CHEMISTRY

BOOKS - NAGEEN CHEMISTRY (ENGLISH)

CHEMICAL BONDING AND MOLECULAR STRUCTURE

Example

1. Give the Lewis structures and empirical formulae of the ionic compounds formed by the combination of the following pairs of elements:

$(i) K. F$

$(ii) Mg, O$

$(iii) Na, S$

$(iv) Al, P$

$(v) Ba. Br$

$(vi) Al, F$

Watch Video Solution

2. Calculate the heat of formation of NaCl from the following data:

Heat of sublimation of sodium = $108.5 kJ mol^{-1}$

Dissociation energy of chlorine = $243.0 kJ mol^{-1}$

Ionisation energy of sodium = 495.8 kJ mol^{-1}

Electron gain enthalpy of chlorine $= -348.8 kJ mol^{-1}$

Lattice energy of sodium chloride $= -758.7 kJ mol^{-1}$.

Watch Video Solution

3. Write the state of hybridisation of sulphur in SO_2

Watch Video Solution

4. Write the state of hybridisation of boron in BCl_3

Watch Video Solution

5. Write the state of hybridisation of sulphur in SO_2

Watch Video Solution

6. Write the state of hybridisation of nitrogen in NH_4^+ ion

Watch Video Solution

7. Write the state of hybridisation of

iodine in IF_7

Watch Video Solution

8. Write the state of hybridisation of

chlorine in CIF_3

Watch Video Solution

Review Exercises

1. Why do atoms combine together ?

Watch Video Solution

2. Give the lewis structures and the formulae of the ionic compound formed by the combination of the following pairs of elements :

Na,I

Watch Video Solution

3. Give the lewis structures and the formulae of the ionic compound formed by the combination of the following pairs of elements :

Ca,O

Watch Video Solution

4. Give the lewis structures and the formulae of the ionic compound formed by the combination of the following pairs of elements :

K,S

Watch Video Solution

5. Give the lewis structures and the formulae of the ionic compound formed by the combination of the following pairs of elements :

Mg ,N

Watch Video Solution

6. Discuss the feasibility of the formation of an ionic bond if

IE of electropositive atom is high and EA of electronegative atom is low

Watch Video Solution

7. Discuss the feasibility of the formation of an ionic bond if

IE of electropositive atom is low and EA of electronegative atom is high

Watch Video Solution

8. Discuss the feasibility of the formation of an ionic bond if

both the atoms are of equal electronegativities.

Watch Video Solution

9. Write the electron dot structures of the following compounds:

MgO, M_gBr_2, KBr, Na_2S and Al_2O_3

Watch Video Solution

10. Explain why

ionic compounds possess very high melting and boiling points?

Watch Video Solution

11. Explain why

ionic compounds are soluble in water but insoluble in organic solvents?

Watch Video Solution

12. Explain why

ionic compounds are hard and brittle?

Watch Video Solution

13. Explain why

An ionic bond cannot be formed between theatoms of the same element?

Watch Video Solution

14. Explain why

lonic reactions are very fast.

Watch Video Solution

15. What is octet rule? illustrate it with some examples.

Watch Video Solution

16. Write Lewis structures of the following species :

$Cl^-, O_2^-, N_3^-, S^{2-}$

Watch Video Solution

17. Explain the formation of CaF_2 molecule.

Watch Video Solution

18. What type of elements do form ionic bonds and why?

Watch Video Solution

19. What do you understand by variable electrovalency? Give atleast two examples.

Watch Video Solution

20. What are the optimum conditions for the formation of a covalent bond?

Watch Video Solution

21. Explain the formation of following molecules :

$PCl_3, CH_4, H_2O, PH_3, OF_2, C_2H_6$

Watch Video Solution

22. What do you understand by covalency? Find the covalency of the underlined element in the

following compounds :

$H_2, \underline{O}$

Watch Video Solution

23. What do you understand by covalency? Find the covalency of the underlined element in the following compounds :

$\underline{N}H_3$

Watch Video Solution

24. What do you understand by covalency? Find the covalency of the underlined element in the following compounds :

$\underline{C_2}H_2$

Watch Video Solution

25. What do you understand by covalency? Find the covalency of the underlined element in the following compounds :

$\underline{N_2}$

Watch Video Solution

26. How would you explain the variable covalency of chlorine? Explain giving electronic configuration.

Watch Video Solution

27. Phosphorus exhibits a covalency of 3 in PCI_3 while of 5 in PCI_5. How would account for this observation?

Watch Video Solution

28. Explain the following:

Covalent solids are usually soft.

Watch Video Solution

29. Explain the following:

Covalent compounds are insoluble in water.

Watch Video Solution

30. Explain the following:

Covalent compounds do not conduct electric current in the fused state, whereas ionic solids do.

Watch Video Solution

31. The solubility product of silver chloride is 1×10^{-10} at $25^{\circ} C$. Calculate the solubility of silver chloride in 0.1 M sodium chloride.

Watch Video Solution

32. Identify the atoms in each of the following compounds which do not obey the octet rule:

NH_3

Watch Video Solution

33. Identify the atoms in each of the following compounds which do not obey the octet rule:

BeF_2

Watch Video Solution

34. Identify the atoms in each of the following compounds which do not obey the octet rule:

BCl_3

Watch Video Solution

35. Identify the atoms in each of the following compounds which do not obey the octet rule:

SF_6

Watch Video Solution

36. Identify the atoms in each of the following compounds which do not obey the octet rule:

PCl_5

Watch Video Solution

37. Draw the Lewis structures of the following species :

$CH_3CH_2CH_3$

Watch Video Solution

38. Draw the Lewis structures of the following species :

H_2S

Watch Video Solution

39. Draw the Lewis structures of the following species :

$SiCl_4$

Watch Video Solution

40. Draw the Lewis structures of the following species :

BCl_3

Watch Video Solution

41. Explain the structures of PCl_5 and SF_6 with in the framework of octet rule.

Watch Video Solution

42. What are the factors which favour the formation of a covalent bond? Explain.

Watch Video Solution

43. On the basis of the structures, predict which of the following molecules are polar?

$H_2O, CO_2, BeCl_2, PH_3, CH_4, CCl_4, SO_2.$

Watch Video Solution

44. The observed dipole moment of HCl is 1.03 D. If the H-Cl bond length is 1.275 Å, calculate the per cent ionic character in HCI.

Watch Video Solution

45. What inferences would you derive from the following observations?

dipole moment of BF_3 is zero.

Watch Video Solution

46. What inferences would you derive from the following observations?

dipole moment of H_2O is 1.85 D.

