

Questions

MathonGo

Q1 - 2024 (04 Apr Shift 1)

Which one of the following molecules has maximum dipole moment?

- (1) NF_3
- (2) CH_4
- (3) PF_5
- (4) NH_3

Q2 - 2024 (04 Apr Shift 1)

Number of molecules/ions from the following in which the central atom is involved in sp^3 hybridization is

NO_3^- , BCl_3 , ClO_2^- , ClO_3

- (1) 4
- (2) 3
- (3) 2
- (4) 1

Q3 - 2024 (04 Apr Shift 1)

Number of molecules/species from the following having one unpaired electron is

O_2 , O_2^{-1} , NO , CN^{-1} , O_2^{2-}

Q4 - 2024 (04 Apr Shift 2)

The correct statement/s about Hydrogen bonding is/are

- A. Hydrogen bonding exists when H is covalently bonded to the highly electro negative atom.
- B. Intermolecular H bonding is present in o-nitro phenol
- C. Intramolecular H bonding is present in HF.
- D. The magnitude of H bonding depends on the physical state of the compound.

Questions

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E. H-bonding has powerful effect on the structure and properties of compounds

Choose the correct answer from the options given below:

(1) A, B, D only

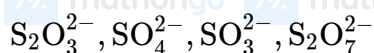
(2) A, D, E only

(3) A only

(4) A, B, C only

Q5 - 2024 (04 Apr Shift 2)

The number of species from the following that have pyramidal geometry around the central atom is _____.



(1) 4

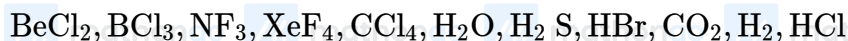
(2) 3

(3) 2

(4) 1

Q6 - 2024 (04 Apr Shift 2)

Number of compounds / species from the following with non-zero dipole moment is _____

**Q7 - 2024 (05 Apr Shift 1)**

In the lewis dot structure for NO_2^- , total number of valence electrons around nitrogen is _____

Q8 - 2024 (05 Apr Shift 2)

Match List I with List II

List - I List - II

(A) ICl (I) T - shape

(B) ICl_3 (II) pyramidal

(C) ClF_5 (III) Pentagonal bipyramidal

(D) IF_7 (IV) Linear

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Choose the correct answer from the options given below :

(1) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

(2) (A)-(I), (B)-(IV), (C)-(III), (D)-(II)

(3) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)

(4) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)

Q9 - 2024 (05 Apr Shift 2)

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

Assertion (A) : NH_3 and NF_3 molecule have pyramidal shape with a lone pair of electrons on nitrogen atom.

The resultant dipole moment of NH_3 is greater than that of NF_3 .

Reason (R) : In NH_3 , the orbital dipole due to lone pair is in the same direction as the resultant dipole moment of the N – H bonds. F is the most electronegative element.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both (A) and (R) are true and (R) is the correct explanation of (A)

(2) (A) is false but (R) is true

(3) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

(4) (A) is true but (R) is false

Q10 - 2024 (05 Apr Shift 2)

Number of compounds from the following with zero dipole moment is _____

HF , H_2 , H_2S , CO_2 , NH_3 , BF_3 , CH_4 , CHCl_3 , SiF_4 , H_2O , BeF_2

Q11 - 2024 (06 Apr Shift 1)

Questions

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Match List I with List II

	List - I (Hybridization)		List - II (Orientation in Space)
A.	sp^3	I.	Trigonal bipyramidal
B.	dsp^2	II.	Octahedral
C.	$sp^3 d$	III.	Tetrahedral
D.	$sp^3 d^2$	IV.	Square planar

Choose the correct answer from the options given below:

(1) A-IV, B-III, C-I, D-II

(2) A-III, B-IV, C-I, D-II

(3) A-III, B-I, C-IV, D-II

(4) A-II, B-I, C-IV, D-III

Q12 - 2024 (06 Apr Shift 1)

