

JEE MAIN CHEMICAL BONDING AND MOLECULAR STRUCTURE — PYQS

Max. Marks: 340

Questions: 85

Section A (MCQ) — 59 questions

- Q.1** Bromine trifluoride autoionizes to form BrF_2^+ and BrF_4^- . The shapes of the cation and anion are respectively _____ and _____.

[JEE Main 2026 (Online) 8th April Evening Shift]

- (1) bent, square planar (2) linear, square planar
(3) bent, see-saw (4) linear, tetrahedral

 Scan or tap for the
full solution


- Q.2** The pairs among $\text{A} = [\text{SO}_3^{2-}, \text{CO}_3^{2-}]$, $\text{B} = [\text{O}_2^{2-}, \text{F}_2]$, $\text{C} = [\text{CN}^-, \text{CO}]$, $\text{D} = [\text{NH}_3, \text{H}_3\text{O}^+]$ and $\text{E} = [\text{MnO}_4^{2-}, \text{CrO}_4^{2-}]$ that do not have similar Lewis dot structure are

[JEE Main 2026 (Online) 6th April Morning Shift]

- (1) A, B and E (2) A and E
(3) B, C and D (4) C and D

 Scan or tap for the
full solution


- Q.3** Given below are two statements :

Statement-I: The number of compounds among SO_2 , SO_3 , SF_4 , SF_6 and H_2S in which sulphur does not obey the Octet rule is 3.

Statement-II: Among $[\text{H}_2\text{O}, \text{ClF}_3, \text{SF}_4]$, $[\text{NH}_3, \text{BrF}_5, \text{SF}_4]$, $[\text{BrF}_5, \text{ClF}_3, \text{XeF}_4]$ and $[\text{XeF}_4, \text{ClF}_3, \text{H}_2\text{O}]$, the number of sets in which all the molecules have one lone pair of electrons on the central atom is 1.

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

[JEE Main 2026 (Online) 6th April Evening Shift]

- (1) Both Statement-I and Statement-II are true
(2) Both Statement-I and Statement-II are false
(3) Statement-I is true but Statement-II is false
(4) Statement-I is false but Statement-II is true

 Scan or tap for the
full solution


- Q.4** Given below are two statements :

Statement-I: $\text{F}_2\text{O} < \text{H}_2\text{O} < \text{Cl}_2\text{O}$ is the correct trend in terms of bond angle.

Statement-II: SiF_4 , SnF_4 and PbF_4 are ionic in nature.

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

[JEE Main 2026 (Online) 6th April Evening Shift]

- (1) Both Statement-I and Statement-II are true
(2) Both Statement-I and Statement-II are false
(3) Statement-I is true but Statement-II is false
(4) Statement-I is false but Statement-II is true

 Scan or tap for the
full solution


- Q.5** The covalent radii of atoms A and B are r_A and r_B , respectively. The covalent bond length and total length of AB molecule are respectively

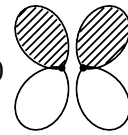
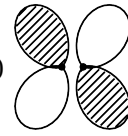
[JEE Main 2026 (Online) 5th April Evening Shift]

- (1) $(r_A + r_B)$, $2(r_A + r_B)$ (2) $\frac{1}{2}(r_A + r_B)$, $(r_A + r_B)$
(3) $(r_A + r_B)$, $(r_A + r_B)$ (4) $2(r_A + r_B)$, $\frac{1}{2}(r_A + r_B)$

 Scan or tap for the
full solution


- Q.6** Which of the following pictorial diagrams most correctly represents the π^* (π antibonding) molecular orbital between two atoms if the internuclear axis is taken to be in the z-direction
($\xrightarrow{\text{z-axis}}$) ?

[JEE Main 2026 (Online) 4th April Evening Shift]

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

 Scan or tap for the
full solution


- Q.7** Given below are two statements :

Statement-I: The correct sequence of bond lengths in the following species is : $\text{O}_2^+ < \text{O}_2 < \text{O}_2^- < \text{O}_2^{2-}$

Statement-II: The correct sequence of number of unpaired electrons in the following species is : $O_2 > O_2^+ > O_2^- > O_2^{2-}$

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

[JEE Main 2026 (Online) 2nd April Morning Shift]

- (1) Both Statement-I and Statement-II are true
 (2) Both Statement-I and Statement-II are false
 (3) Statement-I is true but Statement-II is false
 (4) Statement-I is false but Statement-II is true

Scan or tap for the full solution



Q.8 SF_4 is isostructural with :

- A. $BrF_4^\ominus$ B. CH_4
 C. $IF_4^\oplus$ D. XeF_4
 E. XeO_2F_2

Choose the **correct** answer from the options given below : [JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) C Only (2) C and E Only
 (3) A and D Only (4) B and E Only

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Q.9 Given below are two statements :

Statement-I: The number of species among BF_4^- , SiF_4 , XeF_4 and SF_4 , that have unequal E-F bond lengths is two. Here, E is the central atom.

