

CHEMISTRY · JEE MAIN

Chemical Bonding & Molecular Structure

Chapter-wise previous year questions, with answer key

89

PYQS

2020–2025

PAPERS

7

TOPICS

Covalent Bond and Lewis Structures

Dipole Moment

Hydrogen Bonding

Molecular Orbital Theory

VSEPR Theory

Ionic Bond

Hybridisation

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

Stuck on a question?

Every question has a free step-by-step solution on PrepWiser — tap “Step-by-step solution” under it.

Practise this chapter online with instant answer checking: prepwisser.in/learn · No signup needed to browse

Covalent Bond and Lewis Structures · 6 PYQs

Q1 JEE Main 2024 · 8 Apr · Shift 1

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



Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/uEj7o3aO6t](https://www.prepwiser.in/questions/uEj7o3aO6t)

Q2 JEE Main 2024 · 5 Apr · Shift 1

Number of σ and π bonds present in ethylene molecule is respectively :

(A) 3 and 1

(B) 5 and 1

(C) 4 and 1

(D) 5 and 2

[Step-by-step solution ► prepwiser.in/questions/G_ntsmjiPp](https://www.prepwiser.in/questions/G_ntsmjiPp)

Q3 JEE Main 2023 · 13 Apr · Shift 2

The covalency and oxidation state respectively of boron in $[\text{BF}_4]^-$, are :

(A) 3 and 4

(B) 4 and 3

(C) 4 and 4

(D) 3 and 5

[Step-by-step solution ► prepwiser.in/questions/CfFgp70073](https://www.prepwiser.in/questions/CfFgp70073)

Q4 JEE Main 2023 · 10 Apr · Shift 1

The compound which does not exist is

(A) $(\text{NH}_4)_2\text{BeF}_4$

(B) PbEt_4

(C) BeH_2

(D) NaO_2

[Step-by-step solution ► prepwiser.in/questions/xNKOkk-vlo](https://www.prepwiser.in/questions/xNKOkk-vlo)

Q5 JEE Main 2022 · 29 Jul · Shift 1

Which of the following pair of molecules contain odd electron molecule and an expanded octet molecule?

(A) BCl_3 and SF_6

(B) NO and H_2SO_4

(C) SF_6 and H_2SO_4

(D) BCl_3 and NO

[Step-by-step solution ► prepwiser.in/questions/Yd4mgQf4VY](https://www.prepwiser.in/questions/Yd4mgQf4VY)

Q6 JEE Main 2022 · 25 Jun · Shift 1

Number of electron deficient molecules among the following

PH_3 , B_2H_6 , CCl_4 , NH_3 , LiH and BCl_3 is

(A) 0

(B) 1

(C) 2

(D) 3

[Step-by-step solution ► prepwiser.in/questions/KRa5yn2d2c](https://www.prepwiser.in/questions/KRa5yn2d2c)

Dipole Moment · 12 PYQs

Q7 JEE Main 2025 · 22 Jan · Shift 2

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

HBr, H₂S, NF₃ and CHCl₃

- (A) HBr < H₂S < NF₃ < CHCl₃
(B) H₂S < HBr < NF₃ < CHCl₃
(C) NF₃ < HBr < H₂S < CHCl₃
(D) CHCl₃ < NF₃ < HBr < H₂S

[Step-by-step solution ► prepwiser.in/questions/xTWjpQY_2P](https://www.prepwiser.in/questions/xTWjpQY_2P)

Q8 JEE Main 2024 · 5 Apr · Shift 2

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

HF, H₂, H₂S, CO₂, NH₃, BF₃, CH₄, CHCl₃, SiF₄, H₂O, BeF₂

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Q8qhaFTP68](https://www.prepwiser.in/questions/Q8qhaFTP68)

Q9 JEE Main 2024 · 4 Apr · Shift 2

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

BeCl₂, BCl₃, NF₃, XeF₄, CCl₄, H₂O, H₂S, HBr, CO₂, H₂, HCl

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/VJNUEVNL-C](https://www.prepwiser.in/questions/VJNUEVNL-C)

Q10 JEE Main 2024 · 4 Apr · Shift 1

Which one of the following molecules has maximum dipole moment?

- (A) CH₄ (B) NF₃
(C) NH₃ (D) PF₅

[Step-by-step solution ► prepwiser.in/questions/NGCbs4gDph](https://www.prepwiser.in/questions/NGCbs4gDph)

Q11 JEE Main 2024 · 31 Jan · Shift 2

A diatomic molecule has a dipole moment of 1.2D. If the bond distance is 1Å°, then fractional charge on each atom is _____ × 10⁻¹ esu.