Watch Video Solution

47. Compare the dipole moments of the compounds in the following pairs.

HF, HCl

Watch Video Solution

48. Compare the dipole moments of the compounds in the following pairs.

$CHCl_3, CCl_4$

Watch Video Solution

49. Compare the dipole moments of the compounds in the following pairs.

NH_3, PH_3

Watch Video Solution

50. Compare the dipole moments of the compounds in the following pairs.

CO_2, SO_2

Watch Video Solution

51. What do you understand by polarisation of an anion and when does it take place?

Watch Video Solution

52. Which is more soluble in pyridine than in water?

A. A. LiCl

B. B. NaCl

C. C. KCl

D. D. CsCl

Answer:

Watch Video Solution

53. Why is CuCl more covalent than NaCl?

Watch Video Solution

54. State and explain Fajan's rules.

Watch Video Solution

55. Why is MgCl2 more soluble in water than $AICI_3$?

Watch Video Solution

56. In each of the following pairs, which is more covalent and why?

LiCl and LiBr

Watch Video Solution

57. In each of the following pairs, which is more covalent and why?

LiCl and Lil

Watch Video Solution

58. In each of the following pairs, which is more covalent and why?

AgCl and KCl

Watch Video Solution

59. Describe the formation of a coordinate bond.

Watch Video Solution

60. Give the electron dot structure of the following compounds :

$SO_2, H_2SO_4, HNO_3, HClO_2$ and $HClO_4$

Watch Video Solution

61. Why is a coordinate bond also called a semipolar bond?

Watch Video Solution

62. Why is a coordinate bond also called a semipolar bond?

Watch Video Solution

63. Discuss the important characteristics of coordinate compounds.

Watch Video Solution

64. Explain why glycerol $(CH_2OH.CHOH - CH_2OH)$ is more viscous than ethyl alcohol (C_2H_5OH)?

Watch Video Solution

65. Among covalent bond and hydrogen bond, which bond has a higher bond length?

Watch Video Solution

66. Explain why hydrogen bonding does not exist in HCI although Cl is quite electronegative?

Watch Video Solution

67. Liquids generally have lower density as compared to solids but you must have observed

that ice floatis on water. Find out/why.

Watch Video Solution

68. Water has maximum density at 4°C.

Watch Video Solution

69. Which of the following substances have abnormally high boiling points and why?

$H_2S, H_2O, HF, HI, CH_4, C_2H_5OH.$

Watch Video Solution

70. On the basis of VSEPR theory, predict the shapes of the following molecules :

$SiCl_4$

Watch Video Solution

71. On the basis of VSEPR theory, predict the shapes of the following molecules :

H_2S

Watch Video Solution

72. On the basis of VSEPR theory, predict the shapes of the following molecules :

$HgBr_2$

Watch Video Solution

73. On the basis of VSEPR theory, predict the shapes of the following molecules :

PH_3

Watch Video Solution

74. Which of the following molecules possess a triangular planar geometry?

$BeCl_2, BCl_3, H_2O, NH_3$

Watch Video Solution

75. Explain why :

NH_3 has a bond angle equal to 107° ?

Watch Video Solution

76. Explain why :

Lone pair-lone pair repulsion is more than the bond pair-bond pair repulsion?

Watch Video Solution

77. Explain why :

H_2O molecule is not linear although it is of the type AB_2.

Watch Video Solution

78. On the basis of VSEPR theory predict the bond angles in the following molecules.

$BeCl_2, PH_3, OF_2, BF_3, SiH_4$

Watch Video Solution

79. Compare the H-N-H bond angle in the following species.

NH_3, NH_4^+, NH_2^-

Watch Video Solution

80. Why is the potential energy of the system minimum at the stage of formation of a covalent bond?

Watch Video Solution

81. Discuss the formation of H_2 molecule on the basis of Valence-bond theory.

Watch Video Solution

82. What do you understand by overlapping of orbitals? Discuss the overlapping of p-orbitals.

Watch Video Solution

83. What is meant by σ and π it bonds? Compare their characteristics.

Watch Video Solution

84. Describe the formation of HF and NH_3 molecules on the basis of valence bond theory.

Watch Video Solution

85. Explain why He_2 molecule does not exist.

Watch Video Solution

86. Describe the formation of H_2O molecule on the basis of valence bond theory.

Watch Video Solution

87. What are the limitations of valence bond theory?

Watch Video Solution

88. Sketch the shapes of the molecular orbitals formed by the overlap of (a) s-orbitals (b) end on overlap of two p-orbitals (c) side wise overlap of two p-orbitals. Name the orbitals formed in each case.

Watch Video Solution

89. Explain bonding and antibonding molecular orbitals.

Watch Video Solution

90. Compare atomic orbitals with molecular orbitals.

Watch Video Solution

91. What is bond order? How is it related to bond length and bond dissociation energy?

Watch Video Solution

92. Why are the bond orders in He_2^+ and He identical?

Watch Video Solution

93. Draw the MO diagram for the O_2 molecule and determine the bond order and the magnetic character.

Watch Video Solution

94. Write the ground state electronic configuration of F_2^+.

Watch Video Solution

95. Write the MO electronic configuration of a diatomic molecule having a bond order of three.

Watch Video Solution

96. Write the molecular orbital configuration of the following species :

$(a) N_2 \quad (b) N_2^+ \quad (c) N_2^- \quad (d) N_2^{2-}$

(i) Calculate their bond orders.

(ii) Predict their magnetic behaviour.

(iii) Which of these does show highest paramagnetism?

Watch Video Solution

97. Write the molecular orbital configuration of the following species :

$(a) O_2 \quad (b) O_2^- \quad (c) O_2^+ \quad (d) O_2^{2+}$

(i) Calculate their bond order.

(ii) Predict their magnetic behaviour.

(iii) Which of these does show highest paramagnetism?

Watch Video Solution

98. If Ψ_A and Ψ_B are the wave functions of two combining orbitals, what would be the wave functions of the molecular orbitals formed?

Watch Video Solution

99. How many molecular orbitals are formed by the combination of two lithium atoms?

Watch Video Solution

100. Label the molecular orbitals formed by the following combinations of atomic orbitals if Z-axis is the internuclear axis.

$1s - 1s$

Watch Video Solution

101. Label the molecular orbitals formed by the following combinations of atomic orbitals if Z-axis

is the internuclear axis.

$2p_x - 2p_x$

Watch Video Solution

102. Label the molecular orbitals formed by the following combinations of atomic orbitals if Z-axis is the internuclear axis.

$2p_z - 2P_z$

Watch Video Solution

103. Label the molecular orbitals formed by the following combinations of atomic orbitals if Z-axis is the internuclear axis.

