II. Short Answer Type Questions

Question 1. What is an electrovalent (or ionic) bond? Explain its formation with two examples.

Answer: When a chemical bond is formed by the complete transfer of electrons from one atom to another, so as to complete their outermost shell and therefore, aquire the stable noble gas configuration, the bond formed is called ionic bond or electrovalent bond.

For Example,

(*i*) Formation of sodium chloride (NaCl)

$$\underset{2,8,1}{Na} \longrightarrow \underset{2,8}{Na^+} + e^-$$

$$\underset{2,8,7}{Cl} + e^- \longrightarrow \underset{2,8,8}{[Cl]^-}$$

$$Na^+ + Cl^- \longrightarrow [Na^+]\,[Cl]^-$$

$$\underset{(2,8,1)}{Na^{\cdot}} + \underset{(2,8,7)}{\cdot\ddot{Cl}:} \longrightarrow \underset{(2,8)}{Na^+} \quad \underset{(2,8,8)}{:\ddot{Cl}:^-}$$

(*ii*) Formation of magnesium oxide (MgO)

$$\underset{2,8,2}{Mg:} \quad \underset{2,6}{\ddot{O}:} \longrightarrow \underset{2,8}{[Mg]^{2+}} \quad \underset{2,8}{[:\ddot{O}:]^{2-}}$$

or MgO

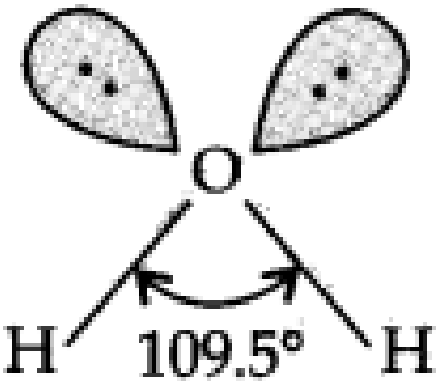
Question 2. What are Lewis structures? Write the Lewis structure of H_2, BeF_2 and H_2O.

Answer: The outer shell electrons are shown as dots surrounding the symbol of the atom. These symbols are known as Lewis symbols or Lewis structures.

H_2 — H:H

BeF_2 — :F:Be:F:

H_2O —



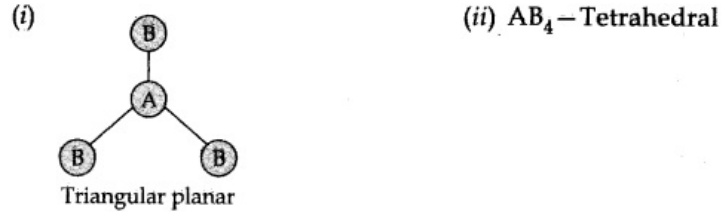
Question 3. Define Lattice energy. How is Lattice energy influenced by (i) Charge on the ions (ii) Size of the ions?

Answer: Lattice energy is defined as the energy released when one

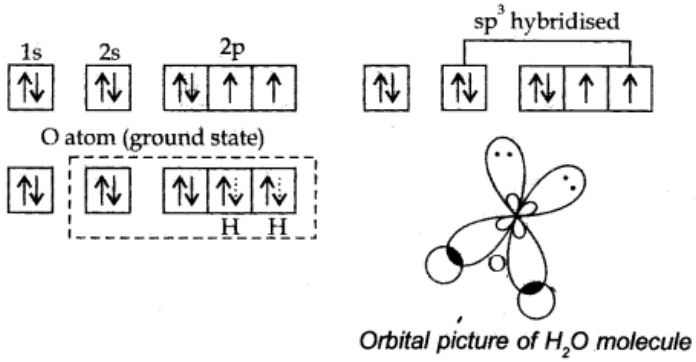
mole of crystalline solid is formed by the combination of oppositely charged ions.
(i) As the magnitude of charge on an ion increases there will be greater force of interionic attraction and hence greater will be the value of Lattice energy,
(ii) Smaller the. size of the ions> lower will be the intemuclear distance and thus greater will be the Lattice energy,

Question 4. Give the shapes of the following molecules:
(i) AB_3 (ii) AB_4

Answer:



Question 5. Define Hybridisation. Explain sp hybridisation with suitable example.
Answer:
Hybridisation: It is the phenomenon of intermixing of atomic orbitals of slightly different energies to form new hybrid orbitals of equivalent energy,
Formation of water. In water (H_2O) > the atomic number of oxygen is 8 and its orbitals electronic configuration
is $1s^2\ 2s^2\ 2p_x^2\ 2p_y^1\ 2p_z^1$.The oxygen atom is also SP^3 hybridised. However, in this case, the two orbitals with one electron each (half filled) are involved in overlap With the hydrogen orbitals.

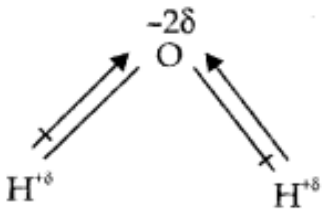


Question 6. Account for the following:
(i) Water is a liquid while H_2S is a gas
(ii) NH_3 has higher boiling point than PH_3.
Answer:
(i) In case of water hydrogen bonding causes association of the H_2O molecules. There is no such hydrogen bonding in H_2S, that's why it is a gas.
(ii) There is hydrogen bonding in NH_3 but not in PH_3.

Question 7. What do you mean by Dipole moment? Draw the dipole diagram of H_2O.
Answer: The product of magnitude of charges (+ve, or -ve) and distance between them is called dipole moment. It is usually denoted by .

$$\mu = Q \times d$$

Its SI unit is Debye.



$$\mu = 1.84 \text{ D}$$

Question 8. What are the main postulates of Valence Shell Electron Pair Repulsion (VSEPR) theory?
Answer:

- The shape of a molecule depends upon the no. of electron pairs around the central atom.
- There is a repulsive force between the electron pairs, which tend to repel one another.
- The electron pairs in space tend to occupy such positions that they are at maximum distance so, that the repulsive force will be minimum.
- A multiple bond is treated as if it is single bond and the remaining electron pairs which constitute the bond may be regarded as single super pair.

Question 9. Define bond order. How is it related to the stability of a molecule?
Answer:
Bond order is defined as half of the difference between the number of electrons present in bonding and antibonding molecular orbitals.
Bond order (B.O.) = $1/2[N_b - N_a]$ z
If the bond order is positive ($N_b > N_a$), the molecule or ion will be stable. If it is negative ($N_b < N_a$) the molecule or ion will be unstable.

Question 10. Explain the diamagnetic behaviour of P_2 molecule on the basis of molecular orbital theory.
Answer:
The orbital electronic configuration of fluorine (Z = 9)

$$= 1s^2\, 2s^2\, 2p_x^2\, 2p_y^2\, 2p_z^1$$

M.O.E.C. of fluorine $= [\sigma 2s]^2[\sigma^* 2s]^2[\sigma 2p_z]^2[\pi^2 p_x]^2[\pi 2p_y]^2[\pi^* 2p_x]^2[\pi^* 2p_y]^2$

Due to presence of all filled orbitals, F_2 is diamagnetic.

********** END **********