(Given 1D = 10⁻¹⁸ esucm)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/vvgOqetz-2](https://www.prepwiser.in/questions/vvgOqetz-2)

Q12 JEE Main 2024 · 29 Jan · Shift 2

The total number of molecules with zero dipole moment among



and SO_2 is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/ICeAgELIei](https://www.prepwisser.in/questions/ICeAgELIei)

Q13 JEE Main 2024 · 27 Jan · Shift 2

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



Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/o4VcjC-w74](https://www.prepwisser.in/questions/o4VcjC-w74)

Q14 JEE Main 2023 · 15 Apr · Shift 1

Consider the following statements:

- (A) NF_3 molecule has a trigonal planar structure.
- (B) Bond length of N_2 is shorter than O_2 .
- (C) Isoelectronic molecules or ions have identical bond order.
- (D) Dipole moment of H_2S is higher than that of water molecule.

Choose the correct answer from the options given below:

- | | |
|-----------------------------|-----------------------------|
| (A) (C) and (D) are correct | (B) (A) and (B) are correct |
| (C) (B) and (C) are correct | (D) (A) and (D) are correct |

[Step-by-step solution ► prepwisser.in/questions/gQs1j6kgAP](https://www.prepwisser.in/questions/gQs1j6kgAP)

Q15 JEE Main 2023 · 10 Apr · Shift 1

The pair from the following pairs having both compounds with net non-zero dipole moment is

- | | |
|------------------------------|--|
| (A) cis-butene, trans-butene | (B) CH_2Cl_2 , CHCl_3 |
| (C) Benzene, anisidine | (D) 1,4-Dichlorobenzene, 1,3-Dichlorobenzene |

[Step-by-step solution ► prepwisser.in/questions/0Jb-TdERX0](https://www.prepwisser.in/questions/0Jb-TdERX0)

Q16 JEE Main 2022 · 25 Jun · Shift 2

Amongst BeF_2 , BF_3 , H_2O , NH_3 , CCl_4 and HCl , the number of molecules with non-zero net dipole moment is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/T4PyB-08vA](https://www.prepwisser.in/questions/T4PyB-08vA)

Q17 JEE Main 2020 · 8 Jan · Shift 1

The predominant intermolecular forces present in ethyl acetate, a liquid, are:

- (A) Dipole-dipole and hydrogen bonding
- (B) hydrogen bonding and London dispersion
- (C) London dispersion, dipole-dipole and hydrogen bonding
- (D) London dispersion and dipole-dipole

Step-by-step solution ► [prepwisser.in/questions/9qsJCEW33a](https://www.prepwisser.in/questions/9qsJCEW33a)

Q18 JEE Main 2020 · 7 Jan · Shift 1

The dipole of CCl_4 , CHCl_3 and CH_4 are in the order :

- (A) $\text{CCl}_4 < \text{CH}_4 < \text{CHCl}_3$
- (B) $\text{CH}_4 = \text{CCl}_4 < \text{CHCl}_3$
- (C) $\text{CH}_4 < \text{CCl}_4 < \text{CHCl}_3$
- (D) $\text{CHCl}_3 < \text{CH}_4 = \text{CCl}_4$

Step-by-step solution ► [prepwisser.in/questions/WkRYzSR0t7](https://www.prepwisser.in/questions/WkRYzSR0t7)

Hydrogen Bonding · 12 PYQs

Q19 JEE Main 2025 · 3 Apr · Shift 2

Given below are two statements:

Statement I : Wet cotton clothes made of cellulose based carbohydrate takes 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 above statements, choose the correct answer from the options given below

- (A) Both Statement I and Statement II are false
- (B) Both Statement I and Statement II are true
- (C) Statement I is false but Statement II is true
- (D) Statement I is true but Statement II is false

Step-by-step solution ► [prepwisser.in/questions/f9d5-07FGG](https://www.prepwisser.in/questions/f9d5-07FGG)

Q20 JEE Main 2025 · 23 Jan · Shift 2

Given below are two statements :

Statement (I) : The boiling points of alcohols and phenols increase with increase in the number of C - atoms.

Statement (II) : The boiling points of alcohols and phenols are higher in comparison to other class of compounds such as ethers, haloalkanes.

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

- (A) Statement I is false but Statement II is true
- (B) Both Statement I and Statement II are true
- (C) Statement I is true but Statement II is false
- (D) Both Statement I and Statement II are false

[Step-by-step solution ► prepwiser.in/questions/eTMBF58X2u](https://www.prepwiser.in/questions/eTMBF58X2u)

Q21 JEE Main 2024 · 4 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 σ -nitro phenol
- C. Intramolecular H bonding is present in HF.
- D. The magnitude of H bonding depends on the physical state of the compound.
- E. H-bonding has powerful effect on the structure and properties of compounds

Choose the correct answer from the options given below:

- (A) A, B, C only
- (B) A only
- (C) A, D, E only
- (D) A, B, D only

[Step-by-step solution ► prepwiser.in/questions/6Rixc7uuEU](https://www.prepwiser.in/questions/6Rixc7uuEU)

Q22 JEE Main 2024 · 1 Feb · Shift 1

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

Assertion (A): PH_3 has lower boiling point than NH_3 .