$2p_y - 2P_y$

Watch Video Solution

104. If Z-axis is the internuclear axis, which of the following combinations are not permissible?

$1s - 1s$

Watch Video Solution

105. If Z-axis is the internuclear axis, which of the following combinations are not permissible?

$1s - 2p_z$

Watch Video Solution

106. If Z-axis is the internuclear axis, which of the following combinations are not permissible?

$2s - 2P_x$

Watch Video Solution

107. If Z-axis is the internuclear axis, which of the following combinations are not permissible?

$2p_x - 2p_y$

Watch Video Solution

108. If Z-axis is the internuclear axis, which of the following combinations are not permissible?

$2p_z - 2p_z$

Watch Video Solution

109. If Z-axis is the internuclear axis, which of the following combinations are not permissible?

$2p_x - 2p_x$

Watch Video Solution

110. Arrange the following species in the decreasing order of their bond dissociation energy.

$O_2, O_2^+, O_2^-, O_2^{2-}$

Watch Video Solution

111. Arrange the following species in the decreasing order of their bond dissociation energy :

$N_2, N_2^+, N_2^-, N_2^{2-}$

Watch Video Solution

112. Why is the bond energy of superoxide ion $\left(O_2^-\right)$ less than that of O_2 molecule?

Watch Video Solution

113. On the basis of molecular orbital theory predict which of the following is paramagnetic.

He_2 and He_2^+

Watch Video Solution

114. On the basis of molecular orbital theory predict which of the following is paramagnetic.

H_2 and H_2^+

Watch Video Solution

115. Why does N_2 possess a higher bond order than N_2^+ ion?

Watch Video Solution

116. Why is the bond energy of superoxide ion $\left(O_2^-\right)$ less than that of O_2 molecule?

Watch Video Solution

117. With the help of molecular orbital theory, predict which of the following species is

diamagnetic

$Li_2^+, O_2, O_2^+, O_2^{2-}$

Watch Video Solution

118. Explain the formation of following molecules :

$PCl_3, CH_4, H_2O, PH_3, OF_2, C_2H_6$

Watch Video Solution

119. What type of covalent bonds are formed during the overlapping of

s-s atomic orbitals?

Watch Video Solution

120. What type of covalent bonds are formed during the overlapping of

s-p atomic orbitals?

Watch Video Solution

121. What type of covalent bonds are formed during the overlapping of

p-p atomic orbitals?

Watch Video Solution

122. How many σ and π bonds are present in the following molecules?

C_2H_6 C_2H_4

C_2H_2 BF_3

Watch Video Solution

123. Arrange with explanation the following bonds in the increasing order of their bond length and bond energy:

$H-H$ $H-F$

$H - Cl \quad H - Br$

$H - I$

Watch Video Solution

124. What types of hybridisation are involved in the formation of following molecules?

C_2H_6

Watch Video Solution

125. What types of hybridisation are involved in the formation of following molecules?

C_2H_4

Watch Video Solution

126. What types of hybridisation are involved in the formation of following molecules?

C_2H_2

Watch Video Solution

127. What types of hybridisation are involved in the formation of following molecules?

$BeCl_2$

Watch Video Solution

128. What types of hybridisation are involved in the formation of following molecules?

BH_3

Watch Video Solution

129. Mention the geometrical shapes of the following molecules :

CH_4

Watch Video Solution

130. Mention the geometrical shapes of the following molecules :

NH_3

Watch Video Solution

131. Mention the geometrical shapes of the following molecules :

H_2O

Watch Video Solution

132. Mention the geometrical shapes of the following molecules :

BeF_2

Watch Video Solution

133. Mention the geometrical shapes of the following molecules :

BF_3

Watch Video Solution

134. Explain why C—C bond length in ethane is 154 pm while that in ethylene is 134 pm.

Watch Video Solution

135. Name the types of hybridisation which lead to the following geometries

Tetrahedral

Watch Video Solution

136. Name the types of hybridisation which lead to the following geometries

Square planar

Watch Video Solution

137. Name the types of hybridisation which lead to the following geometries

Octahedral

Watch Video Solution

138. Name the types of hybridisation which lead to the following geometries

Trigonal bipyramidal.

Watch Video Solution

139. How many hybrid orbitals will be formed if six orbitals of an atom take part in hybridisation?

Watch Video Solution

140. What is the percentage of s- character in sp, sp^2 and sp^3hybrid orbitals?

Watch Video Solution

141. Explain hybridisation in SF_6 molecule. What is the shape of this molecule?

Watch Video Solution

142. Write the state of hybridisation of carbon in CO_3^{2-} ion.

Watch Video Solution

143. Write the state of hybridisation of nitrogen in NO_3^- ion.

Watch Video Solution

144. Arrange the molecules H_2, O_2, F_2 and N_2 in the order of increasing bonds lengths.

Watch Video Solution

145. Define bond dissociation energy.

Watch Video Solution

146. State how the dissociation energy changes with the bond order?

Watch Video Solution

147. Write the state of hybridisation of carbon in CO_3^{2-} ion.

Watch Video Solution

148. Write the state of hybridisation of nitrogen in NO_3^- ion.

Watch Video Solution

149. Write the state of hybridisation of H_2O

Watch Video Solution

150. Write the state of hybridisation of boron in BF_4^- ion

Watch Video Solution

151. What type of hybridization is involved in PCI_5 ?

Watch Video Solution

152. Write the state of hybridisation of boron in BF_3.

Watch Video Solution

153. Write the state of hybridisation of boron in BCl_3

Watch Video Solution

154. Write the state of hybridisation of nitrogen in NH_4^+ ion

Watch Video Solution

155. Depict molecular orbital diagrams of H_2 and F_2^+ ion. Predict which one of the two species will be more stable.

Watch Video Solution

156. Write the electronic configuration of N_2, O_2, F_2 and Ne_2 molecular species.

Watch Video Solution

157. Write the electronic configuration for Scandium and Titanium.

Watch Video Solution

158. The energy of $\sigma 2p_z$, molecular orbital is greater than $\pi 2p_x$ and $\pi 2p_y$ molecular orbitals in nitrogen molecule. Write the complete sequence of energy levels in the increasing order of energy in the molecule. Compare the relative stability and the magnetic behaviour of the following species.

