

Chemical Bonding and Molecular Structure — Assignment 1

Class 11 Chemistry · Topic-wise question bank covering every concept of the chapter · Narayan Gurukul Academy

Instructions: (1) Attempt all questions. This worksheet walks through every concept of the chapter, topic by topic.
(2) The interactive MCQ version of these questions (with instant answer reveal) is available on the notes page.
(3) Universal values: $g = 10 \text{ m/s}^2$ unless stated. Give answers with correct SI units.

Octet Rule and Lewis Structures

MCQ Questions (choose the correct option)

- According to the octet rule, an atom tends to have
 - eight electrons in its outermost shell
 - two electrons in its outermost shell
 - no electrons
 - eighteen electrons
- A Lewis structure represents
 - the valence electrons of atoms in a molecule
 - only the nucleus
 - the neutrons
 - the mass number
- The octet rule is violated by the molecule
 - BF_3
 - CH_4
 - H_2O
 - NH_3
- In a Lewis dot structure, a shared pair of electrons represents
 - a covalent bond
 - an ionic bond
 - a lone pair
 - a double bond

1 Mark Questions

- State the octet rule.
- What is a Lewis dot structure?
- Name one molecule that does not obey the octet rule.

2 Mark Questions

- State the octet rule and its two main limitations.
- Draw the Lewis structure of the water molecule showing lone pairs.

3 Mark Questions

- State the octet rule and explain its limitations with the help of BF_3 and PCl_5 .
- Explain the formation of a covalent bond in the H_2 molecule using Lewis dot structures.

Ionic (Electrovalent) Bond

MCQ Questions (choose the correct option)

1. An ionic bond is formed by
 - (A) the transfer of electrons
 - (B) the sharing of electrons
 - (C) overlap of orbitals
 - (D) resonance
2. The compound formed between a metal and a non-metal is usually
 - (A) ionic
 - (B) covalent
 - (C) metallic
 - (D) coordinate
3. Lattice enthalpy of an ionic compound depends on
 - (A) the charges of the ions and the distance between them
 - (B) the colour of the ions
 - (C) the mass of the ions
 - (D) the number of neutrons
4. Ionic compounds conduct electricity
 - (A) in molten state or in solution
 - (B) in solid state
 - (C) never
 - (D) only when heated to a gas

1 Mark Questions

1. What is an ionic bond?
2. Why do ionic compounds have high melting points?
3. State one property of ionic compounds.

2 Mark Questions

1. Explain the formation of an ionic bond between sodium and chlorine giving the Lewis structures.
2. Explain why ionic compounds conduct electricity in the molten state but not in the solid state.

3 Mark Questions

1. Explain the formation of NaCl and MgO by the transfer of electrons and discuss the factors affecting lattice enthalpy.
2. Define lattice enthalpy and discuss the factors on which it depends, giving examples.

Covalent Bond and Polarity**MCQ Questions (choose the correct option)**

1. A covalent bond is formed by
 - (A) the sharing of a pair of electrons
 - (B) the transfer of electrons
 - (C) the attraction of opposite charges
 - (D) metallic bonding
2. A bond formed between two identical atoms is

- (A) non-polar covalent
 - (B) polar covalent
 - (C) ionic
 - (D) coordinate
3. The polarity of a bond is measured by
- (A) the difference in electronegativity of the atoms
 - (B) the bond length
 - (C) the mass of atoms
 - (D) the bond order
4. A coordinate bond is one in which
- (A) both electrons of the shared pair come from one atom
 - (B) electrons are transferred
 - (C) electrons are unequally shared
 - (D) there is no sharing
5. Which molecule is non-polar despite having polar bonds?
- (A) CO_2
 - (B) H_2O
 - (C) NH_3
 - (D) HCl

1 Mark Questions

1. Define a covalent bond.
2. What is a coordinate bond?
3. Why is the HCl molecule polar?

2 Mark Questions

1. Explain the formation of a covalent bond in the Cl_2 molecule.
2. Distinguish between a polar and a non-polar covalent bond with examples.

3 Mark Questions

1. Explain the formation of a coordinate bond in the ammonium ion and the formation of a covalent bond in water, showing the Lewis structures.
2. Explain how the difference in electronegativity leads to polar and non-polar bonds, giving examples of each.