Reason (R) : In liquid state NH_3 molecules are associated through vander Waal's forces, but PH_3 molecules are associated through hydrogen bonding.

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

- (A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (B) (A) is not correct but (R) is correct
- (C) (A) is correct but (R) is not correct
- (D) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

[Step-by-step solution ► prepwiser.in/questions/lqVExdp407](https://www.prepwiser.in/questions/lqVExdp407)

Q23 JEE Main 2023 · 8 Apr · Shift 1

Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: Butan -1- ol has higher boiling point than ethoxyethane.

Reason R: Extensive hydrogen bonding leads to stronger association of molecules.

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

- (A) A is false but R is true
- (B) Both A and R are true but R is not the correct explanation of A
- (C) Both A and R are true and R is the correct explanation of A
- (D) A is true but R is false

[Step-by-step solution ► prepwisser.in/questions/eQUkCEwTTh](https://www.prepwisser.in/questions/eQUkCEwTTh)

Q24 JEE Main 2023 · 6 Apr · Shift 2

In an ice crystal, each water molecule is hydrogen bonded to _____ neighbouring molecules.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/VVITKd5yqb](https://www.prepwisser.in/questions/VVITKd5yqb)

Q25 JEE Main 2023 · 30 Jan · Shift 2

Boric acid is solid, whereas BF_3 is gas at room temperature because of :

- (A) Strong van der Waal's interaction in Boric acid
- (B) Strong covalent bond in BF_3
- (C) Strong hydrogen bond in Boric acid
- (D) Strong ionic bond in Boric acid

[Step-by-step solution ► prepwisser.in/questions/eGv0TacPLi](https://www.prepwisser.in/questions/eGv0TacPLi)

Q26 JEE Main 2023 · 24 Jan · Shift 1

Decreasing order of the hydrogen bonding in following forms of water is correctly represented by

- A. Liquid water
- B. Ice
- C. Impure water

Choose the correct answer from the options given below :

- (A) $A = B > C$
- (B) $B > A > C$
- (C) $A > B > C$
- (D) $C > B > A$

[Step-by-step solution ► prepwisser.in/questions/U4KgthgjCT](https://www.prepwisser.in/questions/U4KgthgjCT)

Q27 JEE Main 2022 · 27 Jun · Shift 2

The correct order of increasing intermolecular hydrogen bond strength is :

- (A) $\text{HCN} < \text{H}_2\text{O} < \text{NH}_3$
- (B) $\text{HCN} < \text{CH}_4 < \text{NH}_3$
- (C) $\text{CH}_4 < \text{HCN} < \text{NH}_3$
- (D) $\text{CH}_4 < \text{NH}_3 < \text{HCN}$

[Step-by-step solution ► prepwisser.in/questions/SkAdtezkW1](https://www.prepwisser.in/questions/SkAdtezkW1)

Q28 JEE Main 2021 · 26 Feb · Shift 1

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

Assertion A : Dipole-dipole interactions are the only non-covalent interactions, resulting in hydrogen bond formation.

Reason R : Fluorine is the most electronegative element and hydrogen bonds in HF are symmetrical.

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

- (A) Both A and R are true and R is the correct explanation of A
- (B) A is true but R is false
- (C) A is false but R is true
- (D) Both A and R are true but R is NOT the correct explanation of A

[Step-by-step solution ► prepwiser.in/questions/m3YGTH00i1](https://www.prepwiser.in/questions/m3YGTH00i1)

Q29 JEE Main 2020 · 3 Sep · Shift 1

If the boiling point of H_2O is 373 K, the boiling point of H_2S will be :

- (A) greater than 300 K but less than 373 K
- (B) equal to 373 K
- (C) more than 373 K
- (D) less than 300 K

[Step-by-step solution ► prepwiser.in/questions/TYAEIdGkl](https://www.prepwiser.in/questions/TYAEIdGkl)

Q30 JEE Main 2020 · 7 Jan · Shift 1

The relative strength of interionic/intermolecular forces in decreasing order is :

- (A) dipole-dipole > ion-dipole > ion-ion
- (B) ion-dipole > dipole-dipole > ion-ion
- (C) ion-dipole > ion-ion > dipole-dipole
- (D) ion-ion > ion-dipole > dipole-dipole

[Step-by-step solution ► prepwiser.in/questions/3CvdWv6Woa](https://www.prepwiser.in/questions/3CvdWv6Woa)

Molecular Orbital Theory · 30 PYQs

Q31 JEE Main 2025 · 4 Apr · Shift 1

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:

- (A) A & C only
- (B) A & E Only
- (C) A & D Only
- (D) B Only

[Step-by-step solution ► prepwiser.in/questions/TAWrbjLgan](https://www.prepwiser.in/questions/TAWrbjLgan)

Q32 JEE Main 2025 · 28 Jan · Shift 2

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



Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/yHhwH1iBZC](https://www.prepwiser.in/questions/yHhwH1iBZC)

Q33 JEE Main 2025 · 24 Jan · Shift 2

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 $\text{O}=\text{O}$ (double bond) but less than that of a single ($\text{O}-\text{O}$) 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 ($\text{O}=\text{O}$) but more than that of a single bond ($\text{O}-\text{O}$).

