y^2}$ (D) p_z

12. Ans. (B)

Sol. sp^3d^2 — $s + p_x + p_y + p_z$; $d_{x^2-y^2} + d_{z^2}$

13. "The hybrid orbitals are at angle of X° to one another" this statement is not valid for which of the following hybridisation.

(A) sp^3 (B) sp^2 (C*) sp^3d^2 (D) sp

13. "संकरित कक्षक एक दूसरे से X° कोण पर है" यह कथन निम्न में से किस संकरण के लिए वैध नहीं है :

(A) sp^3 (B) sp^2 (C) sp^3d^2 (D) sp

13. Ans. (C)

sp^3	The hybrid orbitals are at angle of 109° 28' to one another
sp^2	The hybrid orbitals are at angle of 120° to one another
sp^3d^2	The hybrid orbitals are at angle of 90° ,180° to one another
sp	The hybrid orbitals are at angle of 180° to one another

So given statement is not valid for sp^3d^2 hybridization.

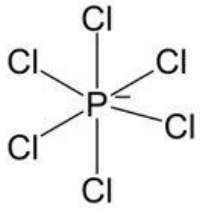
14. Match the following **[3]**

List - I (Molecules/Species)	List - II
(P) PCl_6^-	(1) d_{xy} orbital involved in bonding
(Q) XeO_2F_2	(2) The central atom is sp^3d hybridised
(R) I_3^+	(3) Two lone pair present on central atom
(S) XeF_6	(4) Maximum number of atoms in a plane = 5

	(P)	(Q)	(R)	(S)
(A)	4	3	2	1
(B)	2	4	3	1
(C)	4	2	3	1
(D)	4	2	1	3

14.Ans (C)

(P)



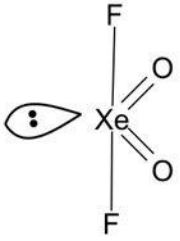
Sp^3d^2 hybridization , so d_{xy} not involved in hybradization

Zero lone pair on central atom,

Maximum number of atoms in a plane = 5

Correct match:- (4)

(Q)



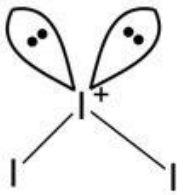
sp^3d hybridization so d_{xy} not involved in hybradization

One lone pair on central atom,

Maximum number of atoms in a plane = 3

Correct match:- (2)

(R)

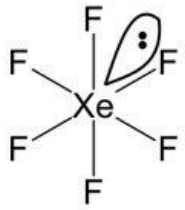


sp^3 hybridization , so d_{xy} not involved in bonding

Two lone pair on central atom,

Maximum number of atoms in a plane = 3

Correct match:- (3)

(S) 

sp^3d^3 hybridization , so d_{xy} orbital involved in bonding

one lone pair on hybridization,

Correct match:- (1)

Solution Race-3.

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RACE # 03 | INORGANIC CHEMISTRY

M.M. : 44 | TIME : 10 Min.

Single Correct :

1. The correct order of hybridization of the central atom in the following species **[3]**

NH_3, XeO_2F_2, SeF_4, NO_2^+

(A) sp^3, sp^3, sp^3d, sp (B) sp^3, sp^3d, sp^3d, sp

(C) sp^3, sp^3d^2, sp^3d, sp^2 (D) sp^2, sp^3d, sp^3d^2, sp

1. निम्न प्रजातियों के केन्द्रीय परमाणु के संकरण का सही क्रम है : **[3]**

NH_3, XeO_2F_2, SeF_4, NO_2^+

(A) sp^3, sp^3, sp^3d, sp (B) sp^3, sp^3d, sp^3d, sp

(C) sp^3, sp^3d^2, sp^3d, sp^2 (D) sp^2, sp^3d, sp^3d^2, sp

Ans. **(B)**

Sol. $S_N = \sigma + L.P.$

NH_3 $4 - sp^3$

XeO_2F_2 $5 - sp^3d$

SeF_4 5- sp^3d

NO_2^+ $2 - sp$

2. In molecules of the type AX_2L_n (where L represents lone pairs and n is its number) there exists a bond between element A and X. The $\angle$ X A X bond angle. **[3]**

(A) Always decreases if n increases (B) Always increases if n increases

(C) Will be maximum for n = 3, 0 (D) Generally decreases if n decreases

2. AX_2L_n प्रकार के अणु में (जहाँ L एकाकी इलेक्ट्रॉन युग्म तथा n इसकी संख्या को प्रदर्शित करते है) A तथा X तत्वों के मध्य एक बंध बनता है। **[3]**

(A) यदि n बढ़ता है तो $\angle$ X A X बंध कोण हमेशा घटता है

(B) यदि n बढ़ता है तो $\angle$ X A X बंध कोण हमेशा बढ़ता है

(C) n = 3, 0 के लिए $\angle$ X A X बंध कोण अधिकतम होगा

(D) यदि n घटता है तो सामान्यत: $\angle$ X A X बंध कोण घटता है

Ans. **(C)**

Sol. AX_2L_n for n = 3 L.P. (3L.P. + 2 B.P.) - linear

molecular geometry is = linear means bond angle 180°

3. Which of the following pairs of species have identical shapes? **[3]**

(A) NO_2^+ and NO_2^- (B) PCl_5 and BrF_5 (C) XeF_4 and ICl_4^- (D) $TeCl_4$ and XeO_4