Statement-II: Among O_2^- , O_2^{2-} , F_2 and O_2^+ , O_2^- has the highest bond order.

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

[JEE Main 2026 (Online) 28th January Morning Shift]

- (1) Both Statement-I and Statement-II are false
 (2) Statement-I is true but Statement-II is false
 (3) Statement-I is false but Statement-II is true
 (4) Both Statement-I and Statement-II are true

Scan or tap for the full solution



Q.10 Match **List-I** with **List-II** according to shape.

List-I		List-II	
A.	XeO_3	I.	BrF_5
B.	XeF_2	II.	NH_3
C.	XeO_2F_2	III.	$[I_3]^-$
D.	$XeOF_4$	IV.	SF_4

Choose the **correct** answer from the options given below :

[JEE Main 2026 (Online) 28th January Evening Shift]

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



Solution

Q.11 Given below are statements about some molecules/ions.

- A. The dipole moment value of NF_3 is higher than that of NH_3 .
 B. The dipole moment value of BeH_2 is zero.
 C. The bond order of O_2^{2-} and F_2 is same.
 D. The formal charge on the central oxygen atom of ozone is -1.
 E. In NO_2 , all the three atoms satisfy the octet rule, hence it is very stable.

Identify the **CORRECT** statements.

Choose the correct answer from the options given below:

[JEE Main 2026 (Online) 24th January Morning Shift]

- (1) B & C Only (2) B, C & D Only
 (3) A, C & D Only (4) A, B, C, D & E

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Q.12 Among the following, the **CORRECT** combinations are

- A. $IF_3 \rightarrow$ T-shaped (sp^3d)
 B. $IF_5 \rightarrow$ Square pyramidal (sp^3d^2)
 C. $IF_7 \rightarrow$ Pentagonal bipyramidal (sp^3d^3)
 D. $ClO_4^- \rightarrow$ Square planar (sp^2d)

Choose the correct answer from the options given below:

[JEE Main 2026 (Online) 24th January Morning Shift]

- (1) B, C and D Only (2) A, B, C and D
 (3) A, B and C Only (4) A and B Only

Scan or tap for the full solution



Q.13 Pair of species among the following having same bond order as well as paramagnetic character will be- [JEE Main 2026 (Online) 24th January Evening Shift]

- (1) O_2^- , N_2^+ (2) O_2^+ , N_2^{2-}
 (3) O_2^- , N_2^- (4) O_2^+ , N_2^-

Scan or tap for the full solution



Q.14 Identify the molecule (X) with maximum number of lone pairs of electrons (obtained using Lewis dot structure) among HNO_3 , H_2SO_4 , NF_3 and O_3 . Choose the correct bond angle made by the central atom of the molecule (X).

[JEE Main 2026 (Online) 23rd January Morning Shift]

- (1) 107° (2) 102° (3) 120° (4) 116°

Scan or tap for the full solution



Q.15 Which statements are **NOT TRUE** about XeO_2F_2 ?

- A. It has a see-saw shape.
 B. Xe has 5 electron pairs in its valence shell in XeO_2F_2 .
 C. The O–Xe–O bond angle is close to 180° .
 D. The F–Xe–F bond angle is close to 180° .
 E. Xe has 16 valence electrons in XeO_2F_2 .
 Choose the **correct** answer from the options given below :

[JEE Main 2026 (Online) 23rd January Evening Shift]

- (1) B, D and E Only (2) B and D Only
 (3) B, C and E Only (4) A and D Only

Scan or tap for the full solution



- Q.16** Two p-block elements X and Y form fluorides of the type EF_3 . The fluoride compound XF_3 is a Lewis acid and YF_3 is a Lewis base. The hybridizations of the central atoms of XF_3 and YF_3 respectively are