Match List I with List II

	List - I (Compound/Species)		List - II (Shape/Geometry)
A.	SF_4	I.	Tetrahedral
B.	BrF_3	II.	Pyramidal
C.	BrO_3^-	III.	See saw
D.	$NH_4^+ + KS$	IV.	Bent T-Shape

Choose the correct answer from the options given below:

(1) A-II, B-III, C-I, D-IV

(2) A-II, B-IV, C-III, D-I

(3) A-III, B-IV, C-II, D-I

(4) A-III, B-II, C-IV, D-I

Q13 - 2024 (06 Apr Shift 1)

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Match List I with List II

	List - I (Molecule/Species)		List - II (Property/Shape)
A.	SO ₂ Cl ₂	I.	Paramagnetic
B.	NO	II.	Diamagnetic
C.	NO ₂ ⁻	III.	Tetrahedral
D.	I ₃ ⁻	IV.	Linear

Choose the correct answer from the options given below:

(1) A-II, B-III, C-I, D-IV

(2) A-III, B-I, C-II, D-IV

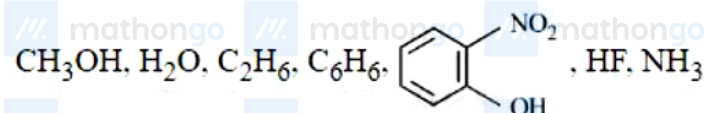
(3) A-IV, B-I, C-III, D-II

(4) A-III, B-IV, C-II, D-I

Q14 - 2024 (06 Apr Shift 1)

Number of molecules from the following which can exhibit hydrogen bonding is

_____ (nearest integer)



Q15 - 2024 (08 Apr Shift 1)

Match List I with List II

	List-I (Molecule)		List-II (Shape)
A.	NH ₃	I.	Square pyramid
B.	BrF ₅	II.	Tetrahedral
C.	PCl ₅	III.	Trigonal pyramidal
D.	CH ₄	IV.	Trigonal bipyramidal

Choose the correct answer from the options given below:

(1) A-II, B-IV, C-I, D-III

(2) A-III, B-I, C-IV, D-II

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(3) A-IV, B-III, C-I, D-II

(4) A-III, B-IV, C-I, D-II

Q16 - 2024 (08 Apr Shift 1)

Match List I with List II

	List-I		List-II
	(Molecule)		(Shape)
A.	$\text{Fe}_4[\text{Fe}(\text{CN})_6]_3 \cdot x\text{H}_2\text{O}$	I.	Violet
B.	$[\text{Fe}(\text{CN})_5\text{NOS}]^{4-}$	II.	Blood Red A
C.	$[\text{Fe}(\text{SCN})]^{2+}$	III.	Prussian Blue
D.	$(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3$	IV.	Yellow

Choose the correct answer from the options given below:

(1) A-III, B-I, C-II, D-IV

(2) A-I, B-II, C-III, D-IV

(3) A-IV, B-I, C-II, D-III

(4) A-II, B-III, C-IV, D-I

Q17 - 2024 (08 Apr Shift 1)

Given below are two statements:

Statement I: $\text{N}(\text{CH}_3)_3$ and $\text{P}(\text{CH}_3)_3$ can act as ligands to form transition metal complexes.Statement II: As N and P are from same group, the nature of bonding of $\text{N}(\text{CH}_3)_3$ and $\text{P}(\text{CH}_3)_3$ is always same with transition metals.

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

(1) Statement I is correct but Statement II is incorrect.

(2) Statement I is incorrect but Statement II is correct.

(3) Both Statement I and Statement II are correct.

(4) Both Statement I and Statement II are incorrect.