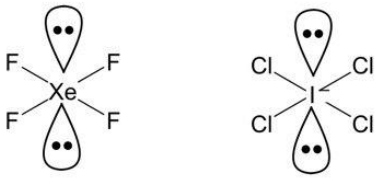
3. निम्न प्रजातियों के युग्मों में से कौनसा युग्म समान आकृति रखता है ? **[3]**

(A) NO_2^+ तथा NO_2^- (B) PCl_5 तथा BrF_5 (C) XeF_4 तथा ICl_4^- (D) $TeCl_4$ तथा XeO_4

Ans. (C)

(A) 

(B) 

(C) 

Same shape

(D) 

4. Choose the correct on the Cl–O bond length in $NaClO_4$. **[3]**

(A) All Cl–O bonds are of equal length.

(B) Three Cl–O bonds are of equal of length one longer.

(C) Two Cl–O bonds are of same length which are longer compared to other two Cl–O bond length.

(D) All are different.

4. $NaClO_4$ में Cl–O बंध लम्बाई के लिए सही कथन का चयन कीजिए - **[3]**

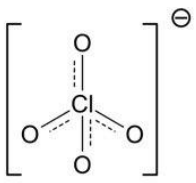
(A) सभी Cl–O बंध समान लम्बाई के हैं

(B) तीन Cl–O बंध समान लम्बाई के है तथा एक की लम्बाई अधिक है

(C) दो Cl–O बंध समान लम्बाई के है जो कि अन्य दो Cl–O बंध लम्बाई की तुलना में अधिक लम्बाई रखते है।

(D) सभी बंध लम्बाईयाँ अलग-अलग हैं

Ans. (A)



Resonance hybrid for ClO_4^-, All Cl-O bonds are same

More than one may be correct :

5. Which molecular geometry are most likely to result, from a octahedral electron geometry? **[3]**

(A) square planar (B) square pyramidal (C) linear (D) V–shaped

5. अष्टफलकीय इलेक्ट्रॉन ज्यामिती से सामान्यतया कौनसी आण्विक ज्यामिती बनती है ? **[3]**

(A) वर्ग समतलीय (B) वर्ग पिरामिडीय (C) रेखीय (D) V–आकृति

Ans. (A, B)

Sol. 4 b.p. + 2 L.p. - square planar

5 b.p. + 1 L.p. - square pyramidal

6. Halogens form compounds among themselves with the formula XX', XX & XX_7 (where X is the heavier halogen) which of the following pair(s) represent(s) correct geometry with polar and non-polar nature (theoretically) **[3]**

(A) XX' — Linear — Polar (B) XX — Linear — Polar

(C) XX' — Linear — Non-polar (D) XX_7' — Pentagonal bipyramidal — Non-polar

6. हैलोजन आपस में सूत्र XX', XX तथा XX_7' (जहाँ पर X भारी हैलोजन है) के यौगिक बनाती हैं। सैद्धान्तिक रूप से निम्न में से कौनसे युग्म ध्रुवीय तथा अध्रुवीय ज्यामिती को सही रूप से प्रदर्शित करते हैं : **[3]**

(A) XX' — रेखीय — ध्रुवीय (B) XX — रेखीय — ध्रुवीय

(C) XX' — रेखीय — अध्रुवीय (D) XX_7' — पंचभुजीय द्विपिरामिडीय — अध्रुवीय

Ans. (A, D)

X——X LINEAR , $\Delta EN = 0$ SO NON POLAR

X——X' LINEAR, $\Delta EN \neq 0$ SO POLAR

XX'_7 sp^3d^3 hybridization, pentagonal by pyramidal geometry, symmetrical geometry so non polar

7. According to hybridization theory, the %s character in sp^3d hybrid orbitals is

(A) 25% (B) 33.33% (C) 20% (D) 16.66%

Ans. C

Total orbitals involved in hybridization = 5

Total s orbitals involved in hybridization =1

% of s character = $\frac{1}{5} \times 100 = 20\%$

8. The number of axial and equitorial positions in octahedral geometry having sp^3d^2 hybridization

(A) 2, 4 (B) 4, 2 (C) 3, 3 (D) 0, 0

8. sp^3d^2 संकरण रखने वाली अष्टफलकीय ज्यामिती में अक्षीय तथा विषुवतीय स्थितियों की संख्या है :

(A) 2, 4 (B) 4, 2 (C) 3, 3 (D) 0, 0

Ans. (D)

Sol. There is no axial and equatorial position in sp^3d^2 all positions in sp^3d^2 geometry are equivalent.