[JEE Main 2026 (Online) 22nd January Morning Shift]

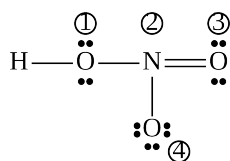
- (1) sp^2 and sp^3 (2) Both sp^3
 (3) Both sp^2 (4) sp^3 and sp^2

Scan or tap for the full solution



- Q.17** The formal charges on the atoms marked as (1) to (4) in the Lewis representation of HNO_3 molecule respectively are

[JEE Main 2026 (Online) 22nd January Morning Shift]



- (1) 0, 0, -1, +1 (2) 0, -1, 0, +1
 (3) 0, +1, 0, -1 (4) +1, 0, 0, -1

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- Q.18** Among H_2S , H_2O , NF_3 , NH_3 and CHCl_3 , identify the molecule (X) with lowest dipole moment value. The number of lone pairs of electrons present on the central atom of the molecule (X) is :

[JEE Main 2026 (Online) 22nd January Evening Shift]

- (1) 3 (2) 2 (3) 0 (4) 1

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- Q.19** Given below are two statements :

Statement-I: The number of species among SF_4 , NH_4^+ , $[\text{NiCl}_4]^{2-}$, XeF_4 , $[\text{PtCl}_4]^{2-}$, SeF_4 and $[\text{Ni}(\text{CN})_4]^{2-}$, that have tetrahedral geometry is 3.

Statement-II: In the set $[\text{NO}_2]$, BeH_2 , BF_3 , AlCl_3 , all the molecules have incomplete octet around central atom.

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

[JEE Main 2026 (Online) 21st January Morning Shift]

- (1) Both Statement-I and Statement-II are true
 (2) Statement-I is true but Statement-II is false
 (3) Statement-I is false but Statement-II is true
 (4) Both Statement-I and Statement-II are false

Scan or tap for the full solution



- Q.20** The correct increasing order of C–H(A), C–O(B), C=O(C) and C≡N(D) bonds in terms of covalent bond length is :

[JEE Main 2026 (Online) 21st January Evening Shift]

- (1) $\text{D} < \text{C} < \text{B} < \text{A}$ (2) $\text{D} < \text{C} < \text{A} < \text{B}$
 (3) $\text{A} < \text{B} < \text{C} < \text{D}$ (4) $\text{A} < \text{D} < \text{C} < \text{B}$

Scan or tap for the full solution



- Q.21** Match the List I with List II.

List - I Molecule/Ion		List - II Bond pair : lone pair (on the central atom)	
A.	ICl_2^-	I.	4:2
B.	H_2O	II.	4:1
C.	SO_2	III.	2:3
D.	XeF_4	IV.	2:2

Choose the correct answer from the options given below: [JEE Main 2025 (Online) 7th April Morning Shift]

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



Solution

- Q.22** In SO_2 , NO_2^- and N_3^- , the hybridizations at the central atom are respectively :

[JEE Main 2025 (Online) 7th April Evening Shift]

- (1) sp^2 , sp^2 and sp^2 (2) sp , sp^2 and sp
 (3) sp^2 , sp and sp (4) sp^2 , sp^2 and sp

Scan or tap for the full solution



- Q.23** Which of the following molecule(s) show/s paramagnetic behavior?

- A. O_2 B. N_2
 C. F_2 D. S_2
 E. Cl_2

Choose the correct answer from the options given below: [JEE Main 2025 (Online) 4th April Morning Shift]

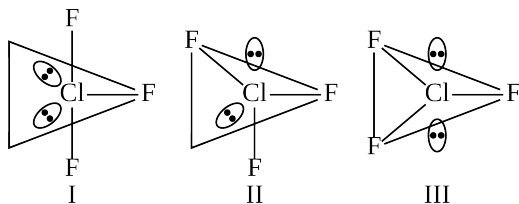
- (1) A & C only (2) A & E Only
 (3) A & D Only (4) B Only

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- Q.24** Given below are two statements:

Statement-I: For ClF_3 , all three possible structures may be drawn as follows.



Statement-II: Structure III is most stable, as the orbitals having the lone pairs are axial, where the lp – bp repulsion is minimum.