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Q18 - 2024 (08 Apr Shift 1)

Number of molecules from the following which are exceptions to octet rule is _____

CO₂, NO₂, H₂SO₄, BF₃, CH₄, SiF₄, ClO₂, PCl₅, BeF₂, C₂H₆, CHCl₃, CBr₄

Q19 - 2024 (08 Apr Shift 2)

The shape of carbocation is :

- (1) diagonal pyramidal
- (2) trigonal planar
- (3) tetrahedral
- (4) diagonal

Q20 - 2024 (08 Apr Shift 2)

When ψ_A and ψ_B are the wave functions of atomic orbitals, then σ^* is represented by :

- (1) $\psi_A + 2\psi_B$
- (2) $\psi_A - \psi_B$
- (3) $\psi_A + \psi_B$
- (4) $\psi_A - 2\psi_B$

Q21 - 2024 (08 Apr Shift 2)

Number of molecules having bond order 2 from the following molecules is _____

C₂, O₂, Be₂, Li₂, Ne₂, N₂, He₂

Q22 - 2024 (09 Apr Shift 1)

In which one of the following pairs the central atoms exhibit sp² hybridization ?

- (1) H₂O and NO₂
- (2) BF₃ and NO₂⁻
- (3) NH₂⁻ and H₂O

Questions

MathonGo

(4) NH_2^- and BF_3

Q23 - 2024 (09 Apr Shift 1)

The total number of species from the following in which one unpaired electron is present, is _____

$\text{N}_2, \text{O}_2, \text{C}_2^-, \text{O}_2^-, \text{O}_2^{2-}, \text{H}_2^+, \text{CN}^-, \text{He}_2^+$

Q24 - 2024 (09 Apr Shift 2)

The correct increasing order for bond angles among BF_3, PF_3 and ClF_3 is :

(1) $\text{BF}_3 < \text{PF}_3 < \text{ClF}_3$

(2) $\text{ClF}_3 < \text{PF}_3 < \text{BF}_3$

(3) $\text{PF}_3 < \text{BF}_3 < \text{ClF}_3$

(4) $\text{BF}_3 = \text{PF}_3 < \text{ClF}_3$

Q25 - 2024 (09 Apr Shift 2)

The incorrect statement regarding ethyne is

(1) The C – C bonds in ethyne is shorter than that in ethene

(2) Both carbons are sp hybridised

(3) Ethyne is linear

(4) The carbon - carbon bonds in ethyne is weaker than that in ethene

Q26 - 2024 (09 Apr Shift 2)

Total number of electrons present in (π^*) molecular orbitals of O_2, O_2^+ and O_2^- is _____.

Questions

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Answer Key

/// mathongo /// mathongo /// mathongo /// mathongo /// mathongo /// mathongo

Q1 (4) mathongo /// matho **Q2** (3) /// mathongo **Q3** (2) mathongo /// matho **Q4** (2) mathongo

Q5 (4) mathongo /// matho **Q6** (5) /// mathongo **Q7** (8) mathongo /// matho **Q8** (1) mathongo

Q9 (1) mathongo /// matho **Q10** (6) /// mathongo **Q11** (2) mathongo /// matho **Q12** (3) mathongo

Q13 (2) thongo /// matho **Q14** (5) /// mathongo **Q15** (2) thongo /// matho **Q16** (1) mathongo

Q17 (1) thongo /// matho **Q18** (6) /// mathongo **Q19** (2) thongo /// matho **Q20** (2) mathongo

Q21 (2) thongo /// matho **Q22** (2) /// mathongo **Q23** (4) thongo /// matho **Q24** (2) mathongo

Q25 (4) thongo /// matho **Q26** (6) /// mathongo /// mathongo /// mathongo /// mathongo

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Solutions

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Q1

 CH_4 & PF_5 , $\mu_{\text{net}} = 0$ (non polar) μ_{NH_3}

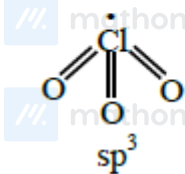
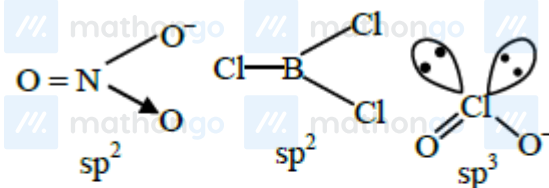
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 μ_{NF_3}

Vector addition of bond moment & lone pair moment

Vector subtraction of bond moment & lone pair moment

Q2



Q3

According to M.O.T.

