

## Polarity Chemistry Questions with Solutions

**Q-1:** Polarity in a molecule arises due to \_\_\_\_\_.

- a) No difference in electronegativity between the bonded atoms
- b) Non -zero electric dipole moment
- c) No electric dipole moment
- d) Same atoms being bonded together

**Answer: b)** Non -zero electric dipole moment

Explanation: A molecule must have a non-zero or permanent electric dipole moment in order to be polar.

**Q-2:** Which of the following liquids dissolve in each other?

- a) Toluene + Water
- b) Toluene + Benzene
- c) Both a) and b)
- d) Water + Benzene

**Answer: b)** Toluene + Benzene

Explanation: Because toluene and benzene are both nonpolar, they dissolve in each other in accordance to dissolve like principle.

**Q-3:**  $C_2H_5OH$  is the chemical formula for ethanol. Which of these two atom's bonds in this compound is the least polar?

- a) C-H
- b) O-H
- c) C-O
- d) C-C

**Answer: d)** C-C

Explanation: Polarity in a bond is caused by electronegativity differences between the bonded atoms. The greater the difference in electronegativity, the greater the polarity. Because both bonded atoms in a C-C bond are the same, there is no difference in electronegativity between them. Hence, the C-C bond is the least polar bond.

**Q-4:** Dipole moment is the measure of \_\_\_\_\_ in a molecule.

- a) Electronegativity difference
- b) Polarity
- c) Charge separation
- d) Bond strength

**Answer: b) Polarity**

Explanation: The dipole moment is a measure of the polarity of chemical bonds that exist between two atoms in a molecule. The separation of negative and positive charge occurs during the dipole moment.

**Q-5:** What can you say about the polarity of  $\text{BrF}_5$ ?

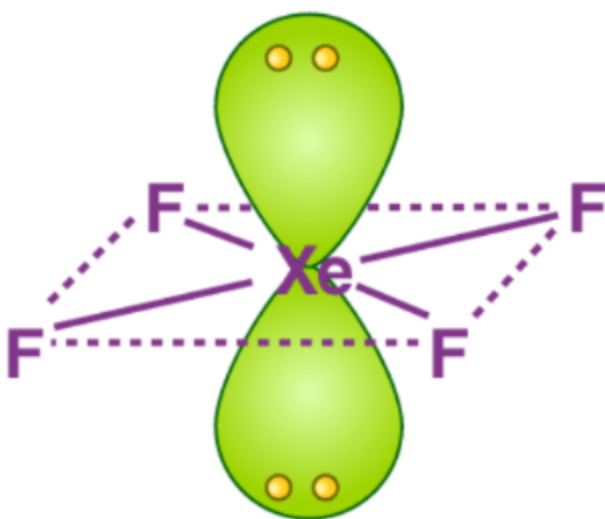
**Answer:** The molecular geometry of bromine pentafluoride is square pyramidal. The presence of a lone pair creates an unbalanced region of negative charge. As a result of its structural asymmetry, it is a polar molecule.

**Q-6:** What is the polarity and molecular shape of xenon tetrafluoride?

- a) Square pyramidal, non polar
- b) Square planar, non polar
- c) Tetrahedral, non polar
- d) Tetrahedral, polar

**Answer: b) Square planar, non polar**

Explanation: The structure of xenon tetrafluoride is given below:



To predict the molecular shape, we must first determine the steric number of the xenon atom.

Steric number = Number of lone pairs on Xe-atom + Number of sigma bonds made by Xe

Steric number =  $2+4=6$

A steric number of 6 corresponds to the hybridisation  $sp^3d^2$ , which corresponds to the square planar shape according to VSEPER.

The structure clearly shows that the dipole moment of all the Xe-F bonds will be nullified, and the lone pairs will also cancel out each other, resulting in a nonpolar molecule.

**Q-7:** What best describes the molecule  $\text{H}_2\text{S}$  in terms of polarity?

- a) A nonpolar molecule with polar covalent bonds.
- b) A polar molecule composed of nonpolar covalent bonds.
- c) A polar molecule composed of polar covalent bonds.
- d) A nonpolar molecule with nonpolar covalent bonds.

**Answer: c)** A polar molecule composed of polar covalent bonds.

Explanation:  $\text{H}_2\text{S}$  is a polar molecule due to its bent geometrical structure, and the small difference in electronegativity between hydrogen(2.1) and sulphur(2.5) results in a non-zero dipole moment. Polar covalent bonds are formed when atoms with slightly different electronegativity values come together.

**Q-8:** Why are some solutes soluble in water while others are soluble in cyclohexane?

**Answer:** Only polar solutes are soluble in polar water because their polarities are identical. Similarly nonpolar solutes are soluble in nonpolar cyclohexane because their polarities are the same.