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

[JEE Main 2025 (Online) 4th April Evening Shift]

- (1) Both Statement-I and Statement-II are correct
- (2) Both Statement-I and Statement-II are incorrect
- (3) Statement-I is correct but Statement-II is incorrect
- (4) Statement-I is incorrect but Statement-II is correct

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Q.25 Match the LIST-I with LIST-II

LIST-I (Molecules/ion)		LIST-II (Hybridisation of central atom)	
A.	PF ₅	I.	dsp ²
B.	SF ₆	II.	sp ³ d
C.	Ni(CO) ₄	III.	sp ³ d ²
D.	[PtCl ₄] ²⁻	IV.	sp ³

Choose the correct answer from the options given below: [JEE Main 2025 (Online) 3rd April Morning Shift]

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



Solution

Q.26 Given below are two statements:

Statement-I: Wet cotton clothes made of cellulose based carbohydrate take comparatively longer time to get dried than wet nylon polymer based clothes.

Statement-II: Intermolecular hydrogen bonding with water molecule is more in nylon-based clothes than in the case of cotton clothes.

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

[JEE Main 2025 (Online) 3rd April Evening Shift]

- (1) Both Statement-I and Statement-II are false
- (2) Both Statement-I and Statement-II are true
- (3) Statement-I is false but Statement-II is true
- (4) Statement-I is true but Statement-II is false

Scan or tap for the full solution



Q.27 A molecule with the formula AX₄Y has all its elements from p-block. Element A is rarest, monoatomic, non-radioactive from its group and has the lowest ionization enthalpy value among A, X and Y. Elements X and Y have first and second highest electronegativity values respectively among all the known elements. The shape of the molecule is: [JEE Main 2025 (Online) 2nd April Morning Shift]

- (1) Pentagonal planar
- (2) Square pyramidal
- (3) Trigonal bipyramidal
- (4) Octahedral



Solution

Q.28 Among SO₂, NF₃, NH₃, XeF₂, ClF₃ and SF₄, the hybridization of the molecule with nonzero dipole moment and highest number of lone-pairs of electrons on the central atom is

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1) sp³
- (2) dsp²
- (3) sp³d²
- (4) sp³d

Scan or tap for the full solution



Q.29 Which among the following molecules is (a) involved in sp³d hybridization, (b) has different bond lengths and (c) has lone pair of electrons on the central atom?

[JEE Main 2025 (Online) 2nd April Evening Shift]

- (1) XeF₄
- (2) XeF₂
- (3) PF₅
- (4) SF₄

Scan or tap for the full solution



Q.30 An element 'E' has the ionisation enthalpy value of 374 kJ mol⁻¹. 'E' reacts with elements A, B, C and D with electron gain enthalpy values of -328, -349, -325 and -295 kJ mol⁻¹, respectively. The correct order of the products EA, EB, EC and ED in terms of ionic character is :

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) EB > EA > EC > ED
- (2) EA > EB > EC > ED
- (3) ED > EC > EA > EB
- (4) ED > EC > EB > EA



Solution

Q.31 The molecules having square pyramidal geometry are [JEE Main 2025 (Online) 28th January Morning Shift]

- (1) BrF₅ & PCl₅
- (2) SbF₅ & PCl₅
- (3) BrF₅ & XeOF₄
- (4) SbF₅ & XeOF₄

Scan or tap for the full solution



Q.32 Which of the following linear combination of atomic orbitals will lead to formation of molecular orbitals in homonuclear diatomic molecules [internuclear axis in z-direction] ?

- A. 2p_z and 2p_x
- B. 2s and 2p_x
- C. 3d_{xy} and 3d_{x²-y²}
- D. 2s and 2p_z

E. $2p_z$ and $3d_{x^2-y^2}$

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 24th January Morning Shift]

- (1) D Only (2) E Only
(3) C and D Only (4) A and B Only

Scan or tap for the full solution 

Q.33 Which of the following statement is true with respect to H_2O , NH_3 and CH_4 ?

- A. The central atoms of all the molecules are sp^3 hybridized.
B. The $H-O-H$, $H-N-H$ and $H-C-H$ angles in the above molecules are 104.5° , 107.5° and 109.5° , respectively.
C. The increasing order of dipole moment is $CH_4 < NH_3 < H_2O$.
D. Both H_2O and NH_3 are Lewis acids and CH_4 is a Lewis base.
E. A solution of NH_3 in H_2O is basic. In this solution NH_3 and H_2O act as Lowry-Bronsted acid and base respectively.

