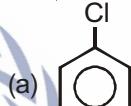
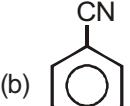
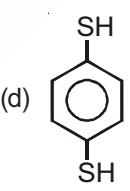


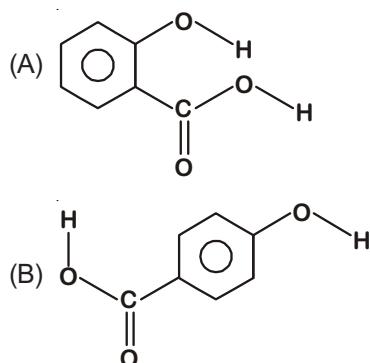
Chemical Bonding and Molecular Structure

1. Using MO theory predict which of the following species has the shortest bond length?
[AIIEEE-2009]
- (1) O_2^+ (2) O_2^-
(3) O_2^{2-} (4) O_2^{2+}
2. At $25^\circ C$, the solubility product of $Mg(OH)_2$ is 1.0×10^{-11} . At which pH, will Mg^{2+} ions start precipitating in the form of $Mg(OH)_2$ from a solution of 0.001 M Mg^{2+} ions?
[AIIEEE-2010]
- (1) 8 (2) 9
(3) 10 (4) 11
3. In which of the following pairs the two species are not isostructural?
[AIIEEE-2012]
- (1) PCl_4^+ and $SiCl_4$ (2) PF_5 and BrF_5
(3) AlF_6^{3-} and SF_6 (4) CO_3^{2-} and NO_3^-
4. ortho-Nitrophenol is less soluble in water than p - and m - Nitrophenols because
[AIIEEE-2012]
- (1) o - Nitrophenol shows Intramolecular H - bonding
(2) o - Nitrophenol shows Intermolecular H - bonding
(3) Melting point of o - Nitrophenol is lower than those of m - and p - isomers
(4) o - Nitrophenol is more volatile in steam than those of m - and p - isomers
5. Which one of the following molecules is expected to exhibit diamagnetic behaviour?
[JEE (Main)-2013]
- (1) C_2 (2) N_2
(3) O_2 (4) S_2
6. In which of the following pairs of molecules/ions, both the species are not likely to exist?
[JEE (Main)-2013]
- (1) H_2^+, He_2^{2-} (2) H_2^-, He_2^{2-}
(3) H_2^{2+}, He_2 (4) H_2^-, He_2^{2+}
7. Stability of the species Li_2 , Li_2^- and Li_2^+ increases in the order of
[JEE (Main)-2013]
- (1) $Li_2 < Li_2^+ < Li_2^-$ (2) $Li_2^- < Li_2^+ < Li_2$
(3) $Li_2 < Li_2^- < Li_2^+$ (4) $Li_2^- < Li_2 < Li_2^+$
8. For which of the following molecule significant $\mu \neq 0$?
[JEE (Main)-2014]
- (a) 
(b) 
(c) 
(d) 
- (1) Only (a)] (2) (a) and (b)
(3) Only (c) (4) (c) and (d)
9. The species in which the N atom is in a state of sp hybridization is
[JEE (Main)-2016]
- (1) NO_2^- (2) NO_3^-
(3) NO_2 (4) NO_2^+
10. Which of the following species is not paramagnetic?
[JEE (Main)-2017]
- (1) O_2 (2) B_2
(3) NO (4) CO
11. According to molecular orbital theory, which of the following will not be a viable molecule?
[JEE (Main)-2018]
- (1) He_2^{2+} (2) He_2^+
(3) H_2^- (4) H_2^{2-}