$N_2, N_2^+, N_2^-, N_2^{2+}$

Watch Video Solution

159. Why all P - F bonds in PF_5 are not equivalent?

Watch Video Solution

160. Which type of hybridisation explains the trigonal bipyramidal shape of SF_4?

Watch Video Solution

161. State the types of hybrid orbitals associated with

$P\text{in} \quad PCl_5$ and

Watch Video Solution

162. State the types of hybrid orbitals associated with

$S \text{ in } SF_6$

Watch Video Solution

163. Write the molecular orbital configuration of O_2^+ Calculate its bond order and predict its magnetic behaviour.

Watch Video Solution

Very Short Answer Type Questions

1. How many electrons are present in a sextet and in an octet?

Watch Video Solution

2. How many valence electrons do the atoms represented by following Lewis structures possess?

$\overset{*}{Li} \cdot \overset{*}{B} \cdot : \overset{* *}{O} : \underset{* *}{\overset{* *}{Ne}} :$

Watch Video Solution

3. Draw the Lewis symbols of the following elements.

Na, Ca, Br, Xe, As, Ge

Watch Video Solution

4. Draw the Lewis structures for the following molecules and ions and tell which do not follow the octet rule.

$F_2, PH_3, H_2S, SiCl_4, C_3H_8, F_2O, Na^+, Cl^-$

Watch Video Solution

5. What type of force does exist between two atoms in an ionic bond?

Watch Video Solution

6. Short out the most and the least electronegative atoms among the following:

Cl, Na, O, N, S, F, Cs

Watch Video Solution

7. What type of bonds are expected to be formed between atoms having electronegativity difference

equal to zero,

Watch Video Solution

8. What type of bonds are expected to be formed between atoms having electronegativity difference equal to 1.1,

Watch Video Solution

9. What type of bonds are expected to be formed between atoms having electronegativity difference equal to 2.0.

Watch Video Solution

10. Which property of water is helpful in the dissolution of an ionic solid in it?

Watch Video Solution

11. Why are the noble gases monoatomic?

Watch Video Solution

12. Define bond energy.

Watch Video Solution

13. Among NH_3 and PH_3 which is expected to have a higher dipole moment and why?

Watch Video Solution

14. Do van der Waals' forces exist between the atoms of noble gases?

Watch Video Solution

15. What is octet rule?

Watch Video Solution

16. What do you understand by lattice energy?

Watch Video Solution

17. The elements of which groups prefer to form cations?

Watch Video Solution

18. Do elements of groups 1 and 2 show variable electrovalency?

Watch Video Solution

19. Do ionic solids conduct electric current in the solid state?

Watch Video Solution

20. Define a covalent bond.

Watch Video Solution

21. How many covalent bonds are present in a molecule of ethylene?

Watch Video Solution

22. Which of the following elements does not show variable covalency?

Al, P, S, Cl

Watch Video Solution

23. What is the maximum covalency of sulphur?

Watch Video Solution

24. How many singlet linkages are present in the Sugden's structure of SF_6?

Watch Video Solution

25. When does a covalent bond acquire partial ionic character?

Watch Video Solution

26. When does an ionic bond develop a partial covalent character?

Watch Video Solution

27. Among AgCl and AgI, which is more covalent?

Watch Video Solution

28. Can a T-bond be formed without the formation of a σ-bond?

Watch Video Solution

29. What type of orbitals can overlap to form a covalent bond?

Watch Video Solution

30. What happens to the potential energy of the system when two atoms form a covalent bond?

Watch Video Solution

31. Is hybridisation between the orbitals of two atoms possible?

Watch Video Solution

32. What type of covalent bonds are formed during the overlapping of

p-p atomic orbitals?

Watch Video Solution

33. How many σ and π bonds are present in $CH_3 - CH = CH_2$?

Watch Video Solution

34. How much s and p characters are present in sp^3 hybrid orbitals?

Watch Video Solution

35. What type of hybridisation do you expect in the following molecules?

$BF_3,$ CH_4 $C_6H_6,$ BeF_2

Watch Video Solution

36. What type of hybridisation do you expect in the following molecules?

$BF_3,$ CH_4 $C_6H_6,$ BeF_2

Watch Video Solution

37. Illustrate the formation of H_3O^+

Watch Video Solution

38. What is a kernel and how is it formed?

Watch Video Solution

39. Does the presence of intermolecular hydrogen bonding affect the boiling point of a liquid?

Watch Video Solution

40. Why are the molecular orbitals regarded as polycentric?

Watch Video Solution

41. Among σ_{2s} and $simga_{2s}^{\cdot}$ molecular orbitals, which one is of lower energy?

Watch Video Solution

42. If Ψ_A and Ψ_B are the wave functions of two combining orbitals, what would be the wave functions of the molecular orbitals formed?

Watch Video Solution

43. What is the probability of finding electrons between the nuclei of the combining atoms in an antibonding molecular orbital?

Watch Video Solution

44. For a molecule, $N_b = N_a$, will the molecule be stable?

Watch Video Solution

45. How is bond length related to the bond order of the molecule?

Watch Video Solution

46. The bond order of He_2^+ ion is $\frac{1}{2}$Comment on its magnetic nature.

Watch Video Solution

47. What for does KK stand in the molecular orbital electronic configuration KK $(\sigma_{2s})^2$ for Li_2

molecule?

Watch Video Solution

48. How many orbitals are singly occupied in O_2 molecule ?

Watch Video Solution

49. Carbon atom possesses only two unpaired electrons. How is it able to show tetracovalency?

Watch Video Solution

50. What are the hybrid states of C atoms in alkanes, alkenes and alkynes?

Watch Video Solution

Short Answer Type Questions

1. Why do atoms combine together and form molecules?

Watch Video Solution

2. What types of bonds will be formed between the following pairs of elements and why? (a) K, CI (b) Ca, S (C)N, H (d) C, O

Watch Video Solution

3. What is lattice energy and how is it related to the stability of an ionic compound?

Watch Video Solution

4. Define electronegativity. How does it vary in the periodic table?

Watch Video Solution

5. Deduce the empirical formulae and draw the Lewis structures for the ionic compounds formed by the following pairs of elements. Na, O, K, S, Na, P, Mg, Br, Al, F,

Ca, O, Li, S

Watch Video Solution

6. Draw Lewis dot symbols for the element Argon.

Watch Video Solution

7. Draw the Lewis symbol for Calcium.

Will it form an ion? What is the expected charge on ion?

Watch Video Solution

8. Draw the lewis symbol for Nitrogen and Sulphur.

Watch Video Solution

9. Explain why

ionic compounds possess very high melting and boiling points?

Watch Video Solution

10. Give reasons why?

Ionic compounds are soluble in water

Watch Video Solution

11. Explain why

ionic compounds are hard and brittle?

Watch Video Solution

12. Why do covalent compounds exhibit stereoisomerism?

Watch Video Solution

13. What do you understand by bond length? On what factors does it depend?

Watch Video Solution

14. Carbon has four electrons in its valence shell. Which type of compounds can be formed by carbon atom and why ? Give any one example of such compounds.

Watch Video Solution

15. Why does a covalent bond develop a partial ionic character when the electronegativities of the combining atoms are different?