9. Increasing order of the energy of hybrid orbitals is **[3]**

(A) $sp^3 < sp^2 < sp$ (B) $sp^2 < sp^3 < sp$ (C) $sp < sp^3 < sp^2$ (D) $sp < sp^2 < sp^3$

9. संकरित कक्षकों की ऊर्जाओं का बढ़ता हुआ क्रम है :

(A) $sp^3 < sp^2 < sp$ (B) $sp^2 < sp^3 < sp$ (C) $sp < sp^3 < sp^2$ (D) $sp < sp^2 < sp^3$

Ans. (D)

Energy of hybrid orbitals ↑ no of involved P orbitals ↑

(As Energy order of mixing orbitals is s<p<d)

10. Match the column : **[8]**

	Column I		**Column II**
(i)	IOF_4^+	(P)	See-saw
(ii)	$IO_2F_2^-$	(Q)	Trigonal bipyramidal
(iii)	XeO_6^{4-}	(R)	Linear
(iv)	XeF_2	(S)	Square bipyramidal

(A) (i) – P, (ii) – S, (iii) – R, (iv) – Q

(B) (i) – Q, (ii) – P, (iii) – S, (iv) – R

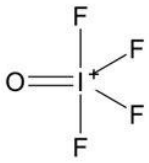
(C) (i) – Q, (ii) – S, (iii) – P, (iv) – R

(D) (i) – Q, (ii) – P, (iii) – R, (iv) – S

10. Ans

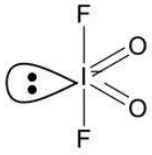
Sol.

I.



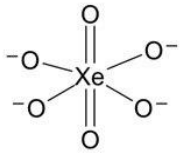
(Q)trigonal bi pyramidal

II.



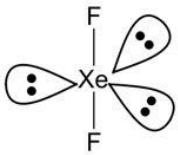
(P)see -saw

III.



(S)Square bipyramidal

IV.

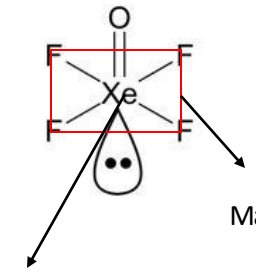


(R) linear

11. Find the maximum number of atom in one plane of $XeOF_4$:- **[3]**

11. $XeOF_4$ के एक तल में उपस्थित परमाणुओं की अधिकतम संख्या बताईये :- **[3]**

11. Ans.(4)



Maximum number of atoms in a plane = 4

Below the plane of 4F atoms due to distortion in geometry

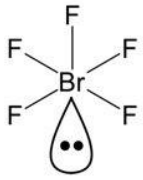
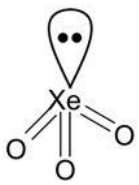
12. Find out the total number of species having atleast one adjacent bond angle is $\leq 90°$ **[3]**

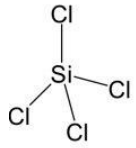
BrF_5, XeO_3, $SiCl_4$, SOF_4, SO_3, PCl_5, $IO_2F_2^{\ominus}$

12. निम्न में से ऐसी स्पीशीज की कुल संख्या बताईये जिनमें कम से कम एक निकटतम बंध कोण $\leq 90°$ का है? **[3]**

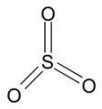
BrF_5, XeO_3, $SiCl_4$, SOF_4, SO_3, PCl_5, $IO_2F_2^{\ominus}$

12. Ans.(4)

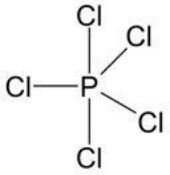
specie	
BrF_5	All bond angle $\cong 90°$
	
XeO_3	All bond angle $\cong 109°28'$
	
$SiCl_4$	All bond angle $109°28'$



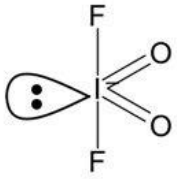
SO_3 All angles 120°

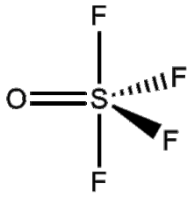


PCl_5 $\angle Cl_{ax}\text{-}P\text{-}Cl_{ax}$ is = 90°



$IO_2F_2^-$ $\angle$F-I-O is $\leq$ 90°





$\angle F_{ax}\text{-}S\text{-}F_{eq} \leq 90°$

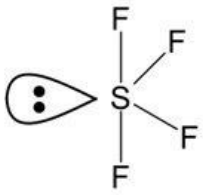
13. Among the following, find out total number of species having planar as well as each bond length is identical. **[3]**

SF_4, ClF_3, $ICl_2^{\ominus}$, $I_3^{\oplus}$, SCl_2, PCl_5, $IF_4^{\ominus}$, BrF_5

13. निम्न में से ऐसी स्पीशीज की कुल संख्या बताईये जो समतलीय के साथ-साथ प्रत्येक बंध लम्बाई समान रखती हैं **[3]**