VSEPR Theory — Molecular Shapes

MCQ Questions (choose the correct option)

1. VSEPR theory is used to predict
 - (A) the shape of a molecule
 - (B) the bond order
 - (C) the lattice energy
 - (D) the magnetic moment
2. According to VSEPR theory, the shape of a molecule depends on
 - (A) the repulsion between electron pairs around the central atom
 - (B) the mass of the central atom

- (C) the colour of the molecule
 - (D) the number of neutrons
3. The shape of the methane (CH_4) molecule is
- (A) tetrahedral
 - (B) square planar
 - (C) trigonal planar
 - (D) linear
4. The shape of the ammonia (NH_3) molecule is
- (A) trigonal pyramidal
 - (B) trigonal planar
 - (C) tetrahedral
 - (D) linear
5. The shape of the water (H_2O) molecule is
- (A) bent (V-shaped)
 - (B) linear
 - (C) tetrahedral
 - (D) trigonal planar

1 Mark Questions

1. State the basis of VSEPR theory.
2. Predict the shape of the CH_4 molecule.
3. Predict the shape of the NH_3 molecule.

2 Mark Questions

1. State VSEPR theory and explain the shapes of CH_4 and NH_3 .
2. Predict and explain the shape of the H_2O molecule using VSEPR theory.

3 Mark Questions

1. Explain VSEPR theory and use it to predict and explain the shapes of BF_3 , CH_4 , NH_3 and H_2O .
2. Explain the order of repulsion between lone pair–lone pair, lone pair–bond pair and bond pair–bond pair, and use it to account for the shapes of NH_3 and H_2O .

Hybridisation of Atomic Orbitals

MCQ Questions (choose the correct option)

1. Hybridisation is the
 - (A) mixing of atomic orbitals of nearly equal energy
 - (B) transfer of electrons
 - (C) addition of protons
 - (D) splitting of a nucleus
2. The hybridisation in the methane (CH_4) molecule is
 - (A) sp^3
 - (B) sp^2
 - (C) sp
 - (D) sp^3d

3. The hybridisation of carbon in ethyne (C_2H_2) is

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

4. The number of sp^2 hybrid orbitals is

- (A) 3
- (B) 2
- (C) 4
- (D) 5

5. The hybridisation in the BF_3 molecule is

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

1 Mark Questions

1. Define hybridisation.
2. What is the hybridisation of carbon in CH_4 ?
3. How many sp hybrid orbitals are formed from one s and one p orbital?

2 Mark Questions

1. Define hybridisation and explain sp^3 hybridisation with the methane molecule.
2. Explain sp^2 hybridisation using the BF_3 molecule.

3 Mark Questions

1. Explain the concept of hybridisation and describe sp , sp^2 and sp^3 hybridisation with one example each.
2. A molecule has a central atom with four bond pairs and no lone pairs. Identify its hybridisation and shape and explain with an example.

Bond Parameters, Resonance and Bond Order

MCQ Questions (choose the correct option)

1. Bond order is defined as
 - (A) half the difference between the number of bonding and antibonding electrons
 - (B) the number of bonds
 - (C) the bond length
 - (D) the bond enthalpy
2. As bond order increases, bond length
 - (A) decreases
 - (B) increases
 - (C) stays the same
 - (D) becomes zero
3. Resonance occurs when
 - (A) a single Lewis structure cannot describe a molecule

- (B) there is no bonding
 - (C) electrons are transferred
 - (D) the molecule is linear
4. The bond order of the oxygen molecule (O_2) is
- (A) 2
 - (B) 1
 - (C) 3
 - (D) 1.5
5. Bond enthalpy generally
- (A) increases with bond order
 - (B) decreases with bond order
 - (C) is independent of bond order
 - (D) is always zero

1 Mark Questions

1. Define bond order.
2. What is resonance?
3. How is bond order related to bond length?

2 Mark Questions

1. Define bond order and explain how it is related to bond length and bond enthalpy.
2. Explain resonance with the example of the carbonate (CO_3^{2-}) ion.

3 Mark Questions

1. Define bond order. Calculate the bond order of O_2 , O_2^- and O_2^{2-} using molecular orbital theory, and arrange them in order of bond length.
2. Explain the concepts of bond length, bond enthalpy, bond order and resonance, and show how they are related, using examples.