Watch Video Solution

16. You are given five neutral atoms A, B, C, D and E having the following electronic configuration :

$A - 1s^2 2s^2 2p^6 3s^2$, $B - 1s^2 2s^2 2p^6 3s^1$, $C - 1s^2 2s^2 2p^1$

$D - 1s^2 2s^2$, $E - 1s^2 2s^2 2p^6$

Write the empirical formulae for the substances containing:

A and D

Watch Video Solution

17. You are given five neutral atoms A, B, C, D and E having the following electronic configuration :

$A - 1s^2 2s^2 2p^6 3s^2$, $B - 1s^2 2s^2 2p^6 3s^1$, $C - 1s^2 2s^2 2p^1$

$D - 1s^2 2s^2$, $E - 1s^2 2s^2 2p^6$

Write the empirical formulae for the substances containing:

B and D

Watch Video Solution

18. You are given five neutral atoms A, B, C, D and E having the following electronic configuration :

$A - 1s^2 2s^2 2p^6 3s^2, B - 1s^2 2s^2 sp^6 3s^1, C - 1s^2 2s^2 2p^1$

$D - 1s^2 2s^2, E - 1s^2 2s^2 2p^6$

Write the empirical formulae for the substances containing:

only D

Watch Video Solution

19. You are given five neutral atoms A, B, C, D and E having the following electronic configuration :

$A - 1s^2 2s^2 2p^6 3s^2, B - 1s^2 2s^2 sp^6 3s^1, C - 1s^2 2s^2 2p^1$

$D - 1s^2 2s^2, E - 1s^2 2s^2 2p^6$

Write the empirical formulae for the substances

containing:

only E

Watch Video Solution

20. Why is ionic bond regarded as an extreme case of a polar covalent bond?

Watch Video Solution

21. Define bond energy. On what factors does it depend?

Watch Video Solution

22. Discuss the formation of MgO.

Watch Video Solution

23. Discuss the factors which govern the formation of an ionic bond.

Watch Video Solution

24. What do you understand by variable electrovalency? Give atleast two examples.

Watch Video Solution

25. What is inert pair effect? How does it account for the variable electrovalency of the elements having configuration of the type ns^2np^{1-4}.

Watch Video Solution

26. What is Born-Haber cycle? Explain with an example.

Watch Video Solution

27. What are the factors which favour the formation of a covalent bond? Explain.

Watch Video Solution

28. What do you understand by variable electrovalency? Give atleast two examples.

Watch Video Solution

29. What are Sidgwick's views regarding the failure of the octet rule?

Watch Video Solution

30. State and explain Fajan's rules.

Watch Video Solution

31. Define dipole moment. How is it related to the molecular structure?

Watch Video Solution

32. Write the resonating structures of O_3 and CO_2.

Watch Video Solution

33. What is lattice energy and how is it related to the stability of an ionic compound?

Watch Video Solution

34. Why do covalent compounds exhibit stereoisomerism?

Watch Video Solution

35. On the basis of VSEPR theory explain why $BeCl_2$ molecule is linear whereas H_2O is angular.

Watch Video Solution

36. What type of forces come into action when two atoms approach each other?

Watch Video Solution

37. Discuss how the valence bond theory explains the pyramidal shape of NH_3 molecule.

Watch Video Solution

38. Give two differences between a sigma bond and a pi bond.* *

Watch Video Solution

39. Draw the shapes of sp^3, sp^2 and sphybrid orbitals.

Watch Video Solution

40. Out of σ and π-bonds, which bond is stronger and why?

Watch Video Solution

41. Why are the molecules like He_2, H_3 and H_4 not formed?

Watch Video Solution

42. What do you understand by bond length? On what factors does it depend?

Watch Video Solution

43. Carbon possesses only two unpaired electrons in its valence shell. How does it show a covalency equal to four in most of its compounds?

Watch Video Solution

44. What are the conditions necessary for the formation of covalent molecules ? Give their properties.

Watch Video Solution

45. Why is a molecule involving sp^2 hybridisation trigonal and planar?

Watch Video Solution

46. Explain how the valence bond theory accounts for a carbon carbon double bond.

Watch Video Solution

47. Explain the formation of C_2H_2 molecule.

Watch Video Solution

48. Explain why the compounds of the type $C_2H_2X_2$ exhibit cis-trans isomerism.

Watch Video Solution

49. Why does a covalent bond develop a partial ionic character when the electronegativities of the combining atoms are different?

Watch Video Solution

50. How do the metals conduct heat and electricity?

Watch Video Solution

51. Explain why :

metals are malleable and ductile,

Watch Video Solution

52. Explain why :

sodium can be cut with a knife,

Watch Video Solution

53. Why is H_2O a liquid and H_2S a gas ?

Watch Video Solution

54. Explain why :

o-nitrophenol possesses low boiling point in spite of the presence of hydrogen bonding in it.

Watch Video Solution

55. What do you understand by overlap integral and what does it signify?

Watch Video Solution

56. State the salient features of molecular orbital theory.

Watch Video Solution

57. What are the main points of difference between inductive and electromeric effects ?

Watch Video Solution

58. What do you understand by linear combination of atomic orbitals?

Watch Video Solution

59. Explain bonding and antibonding molecular orbitals.

Watch Video Solution

60. What are the main points of difference between bonding and antibonding molecular orbitals?

Watch Video Solution

61. Give two differences between a sigma bond and a pi bond.* *

Watch Video Solution

62. Give the molecular orbital description of hydrogen molecule and deduce the bond order.

Watch Video Solution

63. Distinguish two aspects of bonding and antibonding molecular orbitals.

Watch Video Solution

64. Describe molecular orbital. How is it different from an atomic orbital?

Watch Video Solution

65. Explain why He_2 molecule does not exist.

Watch Video Solution

66. What do you understand by bond order and what does it signify?

Watch Video Solution

67. Why is bond order in H_2+ less than that in H_2?

Watch Video Solution

68. Explain on the basis of molecular orbital diagram why O_2 should be paramagnetic.

Watch Video Solution

69. Using molecular orbital diagram, arrange the following molecular species in the increasing order of their stabilities:

H_2, H_2^+ and H_2^-

Watch Video Solution

70. Which of the following species are paramagnetic?

H_2, H_2^+ and H_2^-

Watch Video Solution

71. With the help of molecular orbital approach show the Ne_2 cannot exist as a stable species.

Watch Video Solution

72. Arrange the following species in the decreasing order of their bond dissociation energy.

$O_2, O_2^+, O_2^-, O_2^{2-}$

Watch Video Solution

73. What are the main points of difference between valence bond and molecular orbital theories?

Watch Video Solution

74. Depict molecular orbital diagrams of N_2^+ and He_2^+ and predict which one of the two species will be more stable.

Watch Video Solution

75. Define hybridisation

Watch Video Solution

76. Give reason for the following: Bond order in N_2 is 3 whereas it is 2.5 in NO.

Watch Video Solution

Essay Long Answer Type Questions

1. What is an ionic bond and how is it formed? Illustrate your answer by atleast two examples.

Watch Video Solution

2. Define a covalent bond. Explain the formation of Cl_2, NH_3, O_2 and PCl_3 molecules. How does the multiplicity of bonds affect the bond length and bond energy?