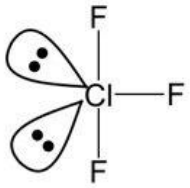
SF_4, ClF_3, $ICl_2^{\ominus}$, $I_3^{\oplus}$, SCl_2, PCl_5, $IF_4^{\ominus}$, BrF_5

13. Ans.(4)



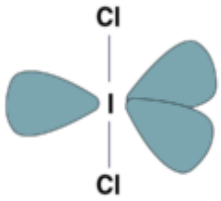
Axial bond length ≠ equatorial bond length

Non planar



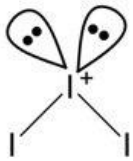
Axial bond length ≠ equatorial bond length

planar



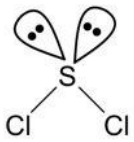
All bond lengths are same

linear



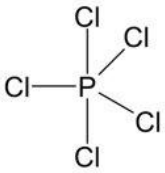
All bond lengths are same

Planar



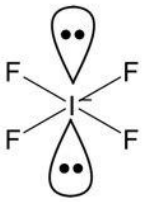
All bond lengths are same

planar



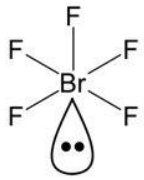
Axial bond length ≠ equatorial bond length

Non planar



All bond lengths are same

planar



All bond lengths are not same

Non planar

PH_3 No Hybr T. Pyramidal

overlap = 1S – 3P(3)

PH_4^+ sp^3 Tetrahedral

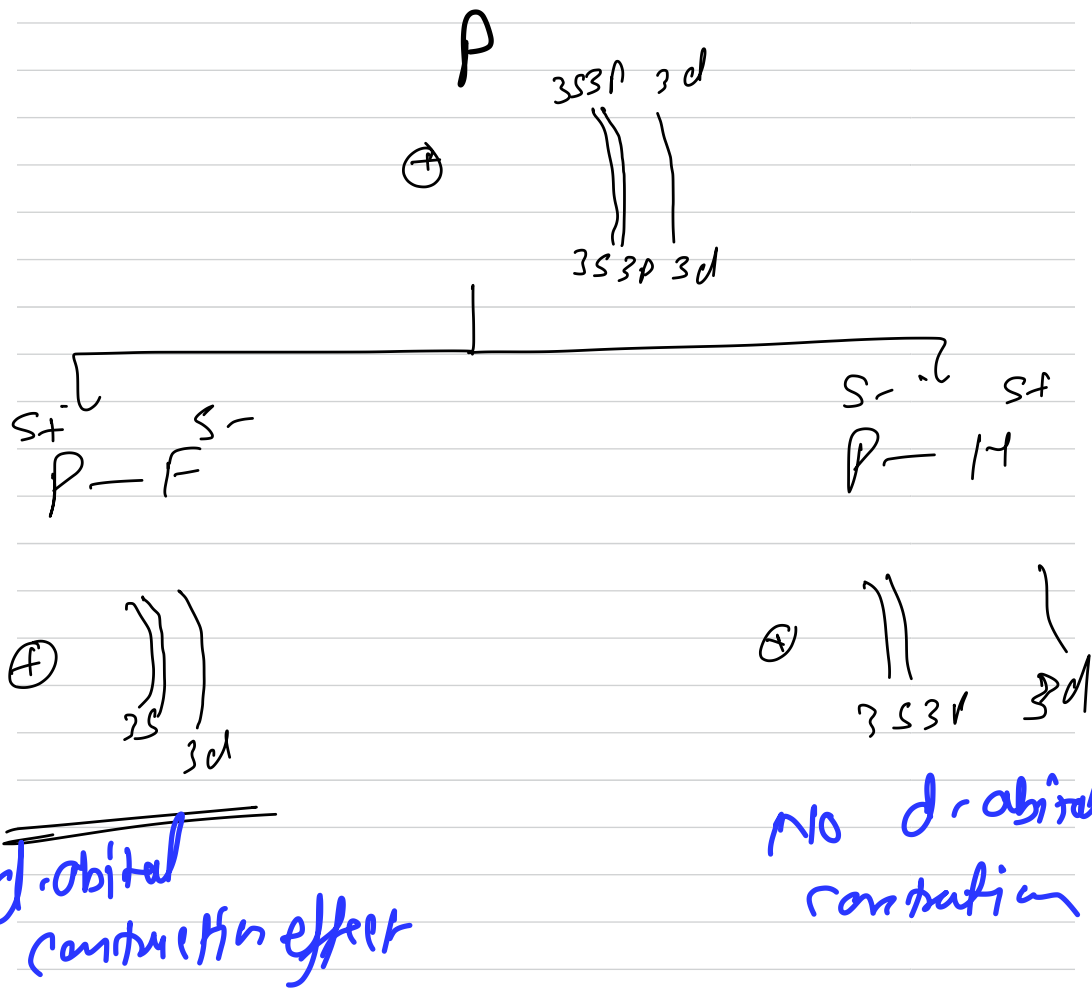
(overlap = sp^3 – 1S)

