

PYQSide

JEE MAIN CHEMICAL BONDING AND MOLECULAR STRUCTURE — PYQS

Max. Marks: 140

Questions: 35

Section A (MCQ)

- 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

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- 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

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- 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

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- 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]

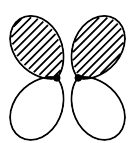
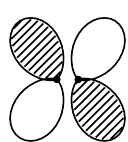
- (1) $(r_A + r_B)$, $2(r_A + r_B)$ (2) $\frac{1}{2}(r_A + r_B)$, $(r_A + r_B)$
(3) $(r_A + r_B)$, $(r_A + r_B)$ (4) $2(r_A + r_B)$, $\frac{1}{2}(r_A + r_B)$

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- 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) 

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- 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

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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

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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

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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

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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^-

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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°

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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

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- 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]

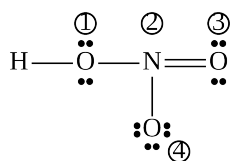
- (1) sp^2 and sp^3 (2) Both sp^3
 (3) Both sp^2 (4) sp^3 and sp^2

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- 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

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- 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) $\text{A} < \text{D} < \text{C} < \text{B}$

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- 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

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- 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

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- 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]

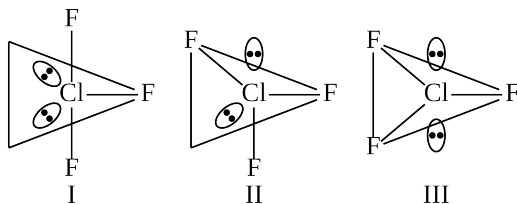
- (1) A & C only (2) A & E Only
 (3) A & D Only (4) B Only

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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

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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

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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

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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

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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

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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

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

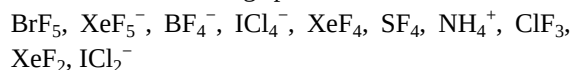
- (1) BrF₅ & PCl₅ (2) SbF₅ & PCl₅
- (3) BrF₅ & XeOF₄ (4) SbF₅ & XeOF₄

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Section B (Numerical)

Q.32 Consider the following species:



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

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

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Q.33 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]

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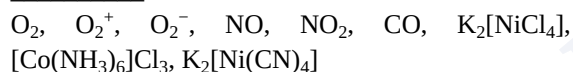
Q.34 The sum of sigma (σ) and pi (π) bonds in Hex-1,3-dien-5-yne is _____.

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

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Q.35 Total number of molecules/species from the following which will be paramagnetic is _____.



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

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ANSWER KEY

Section A (MCQ)

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		
Ans.	3	3	3	4	2	4	4	1	3		

Section B (Numerical)

Ques.	32	33	34	35							
Ans.	4	6	15	6							