**Q-9:** Arrange the following bonds in the order of increasing polarity.

C-H, F-H, N-H, O-H

**Answer:** C-H<N-H<O-H<F-H

Explanation: The greater the difference in electronegativity between the bonded atoms, the greater the polarity. Check the electronegative order of C,F,N, and O because H is common in all. The greater the electronegativity, the greater the electronegativity difference. Fluorine has the highest electronegative potential, while carbon has the lowest. As a result, the correct sequence is C-H<N-H<O-H<F-H.

**Q-10:** Which of the following atoms, when bonded to a fluorine atom, produces the highest degree of polarity?

- a) Sulphur
- b) Hydrogen
- c) Carbon
- d) Oxygen

**Answer: b)** Hydrogen

Explanation: We know that the greater the electronegativity difference in the bonded atoms, the greater the degree of polarity. When fluorine is bonded to hydrogen, the electronegativity difference is 1.9. Hence, the H-F bond produces the highest degree of polarity.

**Q-11:** What are some of the properties of water determined by its polarity?

**Answer:** Water has high cohesion properties due to its polarity, which means it sticks strongly to similar molecules. It is referred to as the universal solvent because it can dissolve anything found in nature due

to its polar nature. Water capillary action through bloodstreams and plant roots is also enabled by polarity.

**Q-12:** Is  $\text{CH}_4$  polar or nonpolar molecule?

**Answer:** Because  $\text{CH}_4$  has symmetrical tetrahedral geometry, it has a zero dipole moment and is thus nonpolar.

**Q-13:** Which of the following statements is correct?

1. If the diatomic molecule's bond is polar, it is polar.
2. The polarity of the molecule has a significant impact on physical properties such as boiling point.

**Answer:** Both the statements are true.

**Explanation:** If the bond between the bonded atoms is polar, the molecule is said to be polar. The boiling point of a molecule is directly proportional to its polarity. The greater the polarity, the greater the boiling point.

**Q-14:** Which of the following is the polar molecule?

- a) Carbon Dioxide
- b) Beryllium chloride
- c) Sulphur dioxide
- d) All of the above

**Answer:** c) Sulphur dioxide

**Explanation:** Sulphur dioxide is polar. Because of the "bent" molecular geometry, the molecule has a nonzero dipole moment. Since it has a dipole moment, it is polar in nature.

**Q-15:** What is the polarity of the acetone molecule? What functional group is present in it?

**Answer:** Acetone ( $\text{CH}_3\text{COCH}_3$ ) is a polar substance due to polarity in the carbonyl group caused by the difference in electronegativity of oxygen and carbon atoms. Ketone ( $-\text{CO}$ ) functional group is present in it.

## Practise Questions on Polarity

**Q-1:** Which of the following ionic bonds has the highest degree of polarity?

- a) Li-O
- b) Li-F
- c) K-Cl
- d) K-Br

**Answer:** b) Li-F

Explanation: Polarity in a bond is caused by electronegativity differences between the bonded atoms. The greater the difference in electronegativity, the greater the polarity.

The below table shows the electronegativity values and the electronegativity difference:

Element	Electronegativity value	Molecule	Electronegativity Difference
Li	1.0	Li-O	2.5
F	4.0	Li-F	3
Cl	3.0	K-Cl	2.2
Br	2.8	K-Br	2.0
O	3.5		
K	0.8		

From the table above, we can conclude that the Li-F bond is most polar as it has a large electronegativity difference.

**Q-2:** How could the  $\text{BeCl}_2$  bonds be classified based on bond polarity?

- a) polar covalent
- b) nonpolar covalent
- c) ionic
- d) covalent

**Answer:** b) nonpolar covalent

Explanation: Because the molecule has linear geometry, its dipole moments are nullified. As a result, it's a nonpolar molecule. Beryllium forms single covalent bonds with two chlorine atoms in the  $\text{BeCl}_2$  molecule by sharing one valence electron with each chlorine atom.

**Q-3:** In the following diatomic molecules, identify the end of the molecule that is positive relative to the other end?

- a) BrF
- b) ICl
- c) HF

**Answer:**

- a) Because Br is less electronegative than F, it is the positive end.
- b) Because I is less electronegative than Cl, it will act as the positive end.

c) Because H has less electronegativity than F, it will act as the positive end.

**Q-4:** What is the significance of the dipole moment in water molecules?

**Answer:** Polarity is provided by the dipole moment in the water molecule. And this polarity characterises many properties of water molecules, including cohesion, adhesion, good solvent, water capillary action, surface tension, and a high dielectric constant.

**Q-5:** Predict the  $C_2H_2$  molecule's shape and polarity.

**Answer:** To predict the molecular shape, we must first determine the steric number of the carbon atom.

Steric number = Number of lone pairs on C-atom + Number of sigma bonds made by Carbon

$$= 0+2$$

$$= 2$$

A steric number of 2 corresponds to the hybridisation  $sp$ , which corresponds to the linear shape according to VSEPER.

$C_2H_2$  molecule exists as  $CH\equiv CH$ , with zero dipole moment. Hence it is non polar.