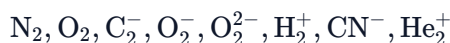
In the light of the above statements, choose the correct answer from the options given below :

- (A) Statement I is false but Statement II is true
- (B) Both Statement I and Statement II are true
- (C) Statement I is true but Statement II is false
- (D) Both Statement I and Statement II are false

[Step-by-step solution ► prepwiser.in/questions/k_kyDo_2r](https://www.prepwiser.in/questions/k_kyDo_2r)

Q34 JEE Main 2024 · 9 Apr · Shift 1

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



Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/hcCl4gX-ew](https://www.prepwiser.in/questions/hcCl4gX-ew)

Q35 JEE Main 2024 · 9 Apr · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/UeNIR8LK2G](https://www.prepwiser.in/questions/UeNIR8LK2G)

Q36 JEE Main 2024 · 8 Apr · Shift 2

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



Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/n-0K9oYq6B](https://www.prepwiser.in/questions/n-0K9oYq6B)

Q37 JEE Main 2024 · 8 Apr · Shift 2

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

(A) $\psi_A + 2\psi_B$

(B) $\psi_A - \psi_B$

(C) $\psi_A - 2\psi_B$

(D) $\psi_A + \psi_B$

[Step-by-step solution](#) ► [prepwisser.in/questions/drprElq5vC](https://www.prepwisser.in/questions/drprElq5vC)

Q38 JEE Main 2024 · 4 Apr · Shift 1

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



Numerical answer — enter the value.

[Step-by-step solution](#) ► [prepwisser.in/questions/myqI1leeuK](https://www.prepwisser.in/questions/myqI1leeuK)

Q39 JEE Main 2024 · 1 Feb · Shift 2

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 :

(A) Both Statement I and Statement II are true

(B) Both Statement I and Statement II are false

(C) Statement I is true but Statement II is false

(D) Statement I is false but Statement II is true

[Step-by-step solution](#) ► [prepwisser.in/questions/5iKOW-ka9n](https://www.prepwisser.in/questions/5iKOW-ka9n)

Q40 JEE Main 2024 · 31 Jan · Shift 1

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

A. have the same energy

B. have the minimum overlap

C. have same symmetry about the molecular axis

D. have different symmetry about the molecular axis

Choose the most appropriate from the options given below:

(A) B, C, D only

(B) A, B, C only

(C) B and D only

(D) A and C only

[Step-by-step solution](#) ► [prepwisser.in/questions/TOZb89jZtz](https://www.prepwisser.in/questions/TOZb89jZtz)

Q41 JEE Main 2024 · 30 Jan · Shift 1

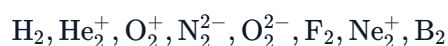
The total number of molecular orbitals formed from 2s and 2p atomic orbitals of a diatomic molecule is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/8kriZ47z3O](https://www.prepwiser.in/questions/8kriZ47z3O)

Q42 JEE Main 2024 · 29 Jan · Shift 1

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



Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/wGA2S8s_AN](https://www.prepwiser.in/questions/wGA2S8s_AN)

Q43 JEE Main 2024 · 29 Jan · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/9Ao2nfGPmN](https://www.prepwiser.in/questions/9Ao2nfGPmN)

Q44 JEE Main 2024 · 27 Jan · Shift 1

Sum of bond order of CO and NO^+ is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/q2JCfSi6vG](https://www.prepwiser.in/questions/q2JCfSi6vG)

Q45 JEE Main 2023 · 13 Apr · Shift 1

In which of the following processes, the bond order increases and paramagnetic character changes to diamagnetic one ?

- (A) $\text{O}_2 \rightarrow \text{O}_2^{2-}$
- (B) $\text{N}_2 \rightarrow \text{N}_2^+$
- (C) $\text{NO} \rightarrow \text{NO}^+$
- (D) $\text{O}_2 \rightarrow \text{O}_2^+$

[Step-by-step solution ► prepwiser.in/questions/pjg6qHecdP](https://www.prepwiser.in/questions/pjg6qHecdP)

Q46 JEE Main 2023 · 12 Apr · Shift 1

The bond order and magnetic property of acetylide ion are same as that of

- | | |
|--------------------|--------------------|
| (A) O_2^+ | (B) O_2^- |
| (C) N_2^+ | (D) NO^+ |

[Step-by-step solution ► prepwiser.in/questions/2_C155LbaM](https://www.prepwiser.in/questions/2_C155LbaM)

Q47 JEE Main 2023 · 29 Jan · Shift 1

The number of molecules or ions from the following, which do not have odd number of electrons are _____.