12. Which of the following compounds contain(s) no covalent bond(s)? **[JEE (Main)-2018]**
 KCl, PH₃, O₂, B₂H₆, H₂SO₄
 (1) KCl, B₂H₆, PH₃
 (2) KCl, H₂SO₄
 (3) KCl
 (4) KCl, B₂H₆
13. Total number of lone pair of electrons in I₃⁻ ion is **[JEE (Main)-2018]**
 (1) 3 (2) 6
 (3) 9 (4) 12
14. According to molecular orbital theory, which of the following is true with respect to Li₂⁺ and Li₂⁻? **[JEE (Main)-2019]**
 (1) Li₂⁺ is unstable and Li₂⁻ is stable
 (2) Li₂⁺ is stable and Li₂⁻ is unstable
 (3) Both are stable
 (4) Both are unstable
15. In which of the following processes, the bond order has increased and paramagnetic character has changed to diamagnetic? **[JEE (Main)-2019]**
 (1) N₂ → N₂⁺ (2) O₂ → O₂⁺
 (3) O₂ → O₂²⁻ (4) NO → NO⁺
16. The type of hybridisation and number of lone pair(s) of electrons of Xe in XeOF₄, respectively, are **[JEE (Main)-2019]**
 (1) sp³d and 2 (2) sp³d² and 2
 (3) sp³d² and 1 (4) sp³d and 1
17. Two pi and half sigma bonds are present in **[JEE (Main)-2019]**
 (1) O₂⁺ (2) O₂
 (3) N₂⁺ (4) N₂
18. The correct statement about ICl₅ and ICl₄⁻ is **[JEE (Main)-2019]**
 (1) ICl₅ is square pyramidal and ICl₄⁻ is tetrahedral.
 (2) Both are isostructural.
 (3) ICl₅ is square pyramidal and ICl₄⁻ is square planar.
 (4) ICl₅ is trigonal bipyramidal and ICl₄⁻ is tetrahedral.
19. The ion that has sp³d² hybridization for the central atom, is **[JEE (Main)-2019]**
 (1) [ICl₂]⁻ (2) [IF₆]⁻
 (3) [BrF₂]⁻ (4) [ICl₄]⁻
20. Among the following molecules/ions, C₂²⁻, N₂²⁻, O₂²⁻, O₂
 Which one is diamagnetic and has the shortest bond length? **[JEE (Main)-2019]**
 (1) O₂ (2) O₂²⁻
 (3) N₂²⁻ (4) C₂²⁻
21. Among the following, the molecule expected to be stabilized by anion formation is **[JEE (Main)-2019]**
 C₂, O₂, NO, F₂
 (1) F₂ (2) NO
 (3) C₂ (4) O₂
22. HF has highest boiling point among hydrogen halides, because it has **[JEE (Main)-2019]**
 (1) Strongest hydrogen bonding
 (2) Lowest dissociation enthalpy
 (3) Strongest van der Waals' interactions
 (4) Lowest ionic character
23. Among the following species, the diamagnetic molecule is **[JEE (Main)-2019]**
 (1) CO (2) NO
 (3) O₂ (4) B₂
24. During the change of O₂ to O₂⁻, the incoming electron goes to the orbital **[JEE (Main)-2019]**
 (1) π2p_x (2) π*2p_x
 (3) π2p_y (4) σ*2p_z
25. The relative strength of interionic/intermolecular forces in decreasing order is **[JEE (Main)-2020]**
 (1) ion-ion > ion-dipole > dipole-dipole
 (2) ion-dipole > dipole-dipole > ion-ion
 (3) ion-dipole > ion-ion > dipole-dipole
 (4) dipole-dipole > ion-dipole > ion-ion
26. The number of possible optical isomers for the complexes MA₂B₂ with sp³ and dsp² hybridized metal atom, respectively, is
 Note : A and B are unidentate neutral and unidentate monoanionic ligands, respectively. **[JEE (Main)-2020]**
 (1) 2 and 2 (2) 0 and 2
 (3) 0 and 1 (4) 0 and 0

27. The bond order and the magnetic characteristics of CN^- are [JEE (Main)-2020]
- $2\frac{1}{2}$, paramagnetic
 - 3, diamagnetic
 - $2\frac{1}{2}$, diamagnetic
 - 3, paramagnetic
28. The predominant intermolecular forces present in ethyl acetate, a liquid, are [JEE (Main)-2020]
- Dipole-dipole and hydrogen bonding
 - London dispersion and dipole-dipole
 - Hydrogen bonding and London dispersion
 - London dispersion, dipole-dipole and hydrogen bonding
29. Arrange the following bonds according to their average bond energies in descending order [JEE (Main)-2020]
- C – Cl, C – Br, C – F, C – I
- $\text{C} - \text{Cl} > \text{C} - \text{Br} > \text{C} - \text{I} > \text{C} - \text{F}$
 - $\text{C} - \text{Br} > \text{C} - \text{I} > \text{C} - \text{Cl} > \text{C} - \text{F}$
 - $\text{C} - \text{F} > \text{C} - \text{Cl} > \text{C} - \text{Br} > \text{C} - \text{I}$
 - $\text{C} - \text{I} > \text{C} - \text{Br} > \text{C} - \text{Cl} > \text{C} - \text{F}$
30. If the magnetic moment of a dioxygen species is 1.73 B.M, it may be [JEE (Main)-2020]
- O_2^- or O_2^+
 - O_2 , O_2^- or O_2^+
 - O_2 or O_2^+
 - O_2 or O_2^-
31. 'X' melts at low temperature and is a bad conductor of electricity in both liquid and solid state. X is [JEE (Main)-2020]
- Zinc sulphide
 - Carbon tetrachloride
 - Mercury
 - Silicon carbide
32. If AB_4 molecule is a polar molecule, a possible geometry of AB_4 is [JEE (Main)-2020]
- Tetrahedral
 - Rectangular planar
 - Square pyramidal
 - Square planar
33. The dipole moments of CCl_4 , CHCl_3 and CH_4 are in the order : [JEE (Main)-2020]
- $\text{CCl}_4 < \text{CH}_4 < \text{CHCl}_3$
 - $\text{CHCl}_3 < \text{CH}_4 = \text{CCl}_4$
 - $\text{CH}_4 = \text{CCl}_4 < \text{CHCl}_3$
 - $\text{CH}_4 < \text{CCl}_4 < \text{CHCl}_3$
34. Match the type of interaction in column A with the distance dependence of their interaction energy in column B
- | A | B |
|-------------------------|---------------------|
| (i) ion-ion | (a) $\frac{1}{r}$ |
| (ii) dipole-dipole | (b) $\frac{1}{r^2}$ |
| (iii) London dispersion | (c) $\frac{1}{r^3}$ |
| | (d) $\frac{1}{r^6}$ |
- [JEE (Main)-2020]
35. The molecular geometry of SF_6 is octahedral. What is the geometry of SF_4 (including lone pair(s) of electrons, if any)? [JEE (Main)-2020]
- Tetrahedral
 - Trigonal bipyramidal
 - Square planar
 - Pyramidal
36. The shape / structure of $[\text{XeF}_5]^-$ and XeO_3F_2 , respectively, are [JEE (Main)-2020]
- Pentagonal planar and trigonal bipyramidal
 - Trigonal bipyramidal and pentagonal planar
 - Octahedral and square pyramidal
 - Trigonal bipyramidal and trigonal bipyramidal
37. If the boiling point of H_2O is 373 K, the boiling point of H_2S will be [JEE (Main)-2020]
- Less than 300 K
 - More than 373 K
 - Equal to 373 K
 - Greater than 300 K but less than 373 K
38. Of the species, NO , NO^+ , NO^{2+} and NO^- , the one with minimum bond strength is [JEE (Main)-2020]
- NO^-
 - NO^{2+}
 - NO^+
 - NO