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 24th January Morning Shift]

- (1) A, D and E Only (2) C, D and E Only
(3) A, B and C Only (4) A, B, C and E Only

Scan or tap for the full solution 

Q.34 Given below are two statements :

Statement-I: Experimentally determined oxygen-oxygen bond lengths in the O_3 are found to be same and the bond length is greater than that of a $O=O$ (double bond) but less than that of a single ($O-O$) bond.

Statement-II: The strong lone pair-lone pair repulsion between oxygen atoms is solely responsible for the fact that the bond length in ozone is smaller than that of a double bond ($O=O$) but more than that of a single bond ($O-O$).

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

[JEE Main 2025 (Online) 24th January Evening Shift]

- (1) Statement-I is false but Statement-II is true
(2) Both Statement-I and Statement-II are true
(3) Statement-I is true but Statement-II is false
(4) Both Statement-I and Statement-II are false

Scan or tap for the full solution 

Q.35 Match the List - I with List - II

Classification of molecules based on octet rule		Example	
A.	Molecules obeying octet rule	I.	NO , NO_2
B.	Molecules with incomplete octet	II.	BCl_3 , $AlCl_3$
C.	Molecules with incomplete octet with odd electron	III.	H_2SO_4 , PCl_5
D.	Molecules with expanded octet	IV.	CCl_4 , CO_2

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 23rd January Morning Shift]

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



Solution

Q.36 Arrange the following compounds in increasing order of their dipole moment :

HBr , H_2S , NF_3 and $CHCl_3$

[JEE Main 2025 (Online) 22nd January Evening Shift]

- (1) $HBr < H_2S < NF_3 < CHCl_3$
(2) $H_2S < HBr < NF_3 < CHCl_3$
(3) $NF_3 < HBr < H_2S < CHCl_3$
(4) $CHCl_3 < NF_3 < HBr < H_2S$



Solution

Q.37 In which one of the following pairs the central atoms exhibit sp^2 hybridization ?

[JEE Main 2024 (Online) 9th April Morning Shift]

- (1) BF_3 and NO_2^- (2) NH_2^- and BF_3
(3) NH_2^- and H_2O (4) H_2O and NO_2

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Q.38 The correct increasing order for bond angles among BF_3 , PF_3 and ClF_3 is :

[JEE Main 2024 (Online) 9th April Evening Shift]

- (1) $BF_3 < PF_3 < ClF_3$ (2) $BF_3 < PF_3 < ClF_3$
(3) $ClF_3 < PF_3 < BF_3$ (4) $PF_3 < BF_3 < ClF_3$

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Q.39 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: [JEE Main 2024 (Online) 8th April Morning Shift]

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



Solution

Q.40 When ψ_A and ψ_B are the wave functions of atomic orbitals, then σ^* is represented by :

[JEE Main 2024 (Online) 8th April Evening Shift]

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

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Q.41 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 ⁺	IV.	Bent T-Shape

Choose the correct answer from the options given below: [JEE Main 2024 (Online) 6th April Morning Shift]

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



Solution

Q.42 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: [JEE Main 2024 (Online) 6th April Morning Shift]

- (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



Solution

Q.43 Match List I with List II

LIST I (Hybridization)		LIST II (Orientation in Shape)	
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: [JEE Main 2024 (Online) 6th April Morning Shift]

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



Solution

Q.44 Given below are two statements :

Statement-I: PF₅ and BrF₅ both exhibit sp³d hybridisation.

Statement-II: Both SF₆ and [Co(NH₃)₆]³⁺ exhibit sp³d² hybridisation.

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

[JEE Main 2024 (Online) 6th April Evening Shift]

- (1) Both Statement-I and Statement-II are false
 (2) Statement-I is true but Statement-II is false
 (3) Statement-I is false but Statement-II is true
 (4) Both Statement-I and Statement-II are true

Scan or tap for the full solution



Q.45 Match List I with List II.

LIST I		LIST II	
A.	ICl	I.	T - shape
B.	ICl ₃	II.	Square pyramidal
C.	ClF ₅	III.	Pentagonal bipyramidal
D.	IF ₇	IV.	Linear

Choose the correct answer from the options given below : [JEE Main 2024 (Online) 5th April Evening Shift]

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

Scan or tap for the full solution



Q.46 Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A): NH₃ and NF₃ molecule have pyramidal shape with a lone pair of electrons on nitrogen atom. The resultant dipole moment of NH₃ is greater than that of NF₃.