(A) NO_2

(B) ICl_4^-

(C) BrF_3

(D) ClO_2

(E) NO_2^+

(F) NO

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/QTxl1UG6zj](https://www.prepwisser.in/questions/QTxl1UG6zj)

Q48 JEE Main 2023 · 24 Jan · Shift 2

What is the number of unpaired electron(s) in the highest occupied molecular orbital of the following species : N_2 ; N_2^+ ; O_2 ; O_2^+ ?

(A) 0, 1, 0, 1

(B) 2, 1, 0, 1

(C) 0, 1, 2, 1

(D) 2, 1, 2, 1

[Step-by-step solution ► prepwisser.in/questions/_dU9vRbxIN](https://www.prepwisser.in/questions/_dU9vRbxIN)

Q49 JEE Main 2022 · 28 Jul · Shift 1

The number of paramagnetic species among the following is _____.



and He_2^+

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/xG3WD3Mj_3](https://www.prepwisser.in/questions/xG3WD3Mj_3)

Q50 JEE Main 2022 · 28 Jul · Shift 2

Given below are two statements: One is labelled as Assertion **A** and the other is labelled as Reason **R**.
Assertion **A** : Zero orbital overlap is an out of phase overlap.

Reason **R** : It results due to different orientation / direction of approach of orbitals.

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

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

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

(C) A is true but R is false

(D) A is false but R is true

[Step-by-step solution ► prepwisser.in/questions/U6mUmHmyKF](https://www.prepwisser.in/questions/U6mUmHmyKF)

Q51 JEE Main 2022 · 27 Jul · Shift 1

Amongst the following, the number of oxide(s) which are paramagnetic in nature is



Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/vZSOvnR1oH](https://www.prepwisser.in/questions/vZSOvnR1oH)

Q52 JEE Main 2022 · 27 Jul · Shift 1

According to MO theory, number of species/ions from the following having identical bond order is _____.



Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/8d2S8mzgpm](https://www.prepwiser.in/questions/8d2S8mzgpm)

Q53 JEE Main 2022 · 25 Jul · Shift 1

Among the following species



the number of species showing diamagnetism is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/v_Emhd7NPz](https://www.prepwiser.in/questions/v_Emhd7NPz)

Q54 JEE Main 2022 · 25 Jun · Shift 1

Bonding in which of the following diatomic molecule(s) become(s) stronger, on the basis of MO Theory, by removal of an electron?

- (A) NO
- (B) N_2
- (C) O_2
- (D) C_2
- (E) B_2

Choose the most appropriate answer from the options given below :

- | | |
|-------------------------------|-------------------------------|
| (A) (A), (B), (C) only | (B) (B), (C), (E) only |
| (C) (A), (C) only | (D) (D) only |

[Step-by-step solution ► prepwiser.in/questions/_fH1UDayKU](https://www.prepwiser.in/questions/_fH1UDayKU)

Q55 JEE Main 2021 · 1 Sep · Shift 2

The spin-only magnetic moment value of B_2^+ species is _____ $\times 10^{-2}$ BM. (Nearest integer) [Given : $\sqrt{3} = 1.73$]

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/9pV_f0VmVM](https://www.prepwiser.in/questions/9pV_f0VmVM)

Q56 JEE Main 2021 · 31 Aug · Shift 2

According to molecular orbital theory, the number of unpaired electron(s) in O_2^{2-} is :

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/oxbhpgA9mX](https://www.prepwiser.in/questions/oxbhpgA9mX)

Q57 JEE Main 2021 · 26 Aug · Shift 2

The bond order and magnetic behaviour of O_2^- ion are respectively :

- (A) 1.5 and paramagnetic (B) 1.5 and diamagnetic
(C) 2 and diamagnetic (D) 1 and paramagnetic

[Step-by-step solution ► prepwiser.in/questions/44dXF0rBsh](https://www.prepwiser.in/questions/44dXF0rBsh)

Q58 JEE Main 2021 · 18 Mar · Shift 1

AX is a covalent diatomic molecule where A and X are second row elements of periodic table. Based on Molecular orbital theory, the bond order of AX is 2.5. The total number of electrons in AX is _____. (Round off to the Nearest Integer).

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/mUiR1sG6kb](https://www.prepwiser.in/questions/mUiR1sG6kb)

Q59 JEE Main 2020 · 9 Jan · Shift 1

If the magnetic moment of a dioxygen species is 1.73 B.M, it may be :

- (A) O_2^- or O_2^+
(B) O_2 , O_2^- or O_2^+
(C) O_2 or O_2^+
(D) O_2 or O_2^-

[Step-by-step solution ► prepwiser.in/questions/nkIc4SkGqR](https://www.prepwiser.in/questions/nkIc4SkGqR)

Q60 JEE Main 2020 · 7 Jan · Shift 2

The bond order and the magnetic characteristics of CN^- are :

- (A) 3, paramagnetic (B) $2\frac{1}{2}$, paramagnetic
(C) 3, diamagnetic (D) $2\frac{1}{2}$, diamagnetic