Watch Video Solution

3. What is octet rule? Is it followed by all molecules? What type of exceptions have been observed to this rule? Illustrate your answer with examples.

Watch Video Solution

4. What do you understand by partial ionic character in a covalent bond? Give at least three examples of the compounds containing partially ionic covalent bonds.

Watch Video Solution

5. Define dipole moment. How is it related to the molecular structure?

Watch Video Solution

6. Explain why :

The dipole moment of CO_2 is zero although it contains electronegative oxygen atoms.

Watch Video Solution

7. Explain why :

Both BF_3 and NH_3 are the molecules of the type AB_3 but their dipole moments are not equal.

Watch Video Solution

8. Explain why :

dipole moment of H_2O is much higher than that of H_2S.

Watch Video Solution

9. What is the molarity of 1N H_2SO_4 solution?

Watch Video Solution

10. What do you understand by variable electrovalency? Give atleast two examples.

Watch Video Solution

11. What do you understand by covalency?The maximum covalency is equal to the number of?

Watch Video Solution

12. Compare the important properties of ionic and covalent compounds.

Watch Video Solution

13. Give some examples which illustrate the failure of the octet rule. What explanations have been suggested to explain the failure of the octet rule?

Watch Video Solution

14. What do you understand by partial ionic character in a covalent bond? Give at least three examples of the compounds containing partially ionic covalent bonds.

Watch Video Solution

15. When does an ionic bond develop a partial covalent character?

Watch Video Solution

16. What do you understand by polarisation? State and explain Fajan's rules.

Watch Video Solution

17. Define resonance and resonance energy. What are the conditions for resonance?

Watch Video Solution

18. State and explain the main postulates of VSEPR theory. How is this theory helpful in explaining the

geometry of the following molecules?

BeF_2, NH_3, H_2O, PCl_5 and SF_6.

Watch Video Solution

19. State and explain the main postulates of valence bond theory. How does this theory explain the shapes of the following molecules?

HF, N_2, H_2S and PH_3

Watch Video Solution

20. What do you understand by overlapping of orbitals? Discuss the overlapping of p-orbitals.

Watch Video Solution

21. What do you understand by hybridisation? Explain with examples the various types of hybridisation involving s and p-orbitals.

Watch Video Solution

22. Write the Lewis structures of the following molecules :

O_3, SO_2, SO_3

Watch Video Solution

23. What do you understand by partial ionic character in a covalent bond? Give at least three examples of the compounds containing partially ionic covalent bonds.

Watch Video Solution

24. Define dipole moment. How is it related to the molecular structure?

Watch Video Solution

25. Arrange on the basis of bond angle

NO3-, NO2- NO2. and NO2+

Watch Video Solution

26. Discuss the shape of the following molecules using the VSEPR model : $SiCl_4$, PCl_5

Watch Video Solution

27. What is hydrogen bonding and what are the conditions which favour its formation?

Watch Video Solution

28. Describe the salient features of valence bond theory. Explain the formation of H_2 molecule on the basis of this theory.

Watch Video Solution

29. State the salient features of molecular orbital theory.

Watch Video Solution

30. Describe molecular orbital. How is it different from an atomic orbital?

Watch Video Solution

31. What is LCAO method? How does it lead to the concept of bonding and antibonding molecular

orbitals? What are the main points of difference between bonding and antibonding molecular orbitals?

Watch Video Solution

32. What do you understand by an energy level diagram? Show the molecular orbitals formed by overlapping of 1s-, 2s- and 2p-atomic orbitals on an energy level diagram.

Watch Video Solution

33. What is bond order? How is it obtained from a MO diagram?

Watch Video Solution

34. Draw the molecular orbital diagrams of H_2, H_2^+ and H_2^- and discuss their relative stabilities.

Watch Video Solution

35. On the basis of molecular orbital theory, explain why He_2 does not exist whereas Hezexists?

Watch Video Solution

36. Draw the molecular orbital diagram of N_2 molecule and write its molecular orbital configuration. Calculate the bond order and discuss the extra stability and diamagnetic nature of the molecule.

Watch Video Solution

37. Draw the molecular orbital diagram of O_2 molecule. How would you explain the paramagnetic nature of the molecule on the basis of this diagram?

Watch Video Solution

38. What are the conditions of combination of atomic orbitals? Which species out of H_2, H_2^+ and H_2^- are paramagnetic and why?

Watch Video Solution

39. Write the molecular orbital configuration of the following species :

$(a) O_2 \quad (b) O_2^- \quad (c) O_2^+ \quad (d) O_2^{2+}$

(i) Calculate their bond order.

(ii) Predict their magnetic behaviour.

(iii) Which of these does show highest paramagnetism?

Watch Video Solution

40. Mention the main points of similarities and differences between valence bond and molecular

orbital theories.

Watch Video Solution

41. What do you understand by hybridisation? Discuss the need and rules of hybridisation.

Watch Video Solution

42. Explain :

The bond angle in methane is $109^{\circ}28'$.

Watch Video Solution

43. Explain :

Ethene is a planar molecule.

Watch Video Solution

44. Give reason for the following.

a) Covalent bonds are directional bonds while ionic bonds are non-directional.

b) Wate molecules has bent whereas carbon dioxide molecule is linear.

c) Ethyne molecule is linear.

Watch Video Solution

45. N_2 has greater bond energy than N_2^+ but O_2 has lower bond dissociation energy than O_2^+. Explain.

Watch Video Solution

Objective Multiple Choice Type Questions

1. During the formation of a chemical bond potential energy of the system

A. increases

B. decreases

C. neither increases nor decreases

D. remains constant.

Answer: B

Watch Video Solution

2. In a crystal cations and anions are held together by

A. electrons

B. electrostatic forces

C. nuclear forces

D. covalent bonds.

Answer: B

Watch Video Solution

3. Which of the following contains both covalent and ionic bonds?

A. CCl_4

B. $CaCl_2$

C. NH_4Cl

D. H_2O

Answer: C

Watch Video Solution

4. Among the following the one which is composed of all the three kinds of bond (ionic, covalent and coordinate bond) is :

A. Water

B. Ammonia

C. Sodium

D. Potassium bromide

Answer: C

Watch Video Solution

5. NH_3 and BF_3 form an adduct readily because they form

A. a coordinate bond

B. a covalent bond

C. an ionic bond

D. a hydrogen bond.

Answer: A

Watch Video Solution

6. The total number of electrons that take part in forming bonds in N_2 is

A. 2

B. 4

C. 6

D. 10

Answer: C

Watch Video Solution

7. KCl readily dissolves in water because

A. it is a salt of K

B. it reacts with water

C. it is an electrovalent compound

D. its ions are easily solvated.

Answer: D

Watch Video Solution

8. Which of the following is least ionic?

A. AgCl

B. KCl

C. $BaCl_2$

D. $CoCl_2$.

Answer: A

Watch Video Solution

9. A bond with maximum covalent character between nonmetallic elements is formed

A. between atoms of same size

B. between chemically similar atoms

C. between identical atoms

D. etween atoms of widely different.

Answer: C

Watch Video Solution

10. Element X is strongly electropositive and element Y is strongly electronegative. Both are univalent. The compound formed would be

A. $X^{+}Y^{-}$

B. $X^{-}Y^{+}$

C. $X - Y$

D. $X \rightarrow Y$

Answer: A

Watch Video Solution

11. Which of the following formula does not correctly represent the bonding capacity of the atom involved?

A. $\left[H - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{P}} - H \right]^{+}$

B. 