 $\text{O}_2 \rightarrow$ no. of unpaired electrons = 2 $\text{O}_2^- \rightarrow$ no. of unpaired electron = 1 $\text{NO} \rightarrow$ no. of unpaired electron = 1 $\text{CN}^- \rightarrow$ no. of unpaired electron = 0 $\text{O}_2^{2-} \rightarrow$ no. of unpaired electron = 0

Q4

(A) Generally hydrogen bonding exists when H is covalently bonded to the highly electronegative atom like F, O, N.

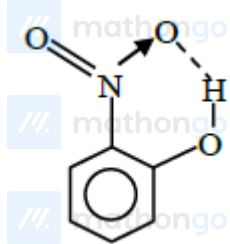
(B) Intramolecular H bonding is present in

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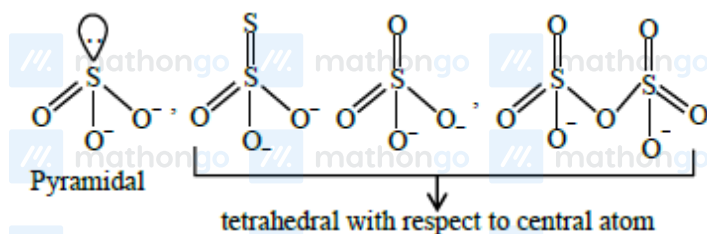


(C) Intermolecular Hydrogen bonding is present in HF

(D) The magnitude has Hydrogen bonding in solid state is greater than liquid state.

(E) Hydrogen bonding has powerfull effect on the structure \& properties of compound like melting point, boiling point, density etc.

Q5



Q6

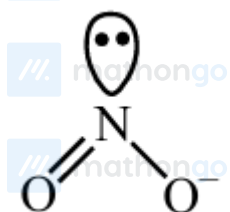
Polar molecule: NF_3 , H_2O , H_2S , HBr , HCl

($\mu \neq 0$)

Non Polar molecule: BeCl_2 , BCl_3 , XeF_4 , CCl_4 , CO_2 , H_2 ($\mu = 0$)

So answer is 5 .

Q7



Number of valence e^- around N-atom = 8

Q8

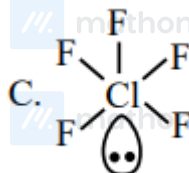
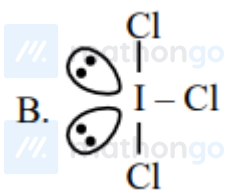
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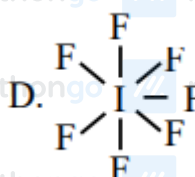
Solutions

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A. I - Cl (iv) linear



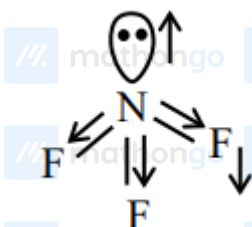
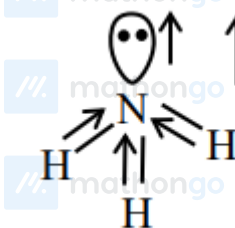
(I) T-shape



(II) Square pyramidal

(III) Pentagonal bipyramidal

Q9

Resultant dipole moment = 0.80×10^{-30} CmResultant dipole moment = 4.90×10^{-30} cm

Q10

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Solutions

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 $\text{H}_2, \text{CO}_2, \text{BF}_3, \text{CH}_4, \text{SiF}_4, \text{BeF}_2$

are symm. molecule so dipole moment is zero

Q11

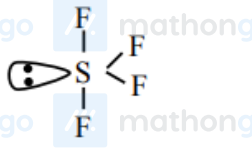
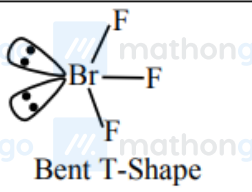
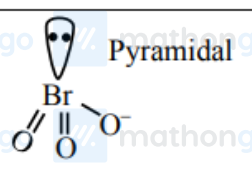
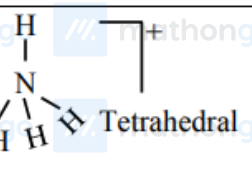
 $sp^3 \rightarrow$ Tetrahedral