[Step-by-step solution ► prepwiser.in/questions/aB4qhpUUEV](https://www.prepwiser.in/questions/aB4qhpUUEV)

VSEPR Theory · 12 PYQs

Q61 JEE Main 2024 · 30 Jan · Shift 1

Aluminium chloride in acidified aqueous solution forms an ion having geometry

- (A) Square planar (B) Octahedral
(C) Trigonal bipyramidal (D) Tetrahedral

[Step-by-step solution ► prepwiser.in/questions/CvVIt5rUPI](https://www.prepwiser.in/questions/CvVIt5rUPI)

Q62 JEE Main 2023 · 10 Apr · Shift 1

The number of bent-shaped molecule/s from the following is _____

N_3^- , NO_2^- , I_3^- , O_3 , SO_2

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/OvGK8MD-hp](https://www.prepwiser.in/questions/OvGK8MD-hp)

Q63 JEE Main 2023 · 10 Apr · Shift 1

The sum of lone pairs present on the central atom of the interhalogen IF_5 and IF_7 is _____

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Q0H4Vb_Snd](https://www.prepwiser.in/questions/Q0H4Vb_Snd)

Q64 JEE Main 2023 · 6 Apr · Shift 1

The number of species from the following which have square pyramidal structure is _____



Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/qflbr-gzu9](https://www.prepwiser.in/questions/qflbr-gzu9)

Q65 JEE Main 2023 · 6 Apr · Shift 2

Structures of BeCl_2 in solid state, vapour phase and at very high temperature respectively are :

(A) Polymeric, Dimeric, Monomeric

(B) Dimeric, Polymeric, Monomeric

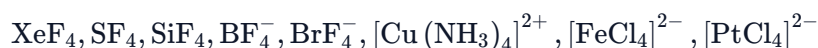
(C) Polymeric, Monomeric, Dimeric

(D) Monomeric, Dimeric, Polymeric

[Step-by-step solution ► prepwiser.in/questions/m44abP3Fyr](https://www.prepwiser.in/questions/m44abP3Fyr)

Q66 JEE Main 2023 · 6 Apr · Shift 2

The number of species having a square planar shape from the following is _____.

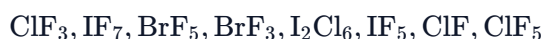


Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/velklODNvQ](https://www.prepwiser.in/questions/velklODNvQ)

Q67 JEE Main 2022 · 28 Jul · Shift 1

The number of interhalogens from the following having square pyramidal structure is :



Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/4xSqGNQChb](https://www.prepwiser.in/questions/4xSqGNQChb)

Q68 JEE Main 2022 · 27 Jul · Shift 2

The number of molecule(s) or ion(s) from the following having non-planar structure is _____.



Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/e8HLiywJHV](https://www.prepwiser.in/questions/e8HLiywJHV)

Q69 JEE Main 2020 · 5 Sep · Shift 1

The structure of PCl_5 in the solid state is :

- (A) square pyramidal
- (B) tetrahedral $[\text{PCl}_4]^+$ and octahedral $[\text{PCl}_6]^-$
- (C) square planar $[\text{PCl}_4]^+$ and octahedral $[\text{PCl}_6]^-$
- (D) trigonal bipyramidal

[Step-by-step solution ► prepwisser.in/questions/A9OraAbSVz](https://www.prepwisser.in/questions/A9OraAbSVz)

Q70 JEE Main 2020 · 5 Sep · Shift 2

The compound that has the largest H-M-H bond angle (M = N, O, S, C) is :

- (A) CH_4
- (B) H_2S
- (C) NH_3
- (D) H_2O

[Step-by-step solution ► prepwisser.in/questions/Gzy_mRQU5r](https://www.prepwisser.in/questions/Gzy_mRQU5r)

Q71 JEE Main 2020 · 2 Sep · Shift 1

If AB_4 molecule is a polar molecule, a possible geometry of AB_4 is

- | | |
|----------------------|-------------------|
| (A) Tetrahedral | (B) see-saw |
| (C) Square pyramidal | (D) Square planar |

[Step-by-step solution ► prepwisser.in/questions/4guF62NT9B](https://www.prepwisser.in/questions/4guF62NT9B)

Q72 JEE Main 2020 · 2 Sep · Shift 2

The shape / structure of $[\text{XeF}_5]^-$ and XeO_3F_2 , respectively, are

- (A) Pentagonal planar and trigonal bipyramidal
- (B) Trigonal bipyramidal and pentagonal planar
- (C) Octahedral and square pyramidal
- (D) Trigonal bipyramidal and trigonal bipyramidal

[Step-by-step solution ► prepwisser.in/questions/93dXZIKu-V](https://www.prepwisser.in/questions/93dXZIKu-V)

Ionic Bond · 7 PYQs

Q73 JEE Main 2025 · 29 Jan · Shift 1

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 :