PH_5 ✗ ✗

↓

Non Existing

Some more existing covalent molecule



PF_5 ✓ PH_5 ✗

SF_6 ✓ SH_6 ✗

SF_4 ✓ SH_4 ✗

IF_7 ✓ IH_7 ✗

IF_5 / BrF_5 ✓ IH_5 BrH_5 ✓ ✗

ClF_3 ✓ ClH_3

XeF_6 ✓ XeH_6 ✗

XeF_4 ✓ XeH_4 ✗

XeF_2 ✓ XeH_2 ✗

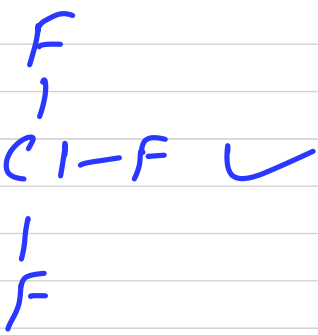
Non polar

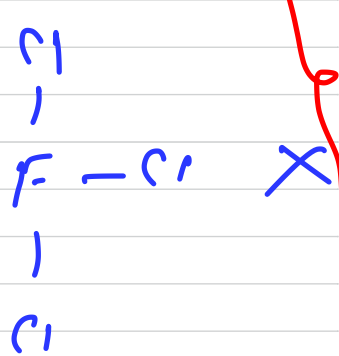
bz d-orbital contribution is NOT possible

PCl_5 ✓ NCl_5 ✗

SF_6 ✓ OF_6 ✗

SF_4 ✓ OF_4 ✗





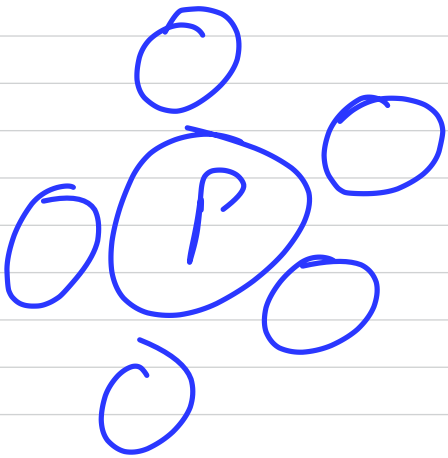
SiF_6^{2-} ✓ CF_6^{2-} ✗

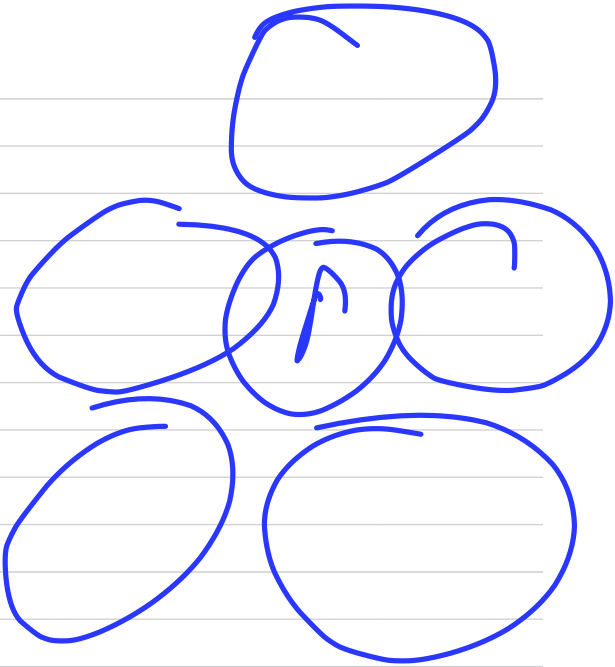
AlF_6^{3-} ✓ BF_6^{3-} ✗

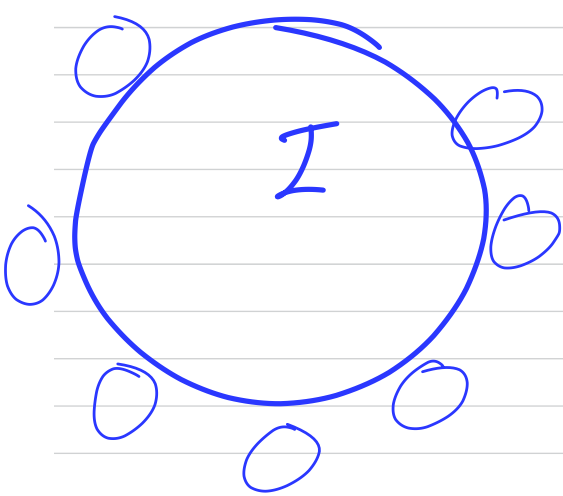
Non existy by No d-orbital in valence shell of (·)ⁿ.