Reason (R): In NH₃, 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 :

[JEE Main 2024 (Online) 5th April Evening Shift]

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

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

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Q.47 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^-

[JEE Main 2024 (Online) 4th April Morning Shift]

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

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Q.48 Which one of the following molecules has maximum dipole moment?

[JEE Main 2024 (Online) 4th April Morning Shift]

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

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Q.49 The correct statement/s about Hydrogen bonding is/are

- Hydrogen bonding exists when H is covalently bonded to the highly electronegative atom.
- Intermolecular H bonding is present in o-nitro phenol
- Intramolecular H bonding is present in HF.
- The magnitude of H bonding depends on the physical state of the compound.
- H-bonding has powerful effect on the structure and properties of compounds

Choose the correct answer from the options given below:

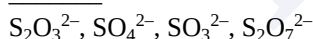
[JEE Main 2024 (Online) 4th April Evening Shift]

- (1) A, B, C only (2) A only
 (3) A, D, E only (4) A, B, D only

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Q.50 The number of species from the following that have pyramidal geometry around the central atom is _____



[JEE Main 2024 (Online) 4th April Evening Shift]

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

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Q.51 Arrange the bonds in order of increasing ionic character in the molecules. LiF , K_2O , N_2 , SO_2 and ClF_3 : [JEE Main 2024 (Online) 1st February Morning Shift]

- $\text{N}_2 < \text{SO}_2 < \text{ClF}_3 < \text{K}_2\text{O} < \text{LiF}$
- $\text{ClF}_3 < \text{N}_2 < \text{SO}_2 < \text{K}_2\text{O} < \text{LiF}$
- $\text{LiF} < \text{K}_2\text{O} < \text{ClF}_3 < \text{SO}_2 < \text{N}_2$
- $\text{N}_2 < \text{ClF}_3 < \text{SO}_2 < \text{K}_2\text{O} < \text{LiF}$



Solution

Q.52 Given below are two statements :

Statement-I: A π bonding MO has lower electron density above and below the inter-nuclear axis.

Statement-II: The π^* antibonding MO has a node between the nuclei.

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

[JEE Main 2024 (Online) 1st February Evening Shift]

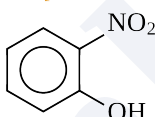
- Both Statement-I and Statement-II are true
- Both Statement-I and Statement-II are false
- Statement-I is true but Statement-II is false
- Statement-I is false but Statement-II is true

Scan or tap for the full solution



Q.53 Select the compound from the following that will show intramolecular hydrogen bonding.

[JEE Main 2024 (Online) 1st February Evening Shift]

- (1)  (2) H_2O
 (3) $\text{C}_2\text{H}_5\text{OH}$ (4) NH_3



Solution

Q.54 The linear combination of atomic orbitals to form molecular orbitals takes place only when the combining atomic orbitals

- have the same energy
- have the minimum overlap
- have same symmetry about the molecular axis
- have different symmetry about the molecular axis

Choose the most appropriate from the options given below:

[JEE Main 2024 (Online) 31st January Morning Shift]

- (1) B, C, D only (2) A, B, C only
 (3) B and D only (4) A and C only

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Q.55 Which of the following is least ionic?

[JEE Main 2024 (Online) 31st January Evening Shift]

- (1) CoCl_2 (2) KCl (3) BaCl_2 (4) AgCl

Scan or tap for the full solution



Q.56 Match List I with List II.

List I (Molecule)		List II (Shape)	
A.	BrF_5	I.	T-Shape
B.	H_2O	II.	See saw
C.	ClF_3	III.	Bent
D.	SF_4	IV.	Square pyramidal

Choose the correct answer from the options given below :

[JEE Main 2024 (Online) 30th January Morning Shift]

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



Solution

Q.57 Given below are two statements:

Statement-I: Since Fluorine is more electronegative than nitrogen, the net dipole moment of NF_3 is greater than NH_3 .

Statement-II: In NH_3 , the orbital dipole due to lone pair and the dipole moment of N-H bonds are in opposite direction, but in NF_3 the orbital dipole due to lone pair and dipole moments of N-F bonds are in same direction.

