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Chemistry

PV-DPS-CHE-188

Daily Practice Sheet

Class XI | Chapter 4: Chemical Bonding and Molecular Structure

Released: 07 July 2026

15 Questions · **45 minutes** · **60 Marks**

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Total Questions	**15**	**Time Allowed**	**45 minutes**
Maximum Marks	**60**	**Difficulty**	**Easy / Medium / Hard**

Instructions

1. All questions are compulsory.
2. Each question carries **4 marks**.
3. There is **no negative marking**.
4. Write the final answer in the space provided or mark the correct option.
5. Time: **45 minutes**.

Questions

1. **Explain the formation of an ionic bond using the example of NaCl. Discuss the factors that favour the formation of ionic bonds.**

   (i) Define ionic bond (electrovalent bond).

   (ii) Show the formation of NaCl using Lewis dot symbols.

   (iii) State the factors that favour the formation of ionic bonds.

   (iv) Arrange the following in order of increasing ionic character: LiCl, NaCl, KCl, RbCl.

2. **Explain the formation of a covalent bond using the concept of orbital overlap. Distinguish between sigma (σ) and pi (π) bonds.**

   (i) Define covalent bond. Explain with the example of H_2 formation.

   (ii) What is a sigma (σ) bond? Give an example.

   (iii) What is a pi (π) bond? Give an example.

(iv) Why is a π bond weaker than a σ bond?

3. Write the Lewis dot structures for the following molecules/ions. Also state the formal charge on each atom where applicable:

(i) CO_2

(ii) NH_3

(iii) H_2O

(iv) NO_3^-

4. State the VSEPR theory. Predict the shapes of the following molecules based on the number of electron pairs around the central atom:

(i) $BeCl_2$

(ii) BF_3

(iii) CH_4

(iv) NH_3

5. Using VSEPR theory, predict the shapes of the following molecules that have lone pairs on the central atom:

(i) H_2O

(ii) SF_4

(iii) ClF_3

(iv) XeF_4

6. Explain the main postulates of Valence Bond Theory (VBT). How does it explain the formation of covalent bonds?

(i) State the main postulates of VBT.

(ii) Explain the formation of H_2 molecule using VBT.

(iii) What is meant by the directional nature of covalent bonds?

(iv) How does VBT explain the bond angle in H_2O (104.5°)?

7. What is hybridization? Explain sp, sp^2, and sp^3 hybridization with suitable examples.

(i) Define hybridization. State the conditions for hybridization.

(ii) Describe sp hybridization with the example of $BeCl_2$ or C_2H_2.

(iii) Describe sp^2 hybridization with the example of BF_3 or C_2H_4.

(iv) Describe sp^3 hybridization with the example of CH_4 or NH_3.

8. Explain sp^3d and sp^3d^2 hybridization with suitable examples. What are the resulting geometries?

(i) Describe sp^3d hybridization with the example of PCl_5.

(ii) What is the geometry of PCl_5? Describe the axial and equatorial bonds.

(iii) Describe sp^3d^2 hybridization with the example of SF_6.

(iv) What is the geometry of SF_6? How many σ bonds are present?

9. State the main postulates of Molecular Orbital Theory (MOT). How does it differ from Valence Bond Theory?

(i) State the main postulates of MOT.

(ii) What are bonding and antibonding molecular orbitals? How are they formed?

(iii) Define bond order. Write the formula for bond order.

(iv) How does MOT explain the paramagnetic nature of O_2?

10. Draw the molecular orbital energy level diagram for O_2 and N_2. Calculate their bond orders and predict magnetic behaviour.

(i) Draw the MO diagram for N_2 and calculate its bond order.

(ii) Draw the MO diagram for O_2 and calculate its bond order.

(iii) Why is O_2 paramagnetic while N_2 is diamagnetic?

(iv) Compare the bond order and bond length of O_2, O_2^+, O_2^-, and O_2^{2-}.

11. Define the following bond parameters and explain the factors affecting them: bond length, bond angle, bond enthalpy, and bond order.

(i) Define bond length. How does it vary with bond order?

(ii) Define bond angle. What factors affect bond angle?

(iii) Define bond enthalpy. How does it relate to bond strength?

(iv) Arrange the following in order of increasing bond length: $C-C$, $C=C$, $C\equiv C$.