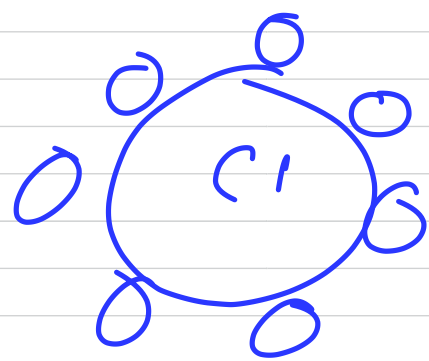
PBr_5 ✓	PI_5 ✗
PCl_6^-	PBr_6^- ✗
IF_2 ✓	ICl_2 ✗
IF_2 ✓	ClF_2 ✗
SiF_6^{2-} ✓	$SiCl_6^{2-}$ ✗

Non existing by of Steric Crowdy


P


P


I


C1

(Not stable)

O=O ✓ S=S ✗
not stable

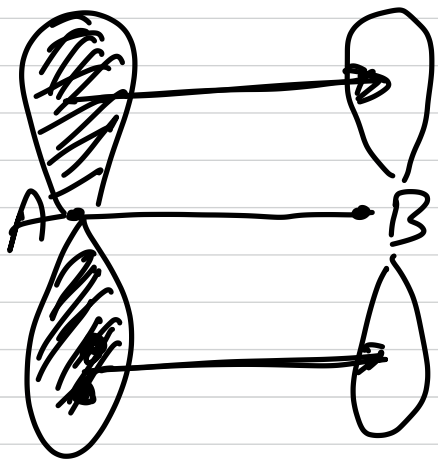
N≡N ✓ P≡P ✗
not stable

Cl–Cl ✓ Cl≡Cl ✗
Not exist

C → D. ✓ Si → D ✓
C → G. ✓ Si → G ✗
Not exist

Not stable by
∵ 3pπ–3pπ
less effective
overlap

(Back bonding)



Basic bonding

σ σ* ✓

σ σ* — ✓

π → p_π – p_π* ✓

π → p_π – d_π* ✓

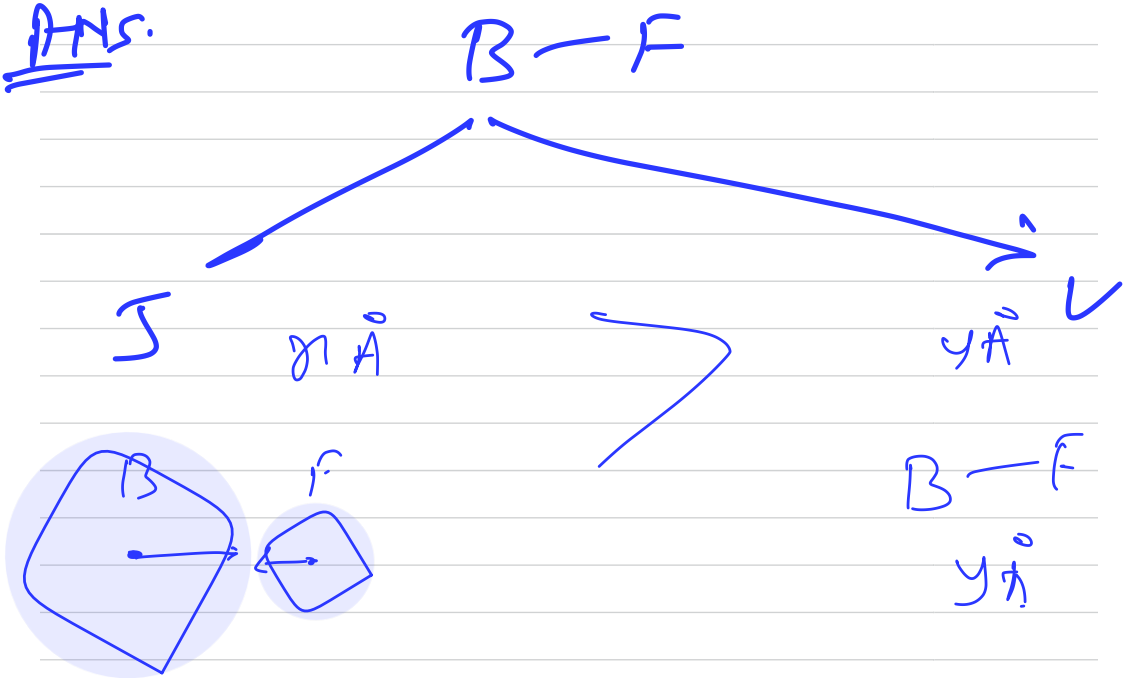
π → d_π* – d_π* ?

* One atom belg to 2nd Period.

* Other atom belg to 2nd or 3rd Period of P.T.

Q.1 B–F bond length in BF_3 is smaller than expected Explain?