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

[JEE Main 2024 (Online) 30th January Evening Shift]

- (1) Statement-I is true but Statement-II is false.
 (2) Both Statement-I and Statement-II are true.
 (3) Both Statement-I and Statement-II are false.
 (4) Statement-I is false but Statement-II is true.

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Q.58 The molecule / ion with square pyramidal shape is

[JEE Main 2024 (Online) 30th January Evening Shift]

- (1) PCl_5 (2) $[\text{Ni}(\text{CN})_4]^{2-}$
 (3) PF_5 (4) BrF_5

Scan or tap for the full solution



Q.59 Choose the polar molecule from the following:

[JEE Main 2024 (Online) 27th January Morning Shift]

- (1) CCl_4 (2) CO_2
 (3) $\text{CH}_2=\text{CH}_2$ (4) CHCl_3



Solution

Section B (Numerical) — 26 questions

Q.60 Consider the following species:

BrF_5 , XeF_5^- , BF_4^- , ICl_4^- , XeF_4 , SF_4 , NH_4^+ , ClF_3 , XeF_2 , ICl_2^-

Number of species having sp^3d hybridized central atom is _____.

[JEE Main 2026 (Online) 5th April Morning Shift]

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Q.61 According to Lewis theory, the total number of σ bond-pairs and lone pair of electrons around the central atom of XeO_6^{4-} ion is _____.

[JEE Main 2026 (Online) 4th April Morning Shift]

Scan or tap for the full solution



Q.62 The sum of sigma (σ) and pi (π) bonds in Hex-1,3-dien-5-yne is _____.

[JEE Main 2025 (Online) 29th January Morning Shift]

Scan or tap for the full solution



Q.63 Total number of non-bonded electrons present in NO_2^- ion based on Lewis theory is _____.

[JEE Main 2025 (Online) 29th January Evening Shift]

Scan or tap for the full solution



Q.64 Total number of molecules/species from the following which will be paramagnetic is _____.

O_2 , O_2^+ , O_2^- , NO , NO_2 , CO , $\text{K}_2[\text{NiCl}_4]$, $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$, $\text{K}_2[\text{Ni}(\text{CN})_4]$

[JEE Main 2025 (Online) 28th January Evening Shift]

Scan or tap for the full solution



Q.65 The number of molecules/ions that show linear geometry among the following is _____.

SO_2 , BeCl_2 , CO_2 , N_3^- , NO_2 , F_2O , XeF_2 , NO_2^+ , I_3^- , O_3

[JEE Main 2025 (Online) 22nd January Morning Shift]

Scan or tap for the full solution



Q.66 The total number of species from the following in which one unpaired electron is present, is _____.

N_2 , O_2 , C_2^- , O_2^- , O_2^{2-} , H_2^+ , CN^- , He_2^+

[JEE Main 2024 (Online) 9th April Morning Shift]

Scan or tap for the full solution



Q.67 Total number of electrons present in (π^*) molecular orbitals of O_2 , O_2^+ and O_2^- is _____.

[JEE Main 2024 (Online) 9th April Evening Shift]

Scan or tap for the full solution



Q.68 Number of molecules from the following which are exceptions to octet rule is _____.

CO_2 , NO_2 , H_2SO_4 , BF_3 , CH_4 , SiF_4 , ClO_2 , PCl_5 , BeF_2 , C_2H_6 , CHCl_3 , CBr_4

[JEE Main 2024 (Online) 8th April Morning Shift]

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Q.69 Number of molecules having bond order 2 from the following molecules is _____.

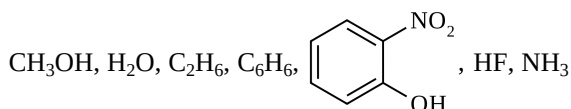
C_2 , O_2 , Be_2 , Li_2 , Ne_2 , N_2 , He_2

[JEE Main 2024 (Online) 8th April Evening Shift]

Scan or tap for the full solution



- Q.70** Number of molecules from the following which can exhibit hydrogen bonding is _____. (nearest integer)

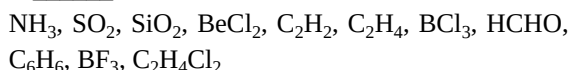


[JEE Main 2024 (Online) 6th April Morning Shift]

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- Q.71** Total number of species from the following with central atom utilising sp² hybrid orbitals for bonding is _____.