C. 

D. 

Answer: D

Watch Video Solution

12. Which one of the following molecules contain one lone pair of electrons on the central atom?

A. CH_4

B. NH_3

C. CCl_4

D. H_2O

Answer: B

Watch Video Solution

13. If the electron pair forming a bond between two atoms A and B is not in the centre, then the bond is

A. single bond

B. polar bond

C. non-polar bond

D. π-bond.

Answer: B

Watch Video Solution

14. Energy required to dissociate 4 g of gaseous hydrogen into free gaseous atoms is 208 k cal at $25^{\circ} C$. The bond energy of H-H bond will be

A. 104 kcal

B. 10.4 kcal

C. 1040 kcal

D. 1.04 kcal

Answer: A

Watch Video Solution

15. The molecule which does not exhibit net dipole moment is

A. NH_3

B. $CHCl_3$

C. H_2O

D. CCl_4

Answer: D

Watch Video Solution

16. Which bond angle would result in the maximum dipole moment for the triatomic molecule YXY ?

A. $\theta = 90^\circ$

B. $\theta = 120^\circ$

C. $\theta = 150^\circ$

D. $\theta = 180^\circ$

Answer: A

Watch Video Solution

17. The table shown lists the bond dissociation energies (E_{diss}) for single covalent bonds formed between carbon and atoms of elements A, B, C and D. Which element has the smallest atom?

(a)C

(b)D

(c)A

(d)B

A. C

B. D

C. A

D. B

Answer: B

Watch Video Solution

18. Which one of the following molecules does not possess a permanent electric dipole moment?

A. H_2S

B. SO_2

C. CS_2

D. SO_3

Answer: C

Watch Video Solution

19. Carbon suboxide (C_3O_2) has recently be shown as a component of the atmosphere of venus. Which of the following formulations represent the correct ground state Lewis structure for carbon suboxide?

A. 

B. 

C. 

D. 

Answer: C

Watch Video Solution

Watch Video Solution

20. Which of the following is planar?

A. $SiCl_4$

B. NF_3

C. SF_4

D. XeF_4

Answer: D

Watch Video Solution

21. The canonical or resonating structures of a molecule required to describe the structure of a molecule follow which of the following rules ?

A. identical arrangement of atoms

B. nearly the same energy content

C. same number of unpaired electrons

D. different number of unpaired electrons.

Answer: D

Watch Video Solution

22. The dipole moment of NF_3 is much less as compared to that of NH_3 because

A. 1. the size of N atom is much less than that of H atom

B. 2. F atom is more electronegative than N atom, whereas H atom is less electronegative than N atom

C. 3. unshared electron pair is not present in NF_3

D. 4. number of lone pairs in NF_3 is much greater than in NH_3.

Answer: B

Watch Video Solution

23. Which does not have zero value of dipole moment?

A. $\left[Ni(CN)_4\right]^{2-}$

B. $CHCl_3$

C. CO_2

D. NH_3

Answer: B

Watch Video Solution

24. Which of the following conditions does not apply to resonating structures?

A. The contributing structures should have the same or nearly same energies.

B. The contributing structures should be represented such that unlike charges reside on the atoms which are the farthest.

C. The electropositive atom should have positive charge and the electronegative atom the negative charge.

D. The contributing structures must have the same number of unpaired electrons.

Answer: B

Watch Video Solution

25. Resonance occurs due to

A. delocalisation of lone pair of electrons

B. delocalisation of σ-electrons

C. delocalisation of π-electrons

D. oscillation of a proton.

Answer: C

Watch Video Solution

26. Which of the following is not the characteristic of a white phosphorus (P_4) molecule?

A. Presence of six P-P single bonds

B. Presence of four P-P single bonds

C. Presence of four lone pairs of electrons

D. Presence of PPP angle of 60°

Answer: B

Watch Video Solution

27. The most unlikely representation of resonance structures of p-nitrophenoxide ion is :

A. 

B. 

C. 

D. 

Answer: C

Watch Video Solution

28. The correct order of decreasing bond lengths of CO, CO_2 and CO_3^{2-} is

A. $CO_3^{2-} < CO_2 < CO$

B. $CO_2 < CO_3^{2-} < CO$

C. $CO < CO_3^{2-} < CO_2$

D. $CO < CO_2 < CO_3^{2-}$

Answer: D

Watch Video Solution

29. The geometry of H_2S and its dipole moment are

A. angular and non-zero

B. angular and zero

C. linear and non-zero

D. linear and zero.

Answer: A

Watch Video Solution

30. Which one of the following pairs of molecules will have permanent dipole moments for both members?

A. SiF_4 and NO_2

B. NO_2 and CO_2

C. NO_2 and O_3

D. SiF_4 and CO_2

Answer: C

Watch Video Solution

31. Which one of the following group represents a collection of isoelectronic species?

A. Na^+, Ca^{2+}, Mg^{2+}

B. N^{3-}, F^-, Na^+

C. Be, Al^{3+}, Cl^-

D. Ca^{2+}, Cs^+, Br

Answer: B

Watch Video Solution

32. Which one of the following sets of ions represents the collection of isoelectronic species? (Atomic numbers : F = 9, CI = 17, Na = 11, Mg = 12,Al = 13, K = 19, Ca = 20, Sc =21)