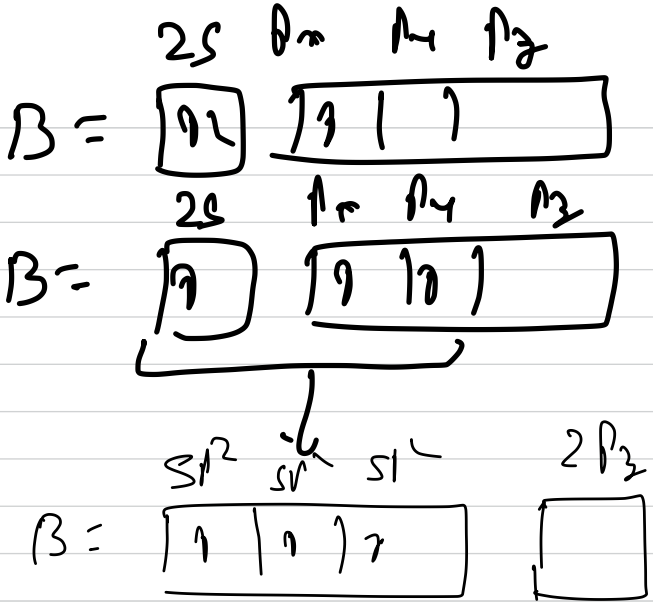
Ans.

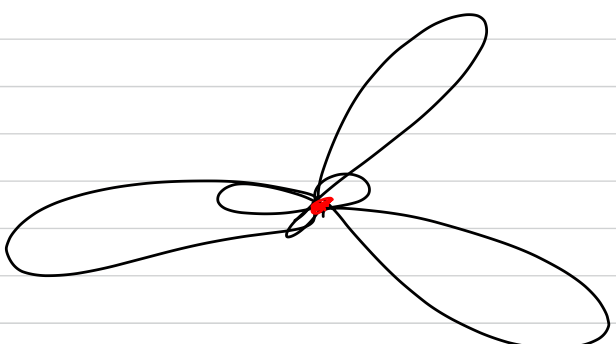


$$d_{B-F} = r_B + r_F$$

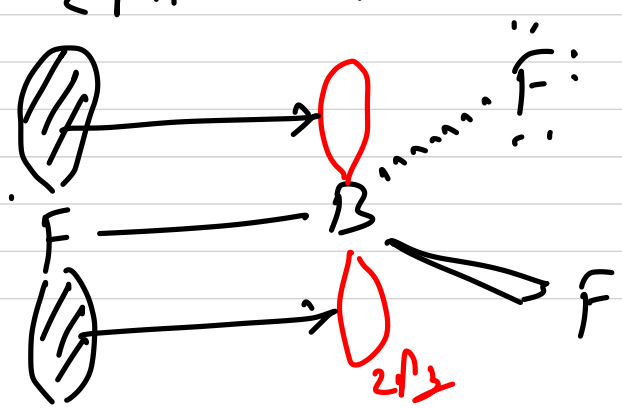
$$\left(d_{B-F} = r_B + r_F - 0.09\,|EN|\right)$$

