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TEXTBOOK QUESTIONS SOLVED

Question 1. Explain the formation of a chemical bond.
Answer: According to Kossel and Lewis, atoms combine together in order to complete their respective octets so as to acquire the stable inert gas configuration. This can occur in two ways; by transfer of one or more electrons from one atom to other or by sharing of electrons between two or more atoms.

Question 2. Write Lewis dot symbols for atoms of the following elements: Mg, Na, B, O, N, Br.
Answer:

$_{12}Mg$ = 2, 8, 2 ∴ Lewis symbol = $\dot{M}g\cdot$

$_{11}Na$ = 2, 8, 1 ∴ Lewis symbol = $\dot{N}a$

$_{5}B$ = 2, 3 ∴ Lewis symbol = $\cdot\dot{B}\cdot$

$_{8}O$ = 2, 6 ∴ Lewis symbol = $:\ddot{O}:$

$_{7}N$ = 2, 5 ∴ Lewis symbol = $:\dot{\underset{\cdot}{N}}\cdot$

$_{35}Br$ = 2, 8, 18, 7 ∴ Lewis symbol = $:\ddot{\underset{\cdot\cdot}{B}}r\cdot$

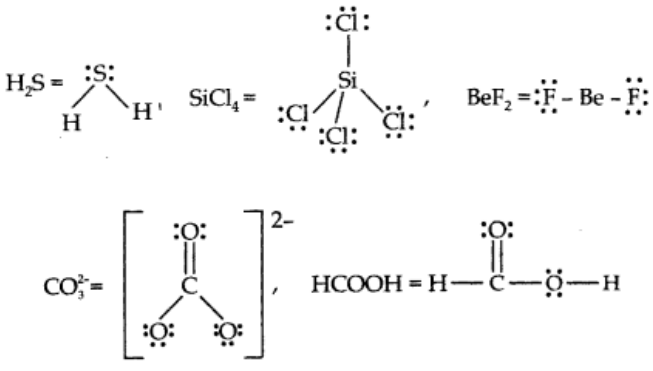
Question 3. Write Lewis symbols for the following atoms and ions: S and S^{2-} ; Al and Al^{3+}; H and H^-
Answer:

$_{16}S$ = 2, 8, 6 ∴ Lewis symbol = $:\ddot{S}:$, S^{2-} ions = $[:\ddot{\underset{\cdot\cdot}{S}}:]^{2-}$

$_{13}Al$ = 2, 8, 3 ∴ Lewis symbol = $\cdot\dot{A}l\cdot$, Al^{3+} ion = $[Al]^{3+}$

$_{1}H$ = 1 ∴ Lewis symbol = $H\cdot$, H^- ion = $\dot{H}\cdot$

Question 4. Draw the Lewis structures for the following molecules and ions:
H_2S, $SiCl_4$, BeF_2, CO_3^{2-}, HCOOH
Answer:



Question 5. Define Octet rule. Write its significance and limitations.

Answer:
Octet rule: Atoms of elements combine with each other in order to complete their respective octets so as to acquire the stable gas configuration.
Significance: It helps to explain why different atoms combine with each other to form ionic compounds or covalent compounds.
Limitations of Octet rule:

- According to Octet rule, atoms take part in chemical combination to achieve the configuration of nearest noble gas elements. However, some of noble gas elements like Xenon have formed compounds with fluorine and oxygen. For example: XeF_2, XeF_4 etc. Therefore, validity of the octet rule has been challenged.
- This theory does not account for shape of molecules.

Question 6. Write the favourable factors for the formation of ionic bond.
Answer:

1. Low ionization enthalpy of metal atoms
2. High electron gain enthalpy of non-metal atoms
3. High lattice enthalpy of compound formed.

Question 7. Discuss the shape of the following molecules using the VSEPR model:
$BeCl_2$, BCl_3 , $SiCl_4$, AsF_5, H_2S, PH_3
Answer:

(*i*) $BeCl_2$ = Cl: Be: Cl.
The central atom has only two bond pairs and there is no lone pair, *i.e.*, it is of the type AB_2. Hence, shape is **linear.**

(*ii*) BCl_3 = Cl :B: Cl.
The central atom has only 3 bond pairs and no lone pair, *i.e.*, it is of the type AB_3. Hence, shape is **triangular planar.**

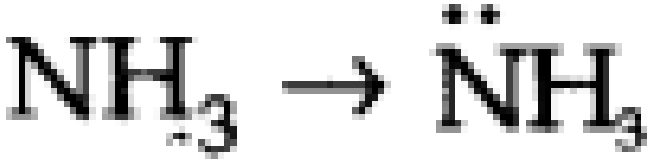
(*iii*) $SiCl_4$ = Cl:Si:Cl (Cl above Si, Cl below Si)
Bond pairs = 4, lone pairs = 0, *i.e.*, it is of the type AB_4.
Hence, shape is **Tetrahedral.**

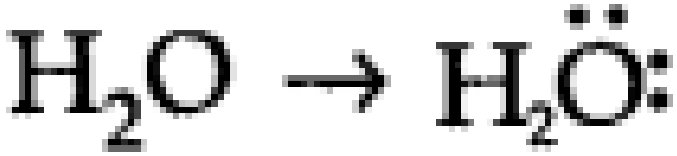
(*iv*) AsF_5 = F:As:F (F, F above As; F below As)
Bond pairs = 5, lone pairs = 0, *i.e.*, it is of the type AB_5.
Hence, shape is **Trigonal bipyramidal.**

(*v*) H_2S = H:S:H
Bond pairs = 2, lone pairs = 2, *i.e.*, it is of the type AB_2L_2.
Hence, shape is **Bent/V-shaped.**

(*vi*) PH_3 = H:P:H (H above P)
Bond pairs = 3, lone pair = 1, *i.e.*, it is of the type AB_3L.
Hence, shape is **Trigonal.**

Question 8. Although geometries of NH_3 and H_20 molecules are distorted tetrahedral, bond angle in water is less than that of ammonia. Discuss.
Answer:





Because of two lone pairs of electrons on O-atom, repulsion on

bond pairs is greater in H_2O in comparison to NH_3. Thus, the bond angle is less in H_2O molecules.

Question 9. How do you express the bond strength in terms of bond order?
Answer: Bond strength is directly proportional to the bond order. Greater the bond order, more is the bond strength.

Question 10. Define the bond-length.
Answer: Bond-length: It is the equilibrium distance between the nuclei of two bonded atoms in a molecule. Bond-lengths are measured by spectroscopic methods.

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