12. Define dipole moment. How is it used to determine the polarity of molecules? Explain with examples.

(i) Define dipole moment (μ). Write its formula and SI unit.

(ii) What is the dipole moment of CO_2? Explain why.

(iii) Why does H_2O have a dipole moment while CO_2 has zero dipole moment?

(iv) Arrange the following in order of increasing dipole moment: CH_4, NH_3, H_2O, HF.

13. What is resonance? Explain the concept of resonance structures with suitable examples. How does resonance stabilize a molecule?

(i) Define resonance. What are canonical structures?

(ii) Draw the resonance structures of CO_3^{2-} (carbonate ion).

(iii) Draw the resonance structures of benzene (C_6H_6).

(iv) How does resonance affect bond length? Explain with the example of O_3 (ozone).

14. What is hydrogen bonding? Explain the types of hydrogen bonding with examples. How does it affect physical properties?

(i) Define hydrogen bond. What are the conditions for hydrogen bonding?

(ii) Distinguish between intermolecular and intramolecular hydrogen bonding with examples.

(iii) Why does water have a higher boiling point than H_2S?

(iv) Explain why HF has a higher boiling point than HCl.

15. Solve the following problems on chemical bonding:

(i) Predict the hybridization and shape of XeF_2 using VSEPR theory.

(ii) Calculate the bond order of He_2 using MOT. Is He_2 stable?

(iii) Which has a higher bond dissociation energy: N_2 or O_2? Explain using MOT.

(iv) Arrange the following in order of increasing bond strength: F_2, Cl_2, Br_2, I_2.

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Answer Key

Q. No.	Answer
1	(i) Ionic bond: complete transfer of electrons from one atom to another, forming ions held by electrostatic attraction. (ii) Na $\rightarrow$ $Na^+ + e^-$; Cl + e^- $\rightarrow$ Cl^-; $Na^+ + Cl^- \rightarrow$ NaCl. (iii) Factors: low ionization enthalpy of metal, high electron gain enthalpy of non-metal, high lattice energy. (iv) LiCl $<$ NaCl $<$ KCl $<$ RbCl (ionic character increases down group as cation size increases)
2	(i) Covalent bond: sharing of electrons between atoms. H_2: each H has 1 electron, share to achieve duplet. (ii) σ bond: formed by end-to-end overlap along internuclear axis; e.g., H_2 ($1s - 1s$ overlap). (iii) π bond: formed by sidewise overlap of p orbitals above and below internuclear axis; e.g., $C = C$ in ethene. (iv) π bond has lesser overlap area than σ bond, so it is weaker
3	(i) CO_2: $O = C = O$ (linear, no formal charge). (ii) NH_3: H-N-H with one lone pair on N (trigonal pyramidal). (iii) H_2O: H-O-H with two lone pairs on O (bent). (iv) NO_3^-: N with three O atoms, one $N = O$ double bond, two $N - O^-$ single bonds; resonance hybrid; formal charge on N = $+1$, on double-bonded O = 0, on single-bonded O = -1
4	(i) $BeCl_2$: 2 bond pairs, 0 lone pairs; linear (180°). (ii) BF_3: 3 bond pairs, 0 lone pairs; trigonal planar (120°). (iii) CH_4: 4 bond pairs, 0 lone pairs; tetrahedral (109.5°). (iv) NH_3: 3 bond pairs, 1 lone pair; trigonal pyramidal (107°)
5	(i) H_2O: 2 bond pairs, 2 lone pairs; bent/V-shaped (104.5°). (ii) SF_4: 4 bond pairs, 1 lone pair; see-saw shape. (iii) ClF_3: 3 bond pairs, 2 lone pairs; T-shaped. (iv) XeF_4: 4 bond pairs, 2 lone pairs; square planar
6	(i) Postulates: (1) Covalent bond formed by overlap of half-filled atomic orbitals; (2) Overlap must be with opposite spins; (3) Greater overlap $\rightarrow$ stronger bond; (4) Bond is directional along overlap axis. (ii) H_2: two H atoms with $1s^1$ each, overlap with opposite spins forms σ bond. (iii) Directional nature arises because p and d orbitals have specific orientations in space. (iv) H_2O: O has sp^3 hybridization with 2 lone pairs; lone pair–lone

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