$$d_{B-F} = \gamma\,Å$$





2pπ - 2*π



Q In which of the following B is NOT involve in Bond lowering –

(A) BH_3 (B) BCl_3

(C) BF_4^- (D) BO_3^{3-}

Q Compare B–F bond length in

BF_3 & BF_4^-

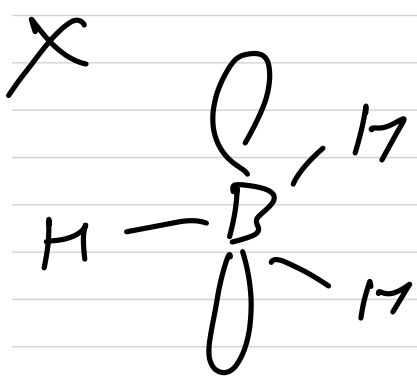
Q- Compare Lewis acidic strength of

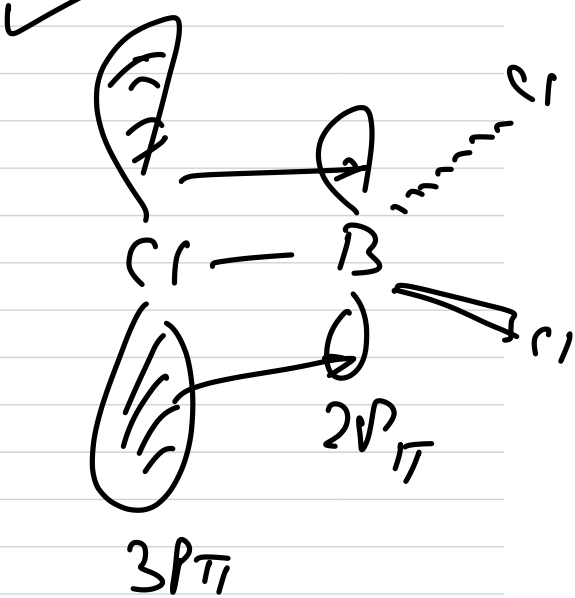
BF_3 BCl_3 BBr_3

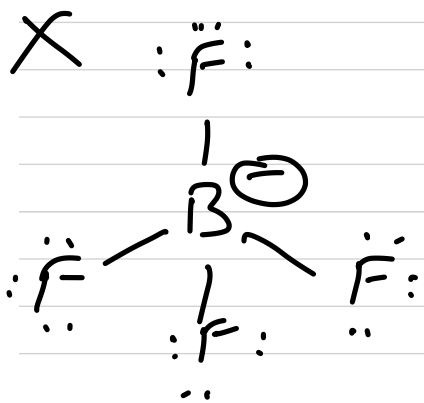
Q4 Draw structure of

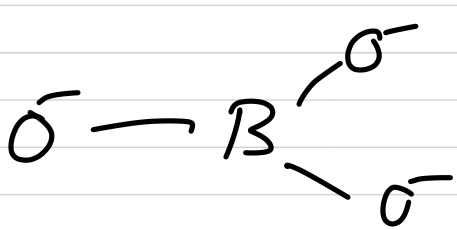
(i) $N(CH_3)_3$

(ii) $N(SiH_3)_3$









Q5 Compare B–O Bond length in

BO_3^{3-}, $B(OH)_4^-$, H_3BO_3

Q6 Draw Struct of

$B_3N_3H_6$

& Specify type of basic bonding ?

RACE # 04 — INORGANIC CHEMISTRY

M.M. : 30 — TIME : 10 Min.

Only one correct

1. Which of the bond length order data is **INCORRECT** - **[3]**

(A) P–Cl > P–F in PCl_3F_2

(B) $S–F_{(axial)} > S – F_{(eq)}$ in SF_6

(C) $S–F_{(axial)} > S – F_{(eq)}$ in SF_4

(D) $NO_2^- < NO_3^-$ (N – O)

2. O_2F_2 is an unstable yellow orange solid and H_2O_2 is a colourless liquid, both have O–O bond. O–O bond length in H_2O_2 & O_2F_2 is respectively. **[3]**

(A) 1.22Å, 1.48Å (B) 1.48Å, 1.22Å (C) 1.22Å, 1.22Å (D) 1.48Å, 1.48Å

3. Select the correct order of following property. **[3]**

(A) % s-character : $sp^3 > sp^2 > sp$

(B) $\hat{O}NO$ bond angle : $NO_3^- > \overset{\oplus}{N}O_2$

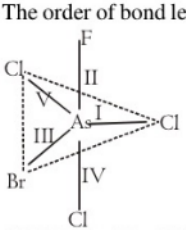
(C) All angles in CH_2F_2 are not identical

(D) C – F bond length : $CF_4 > CH_3F > CH_2F_2 > CF_3H$

4. The strongest P–O bond is found in the molecule **[3]**

(A) F_3PO (B) Cl_3PO (C) Br_3PO (D) $(CH_3)_3PO$

5. The order of bond length from the following structure. **[3]**



(A) III > I = V > IV > II (B) IV > II > I = V > III

(C) III > IV > I = V > II (D) I > II > III > IV > V

6. Comment on the C – C bond length for C_2H_6 and C_2F_6 compounds : **[3]**

(A) $d_{C-C}(C_2H_6) > d_{C-C}(C_2F_6)$ (B) $d_{C-C}(C_2F_6) > d_{C-C}(C_2H_6)$

(C) $d_{C-C}(C_2F_6) = d_{C-C}(C_2H_6)$ (D) Can't be predicted

More than one may be correct

7. The **CORRECT** set of their indicated bond length is:- **[3]**

(A) S–S (S_8) > P–P (P_4)
(B) d_{N-N}; NH_2–NH_2 > NF_2–NF_2
(C) d_{S-Cl}; $SOCl_2 < SO_2Cl_2$
(D) d_{B-O}; $B(OH)_3 < [B(OH)_4]^-$

8. The **CORRECT** statements about the structures of H_2O_2, O_2F_2 and OF_2 is/are : **[3]**

(A) H_2O_2, O_2F_2, OF_2 are polar compounds

(B) d_{O-O} of $H_2O_2 > d_{O-O}$ of O_2F_2

(C) d_{O-F} of $OF_2 > d_{O-F}$ of O_2F_2

(D) the strength of O – O bond in O_2F_2 is greater than that of H_2O_2

Paragraph for Q.9 to 10

According VSEPR theory, in the electronic geometry of the molecule(s), electron pair tend to minimise repulsion and follow the repulsion order in presence of lone pair of electrons with bond pair of electrons.

$\ell p - \ell p > \ell p - bp > bp - bp$

and similarly double bond pair of electrons follow the repulsion order with single bond pair of electrons.

double bond – double bond > double bond – single bond > single bond – single bond

9. Which of the following molecular geometry is distored geometry from their ideal geometry.

(A) PCl_3F_2 (B) SOF_4 (C) $XeF_5^{\ominus}$ (D) XeO_3F_2

10. Which of the following statement is **CORRECT** about XeO_2F_2?

(A) XeO_2F_2 is sp^3d hybridized and has lone pair of electron at axial position of its electronic geometry.

(B) XeO_2F_2 has maximum 10- lone pair of electrons.

(C) XeO_2F_2 has distorted see-saw shape.

(D) XeO_2F_2 contains $d\pi$–$d\pi$ bond.