 $dsp^2 \rightarrow$ Square planar

 $sp^3 d \rightarrow$ Trigonal Bipyramidal

 $sp^3 d^2 \rightarrow$ Octahedral

Q12

(A)	SF_4	sp^3d hybridisation	
(B)	BrF_3	sp^3d hybridisation	 Bent T-Shape
(C)	BrO_3^-	sp^3 hybridisation	 Pyramidal
(D)	NH_4^+	sp^3 hybridisation	 Tetrahedral

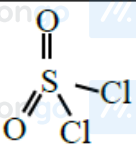
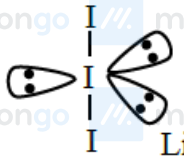
Q13

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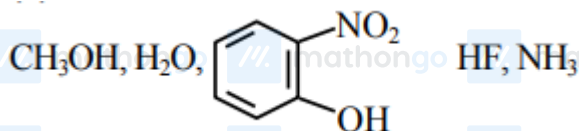
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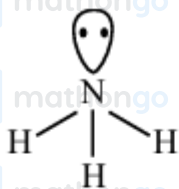
(A)	SO_2Cl_2	sp^3	 Tetrahedral
(B)	NO		Paramagnetic
(C)	NO_2^-		Diamagnetic
(D)	I_3^-	sp^3d	 Linear

Q14

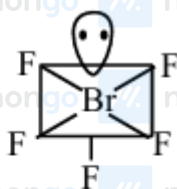


Can show H-bonding.

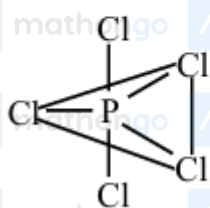
Q15



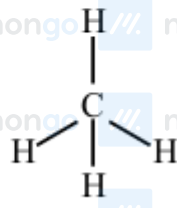
Trigonal pyramidal



Square pyramidal

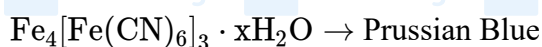


Trigonal bipyramidal



Tetrahedral

Q16

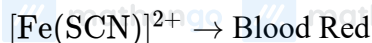


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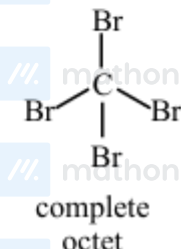
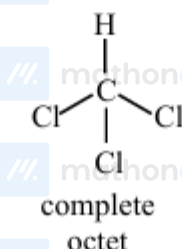
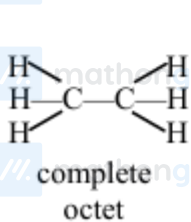
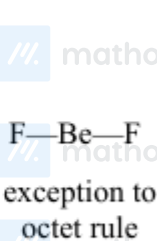
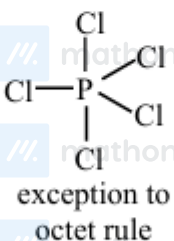
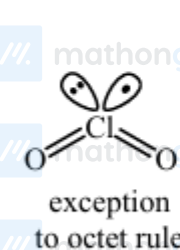
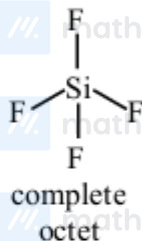
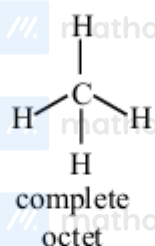
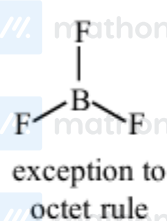
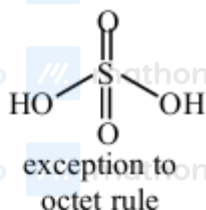
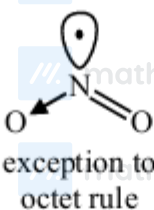
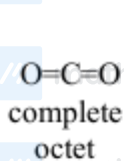
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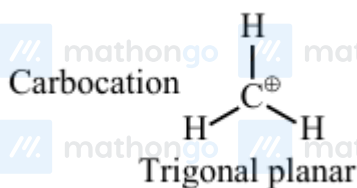
Q17

$\text{N}(\text{CH}_3)_3$ and $\text{P}(\text{CH}_3)_3$ both are Lewis base and acts as ligand, However, $\text{P}(\text{CH}_3)_3$ has a π -acceptor character.