39. Consider the following molecules and statements related to them



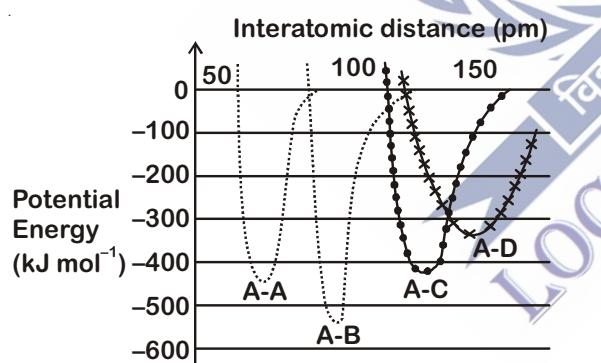
- (a) (B) is more likely to be crystalline than (A)
 - (b) (B) has higher boiling point than (A)
 - (c) (B) dissolves more readily than (A) in water

Identify the correct option from below

[JEE (Main)-2020]

- (1) (a) and (c) are true
 - (2) Only (a) is true
 - (3) (b) and (c) are true
 - (4) (a) and (b) are true

40. The intermolecular potential energy for the molecules A, B, C and D given below suggests that



- (1) A-B has the stiffest bond

(2) A-D has the shortest bond length

(3) A-A has the largest bond enthalpy

(4) D is more electronegative than other atoms

41. The potential energy curve for the H_2 molecule as a function of internuclear distance is

[JEE (Main)-2020]

- A graph illustrating the potential energy of a diatomic molecule as a function of internuclear distance. The vertical axis is labeled "Energy" with an upward-pointing arrow, and the horizontal axis is labeled "Internuclear distance" with a rightward-pointing arrow. The curve starts at a high energy value on the y-axis and decreases monotonically as the internuclear distance increases, asymptotically approaching zero.

- (2) Energy

A graph with 'Energy' on the vertical axis and 'Internuclear distance' on the horizontal axis. The curve starts at a minimum and increases asymptotically towards a maximum.

- A graph illustrating the potential energy of a diatomic molecule as a function of the internuclear distance between its two nuclei. The vertical axis is labeled "Energy" with an upward-pointing arrow, and the horizontal axis is labeled "Internuclear distance" with a rightward-pointing arrow. The curve starts at a high energy level for small internuclear distances, representing repulsion between nuclei. It then drops to a minimum value, indicating the most stable state of the molecule, before rising again as the nuclei are pushed too far apart, representing the onset of another form of repulsion or the breaking of the bond.

- A graph illustrating the potential energy of a diatomic molecule as a function of internuclear distance. The vertical axis is labeled '(4) Energy' with an upward-pointing arrow. The horizontal axis is labeled 'Internuclear distance' with a rightward-pointing arrow. The curve starts at a minimum energy point, rises to a peak, and then falls back towards the baseline.