- (A) $\text{EB} > \text{EA} > \text{EC} > \text{ED}$
- (B) $\text{EA} > \text{EB} > \text{EC} > \text{ED}$
- (C) $\text{ED} > \text{EC} > \text{EA} > \text{EB}$
- (D) $\text{ED} > \text{EC} > \text{EB} > \text{EA}$

[Step-by-step solution ► prepwisser.in/questions/Ym600_n99o](https://www.prepwisser.in/questions/Ym600_n99o)

Q74 JEE Main 2024 · 1 Feb · Shift 1

Arrange the bonds in order of increasing ionic character in the molecules. LiF , K_2O , N_2 , SO_2 and ClF_3 :

- (A) $\text{N}_2 < \text{SO}_2 < \text{ClF}_3 < \text{K}_2\text{O} < \text{LiF}$
(B) $\text{ClF}_3 < \text{N}_2 < \text{SO}_2 < \text{K}_2\text{O} < \text{LiF}$
(C) $\text{LiF} < \text{K}_2\text{O} < \text{ClF}_3 < \text{SO}_2 < \text{N}_2$
(D) $\text{N}_2 < \text{ClF}_3 < \text{SO}_2 < \text{K}_2\text{O} < \text{LiF}$

[Step-by-step solution](https://www.prepwiser.in/questions/e33uy4Y3Xp) ► [prepwiser.in/questions/e33uy4Y3Xp](https://www.prepwiser.in/questions/e33uy4Y3Xp)

Q75 JEE Main 2024 · 31 Jan · Shift 2

Which of the following is least ionic?

- (A) CoCl_2 (B) KCl
(C) BaCl_2 (D) AgCl

[Step-by-step solution](https://www.prepwiser.in/questions/j25j-n5qbM) ► [prepwiser.in/questions/j25j-n5qbM](https://www.prepwiser.in/questions/j25j-n5qbM)

Q76 JEE Main 2023 · 8 Apr · Shift 1

The number of following factors which affect the percent covalent character of the ionic bond is _____

- (A) Polarising power of cation
(B) Extent of distortion of anion
(C) Polarisability of the anion
(D) Polarising power of anion

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwiser.in/questions/6Qn3Euczde) ► [prepwiser.in/questions/6Qn3Euczde](https://www.prepwiser.in/questions/6Qn3Euczde)

Q77 JEE Main 2023 · 24 Jan · Shift 1

Order of Covalent bond;

- A. $\text{KF} > \text{KI}$; $\text{LiF} > \text{KF}$
B. $\text{KF} < \text{KI}$; $\text{LiF} > \text{KF}$
C. $\text{SnCl}_4 > \text{SnCl}_2$; $\text{CuCl} > \text{NaCl}$
D. $\text{LiF} > \text{KF}$; $\text{CuCl} < \text{NaCl}$
E. $\text{KF} < \text{KI}$; $\text{CuCl} > \text{NaCl}$

Choose the correct answer from the options given below :

- (A) B, C only (B) A, B only
(C) C, E only (D) B, C, E only

[Step-by-step solution](https://www.prepwiser.in/questions/6RzMGY7zUY) ► [prepwiser.in/questions/6RzMGY7zUY](https://www.prepwiser.in/questions/6RzMGY7zUY)

Q78 JEE Main 2022 · 26 Jul · Shift 2

Arrange the following in increasing order of their covalent character.

- A. CaF_2
- B. CaCl_2
- C. CaBr_2
- D. CaI_2

Choose the correct answer from the options given below.

- (A) $B < A < C < D$
- (B) $A < B < C < D$
- (C) $A < B < D < C$
- (D) $A < C < B < D$

[Step-by-step solution ► prepwiser.in/questions/Lbzu0J0W25](https://www.prepwiser.in/questions/Lbzu0J0W25)

Q79 JEE Main 2022 · 29 Jun · Shift 1

Arrange the following in the decreasing order of their covalent character :

- (A) LiCl
- (B) NaCl
- (C) KCl
- (D) CsCl

Choose the most appropriate answer from the options given below :

- (A) $(A) > (C) > (B) > (D)$
- (B) $(B) > (A) > (C) > (D)$
- (C) $(A) > (B) > (C) > (D)$
- (D) $(A) > (B) > (D) > (C)$

[Step-by-step solution ► prepwiser.in/questions/L7CBV7L-Oy](https://www.prepwiser.in/questions/L7CBV7L-Oy)

Hybridisation · 10 PYQs

Q80 JEE Main 2025 · 2 Apr · Shift 1

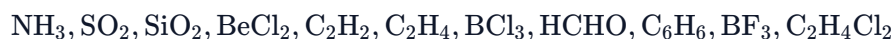
Among SO_2 , NF_3 , NH_3 , XeF_2 , ClF_3 and SF_4 , the hybridization of the molecule with nonzero dipole moment and highest number of lone-pairs of electrons on the central atom is

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

[Step-by-step solution ► prepwiser.in/questions/WK_TiWLNWL](https://www.prepwiser.in/questions/WK_TiWLNWL)

Q81 JEE Main 2024 · 6 Apr · Shift 2

Total number of species from the following with central atom utilising sp^2 hybrid orbitals for bonding is _____.



Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/hcnMb_MaSW](https://www.prepwiser.in/questions/hcnMb_MaSW)

Q82 JEE Main 2024 · 6 Apr · Shift 2

Given below are two statements :

Statement I : PF_5 and BrF_5 both exhibit sp^3d hybridisation.

Statement II : Both SF_6 and $[\text{Co}(\text{NH}_3)_6]^{3+}$ exhibit sp^3d^2 hybridisation.

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

- (A) Both Statement I and Statement II are false
- (B) Statement I is true but Statement II is false
- (C) Statement I is false but Statement II is true
- (D) Both Statement I and Statement II are true

[Step-by-step solution ► prepwiser.in/questions/kR0UUZNBtk](https://www.prepwiser.in/questions/kR0UUZNBtk)

Q83 JEE Main 2024 · 4 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^-

- (A) 2
- (B) 4
- (C) 1
- (D) 3

[Step-by-step solution ► prepwiser.in/questions/DXhte_PbNe](https://www.prepwiser.in/questions/DXhte_PbNe)

Q84 JEE Main 2024 · 31 Jan · Shift 1

The number of species from the following in which the central atom uses sp^3 hybrid orbitals in its bonding is _____.

NH_3 , SO_2 , SiO_2 , BeCl_2 , CO_2 , H_2O , CH_4 , BF_3

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/ZIXB-KIOfM](https://www.prepwiser.in/questions/ZIXB-KIOfM)

Q85 JEE Main 2024 · 27 Jan · Shift 2

Identify from the following species in which d^2sp^3 hybridization is shown by central atom :

- (A) $[\text{Co}(\text{NH}_3)_6]^{3+}$
- (B) SF_6
- (C) $[\text{Pt}(\text{Cl}_4)]^{2-}$
- (D) BrF_5

[Step-by-step solution ► prepwiser.in/questions/OSfB28GEGM](https://www.prepwiser.in/questions/OSfB28GEGM)

Q86 JEE Main 2022 · 28 Jun · Shift 1

The hybridization of P exhibited in PF_5 is sp^xd^y . The value of y is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/P-RfUoCU_p](https://www.prepwiser.in/questions/P-RfUoCU_p)

Match List-I with List-II :

List-I (Species)	List-II (Hybrid Orbitals)
(a) SF_4	(i) sp^3d^2
(b) IF_5	(ii) d^2sp^3
(c) NO_2^+	(iii) sp^3d
(d) NH_4^+	(iv) sp^3
	(v) sp

Choose the correct answer from the options given below :

(A) (a)-(i), (b)-(ii), (c)-(v) and (d)-(iii)

(B) (a)-(ii), (b)-(i), (c)-(iv) and (d)-(v)

(C) (a)-(iii), (b)-(i), (c)-(v) and (d)-(iv)

(D) (a)-(iv), (b)-(iii), (c)-(ii) and (d)-(v)

[Step-by-step solution ► prepwiser.in/questions/v7Z2sgjUqX](https://www.prepwiser.in/questions/v7Z2sgjUqX)

The molecule in which hybrid MOs involve only one d-orbital of the central atom is :

(A) XeF_4

(B) $[Ni(CN)_4]^{2-}$

(C) $[CrF_6]^{3-}$

(D) BrF_5

[Step-by-step solution ► prepwiser.in/questions/IN-6mlsjo5](https://www.prepwiser.in/questions/IN-6mlsjo5)

The number of sp^2 hybrid orbitals in a molecule of benzene is :

(A) 24

(B) 12

(C) 6

(D) 18

[Step-by-step solution ► prepwiser.in/questions/j0gtqPFaPA](https://www.prepwiser.in/questions/j0gtqPFaPA)

Answer key — Chemical Bonding & Molecular Structure

Numbers match the question numbers above. For full working, open the solution link under each question.

1	6	2	B	3	B	4	D	5	B	6	C	7	C	8	6
9	5	10	C	11	0	12	3	13	4	14	C	15	B	16	3
17	D	18	B	19	D	20	B	21	C	22	C	23	C	24	4
25	C	26	B	27	C	28	C	29	D	30	D	31	C	32	6
33	C	34	4	35	6	36	2	37	B	38	2	39	D	40	D
41	8	42	1	43	4	44	6	45	C	46	D	47	3	48	C
49	4	50	A	51	4	52	3	53	2	54	C	55	173	56	0
57	A	58	15	59	A	60	C	61	B	62	3	63	1	64	3
65	A	66	4	67	3	68	6	69	B	70	A	71	B	72	A
73	A	74	A	75	D	76	3	77	D	78	B	79	C	80	D
81	6	82	A	83	A	84	3	85	A	86	1	87	C	88	B
89	D														

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