Q18



Q19



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Solutions

MathonGo

Q20

Antibonding molecular orbitals are formed by destructive interference of wave functions.

$$(\text{ABMO})\sigma^* = \psi_A - \psi_B$$

Q21

 C_2

$$(12e^-) : \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2 [\pi 2p_x^2 = \pi 2p_y^2]$$

$$\text{B.O.} = \frac{8 - 4}{2} = 2$$

 O_2

$$(16e^-) : \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2$$

$$[\pi 2p_x^2 = \pi 2p_y^2] [\pi^* 2p_x^1 = \pi^* 2p_y^1]$$

$$\text{B.O.} = \frac{10 - 6}{2} = 2$$

 Be_2

$$(8e^-) : \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2$$

$$\text{B.O.} = \frac{4 - 4}{2} = 0$$

 Li_2

$$(6e^-) : \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2$$

$$\text{B.O.} = \frac{4 - 2}{2} = 1$$

 Ne_2

$$(20e^-) : \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2$$

$$[\pi 2p_x^2 = \pi 2p_y^2] [\pi^* 2p_x^2 = \pi^* 2p_y^2] \sigma^* 2p_z^2$$

$$\text{B.O.} = \frac{10 - 10}{2} = 0$$

 N_2

$$(14e^-) : \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2 [\pi 2p_x^2 = \pi 2p_y^2] \sigma 2p_z^2$$

$$\text{B.O.} = \frac{10 - 4}{2} = 6$$

 He_2

$$(4e^-) : \sigma 1s^2, \sigma^* 1s^2$$

$$\text{B.O.} = \frac{2 - 2}{2} = 0$$

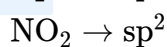
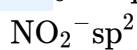
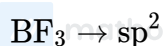
Q22

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Solutions

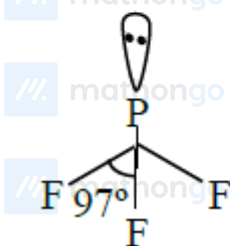
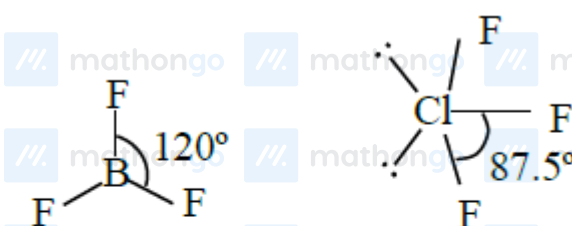
MathonGo



Q23

One unpaired e^- is present in : C_2^- ; O_2^- ; H_2^+ ; He_2^+

Q24

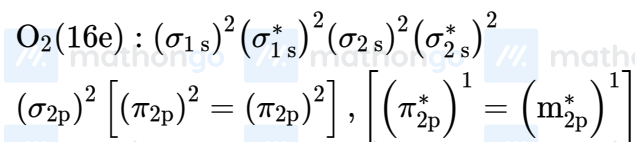
Order of bond angle is $\text{ClF}_3 < \text{PF}_3 < \text{BF}_3$

Q25

The carbon-carbon bonds in ethyne is stronger than that in ethene.

 $(\text{H} - \text{C} \equiv \text{C} - \text{H})$ Ethyne is linear and carbon atoms are SP hybridised.

Q26

Number of e^- present in (π^*) of $\text{O}_2 = 2$ Number of e^- present in (π^*) of $\text{O}_2^+ = 1$

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Solutions

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Number of e^- present in (π^*) of $O_2^- = 3$

So total e^- in $(\pi^*) = 2 + 1 + 3 = 6$

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