[JEE Main 2024 (Online) 6th April Evening Shift]

Scan or tap for the full solution



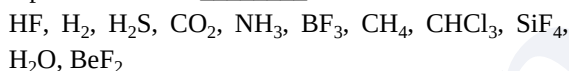
- Q.72** In the Lewis dot structure for NO₂⁻, total number of valence electrons around nitrogen is _____.

[JEE Main 2024 (Online) 5th April Morning Shift]

Scan or tap for the full solution



- Q.73** Number of compounds from the following with zero dipole moment is _____.

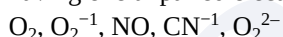


[JEE Main 2024 (Online) 5th April Evening Shift]

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- Q.74** Number of molecules/species from the following having one unpaired electron is _____.

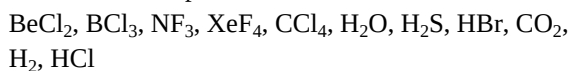


[JEE Main 2024 (Online) 4th April Morning Shift]

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- Q.75** Number of compounds / species from the following with non-zero dipole moment is _____.



[JEE Main 2024 (Online) 4th April Evening Shift]

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- Q.76** The number of molecules/ion/s having trigonal bipyramidal shape is _____.

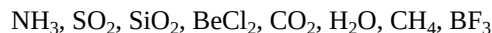


[JEE Main 2024 (Online) 1st February Morning Shift]

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- Q.77** The number of species from the following in which the central atom uses sp³ hybrid orbitals in its bonding is _____.



[JEE Main 2024 (Online) 31st January Morning Shift]

Scan or tap for the full solution



- Q.78** A diatomic molecule has a dipole moment of 1.2 D. If the bond distance is 1 Å, then fractional charge on each atom is _____ × 10⁻¹ esu. (Given 1 D = 10⁻¹⁸ esucm)

[JEE Main 2024 (Online) 31st January Evening Shift]

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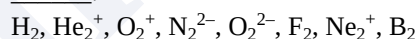
- Q.79** The total number of molecular orbitals formed from 2s and 2p atomic orbitals of a diatomic molecule is _____.

[JEE Main 2024 (Online) 30th January Morning Shift]

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- Q.80** The number of species from the following which are paramagnetic and with bond order equal to one is _____.

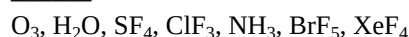


[JEE Main 2024 (Online) 29th January Morning Shift]

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- Q.81** Number of compounds with one lone pair of electrons on central atom amongst following is _____.



[JEE Main 2024 (Online) 29th January Morning Shift]

Scan or tap for the full solution



- Q.82** Sum of bond order of CO and NO⁺ is _____.

[JEE Main 2024 (Online) 27th January Morning Shift]

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- Q.83** The total number of molecules with zero dipole moment among CH₄, BF₃, H₂O, HF, NH₃, CO₂ and SO₂ is _____.

[JEE Main 2024 (Online) 29th January Evening Shift]

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- Q.84** The total number of anti bonding molecular orbitals, formed from 2s and 2p atomic orbitals in a diatomic molecule is _____.

[JEE Main 2024 (Online) 29th January Evening Shift]

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Q.85 The number of non-polar molecules from the following is _____.

HF, H₂O, SO₂, H₂, CO₂, CH₄, NH₃, HCl, CHCl₃, BF₃

[JEE Main 2024 (Online) 27th January Evening Shift]

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full solution



ANSWER KEY

Section A (MCQ) — 59 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	1	2	4	3	1	3	3	2	1	3	1
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	3	4	2	3	1	3	4	3	4	4	4
Ques.	23	24	25	26	27	28	29	30	31	32	33
Ans.	3	3	3	4	2	4	4	1	3	1	3
Ques.	34	35	36	37	38	39	40	41	42	43	44
Ans.	3	3	3	1	3	2	2	2	2	2	1
Ques.	45	46	47	48	49	50	51	52	53	54	55
Ans.	2	4	1	3	3	4	1	4	1	4	4
Ques.	56	57	58	59							
Ans.	2	3	4	4							

Section B (Numerical) — 26 questions

Ques.	60	61	62	63	64	65	66	67	68	69	70
Ans.	4	6	15	12	6	6	4	6	6	2	5
Ques.	71	72	73	74	75	76	77	78	79	80	81
Ans.	6	8	6	2	5	3	4	0	8	1	4
Ques.	82	83	84	85							
Ans.	6	3	4	4							