A. $K^+, Ca^{2+}, Sc^{3+}, Cl^-$

B. $Na^+, Ca^{2+}, Sc^{3+}, F^-$

C. $K^+, Cl^-, Mg^{2+}, Sc^{3+}$

D. $Na^+, Mg^{2+}, Al^{3+}, Cl^-$

Answer: A

Watch Video Solution

33. Lattice energy of an ionic compound depends on

A. charge on the ion and size of the ion

B. packing of ions only

C. size of the ion only

D. charge on the ion only.

Answer: A

Watch Video Solution

34. The molecular shapes of SF_4, CF_4 and XeF_4 are

A. different with 1, 0 and 2 lone pairs of electrons on the central atom, respectively

B. different with 0, 1 and 2 lone pairs of electrons on the central atom, respectively

C. the same with 1, 1 and 1 lone pair of electrons on the central atom, respectively

D. the same with 2,0 and 1 lone pairs of electrons on the central atom, respectively.

Answer: A

Watch Video Solution

35. Of the following sets which one does not contain isoelectronic species?

A. $BO_3^{3-}, cO_3^{2-}, NO_3^-$

B. $SO_3^{2-}, CO_3^{2-}, NO_3^-$

C. CN^-, N_2, C_2^{2-}

D. $PO_4^{3-}, SO_4^{2-}, CIO_4^-$

Answer: B

Watch Video Solution

36. Which molecule/ ion out of the following does not contain unpaired electrons ?

A. O_2^{2-}

B. B_2

C. N_2^+

D. O_2

Answer: A

Watch Video Solution

37. Which one of the following sets of ions represents a collection of isoelectronic species?

A. $K^+, Cl^-, Ca^{2+}, Sc^{3+}$

B. $Ba^{2+}, Sr^{2+}, K^+, S^{2-}$

C. $N^{3-}, O^{2-}, F^-, S^{2-}$

D. $Li^+, Na^+, Mg^{2+}, Ca^{2+}$

Answer: A

Watch Video Solution

38. In which of the following molecule/ion all the bonds are not equal?

A. SF_4

B. SiF_4

C. XeF_4

D. BF_4

Answer: A

Watch Video Solution

39. In which of the following ionisation processes, the bond order has increased and the magnetic behaviour has changed?

A. $C_2 \rightarrow C_2^+$

B. $NO \rightarrow NO^+$

C. $O_2 \rightarrow O_2^+$

D. $N_2 \rightarrow N_2^+$

Answer: B

Watch Video Solution

40. Which of the following species exhibits the diamagnetic behaviour?

A. O_2^{2-}

B. O_2^{+}

C. O_2

D. NO.

Answer: A

Watch Video Solution

41. The calculated bond order of O_2^{-} is

A. 2.5

B. 2.0

C. 1.5

D. 1.0

Answer: C

Watch Video Solution

42. Which of the following is paramagnetic?

A. O_2^-

B. CN^-

C. CO

D. NO^+

Answer: A

Watch Video Solution

43. Which one of the following compounds has sp-hybridisation?

A. CO_2

B. SO_2

C. N_2O

D. CO

Answer: B

Watch Video Solution

44. The calculated bond order in H_2^+ ion is

A. 0

B. $\frac{1}{2}$

C. $-\frac{1}{2}$

D. 1

Answer: B

Watch Video Solution

45. The bond order in the species O_2, O_2^+ and O_2^- follows the order

A. $O_2 > O_2^+ > O_2^-$

B. $O_2^+ > O_2 > O_2^-$

C. $O_2^- > O_2 > O_2^+$

D. $O_2^+ > O_2^- > O_2$

Answer: B

Watch Video Solution

46. Which of the following molecular orbitals has the lowest energy?

A. σ_{2pz}

B. π^*_{2py}

C. σ^*_{2pz}

D. σ^*_{2s}

Answer: D

Watch Video Solution

47. Among the following compounds the one that is polar and has the central atom with sp^2-hybridisation is

A. H_2CO_3

B. SiF_4

C. BF_3

D. $HClO_2$

Answer: A

Watch Video Solution

48. Oxygen molecule shows the property of :

A. diamagnetism

B. ferromagnetism

C. paramagnetism

D. none of these

Answer: C

Watch Video Solution

49. Which has the bond order $\frac{1}{2}$?

A. O_2

B. N_2

C. F_2

D. H_2^+

Answer: D

Watch Video Solution

50. Which of the following is not a linear molecule?

A. CO_2

B. C_2H_2

C. HCN

D. H_2O

Answer: D

Watch Video Solution

51. Ammonia molecule is formed by the following hybrid orbitals:

A. dsp^2

B. sp^3

C. sp^3d

D. d^2sp

Answer: B

Watch Video Solution

52. Which of the following species exhibits the diamagnetic behaviour?

A. O_2^+

B. O_2

C. O_2^-

D. O_2^{2-}

Answer: D

Watch Video Solution

53. If a molecule MX_3 has zero dipole moment , the sigma bonding orbitals used by M are

A. pure p

B. sp hybrids

C. sp^2 hybrids

D. sp^3hybrids

Answer: C

Watch Video Solution

54. Molecule in which the distance between two adjacent carbon atom is largest is

A. benzene

B. ethyne

C. ethene

D. ethane

Answer: D

Watch Video Solution

55. The bond order in F_2 molecule is :

A. 0

B. 1

C. 2

D. 3

Answer: B

Watch Video Solution

56. In which of the following pairs of molecules/ions, the central atoms have sp^2 hybridisation?

A. NO_2^- and NH_3

B. BF_3 and NO_2^-

C. NH_2^- and H_2O

D. BF_3 and NH_2^-

Answer: B

Watch Video Solution

57. Which one of the following species does not exist under normal conditions?

A. Be_2^+

B. Be_2

C. B_2

D. Li_2

Answer: B

Watch Video Solution

58. Which of the following species contains three bond pairs and one lone pair around the central atom?

A. H_2O

B. BF_3

C. NH_2^-

D. PCl_3

Answer: D

Watch Video Solution

59. Which of the following molecules has the maximum dipole moment?

A. CO_2

B. CH_4

C. NH_3

D. NF_3

Answer: C

Watch Video Solution

60. Which of the following organic compounds has same hybridisation as its combustion product $-(CO_2)$?

A. Ethane

B. Ethyne

C. Ethene

D. Ethanol

Answer: B

Watch Video Solution

61. The correct statement for the molecule, Csl_3 is

A. it is a covalent molecule

B. it contains Cs^+ and I_3^-

C. it contains Cs^{3+} and I^- ions

D. it contains Cs^+, I^- and lattice l_2 molecule

Answer: B

Watch Video Solution

62. For which of the following molecule significant

$\mu \neq 0$?

Watch Video Solution

63. Which one of the following molecules is expected to exhibit diamagnetic behaviour?

A. C_2

B. N_2

C. O_2

D. S_2

Answer: A::B

Watch Video Solution

64. In which of the following pairs of molecules/ions, both the species are not likely to exist?

A. H_2^+, He_2^{2-}

B. H_2^-, He_2^{2-}

C. H_2^{2+}, He_2

D. H_2^-, He_2^{2+}

Answer: C

Watch Video Solution

Watch Video Solution

65. Among the following, the maximum covalent character is shown by the compound

A. $FeCl_2$

B. $SnCl_2$

C. $AlCl_3$

D. $MgCl_2$

Answer: C

Watch Video Solution

66. The types of hybrid orbitals of nitrogen in NO_2^+, NO_3^- and NH_4^+ respectively are excepted to be

A. sp, sp^2, sp^3

B. sp^2, sp, sp^3

C. sp, sp^3, sp^2

D. sp^2, sp^3, sp

Answer: B

Watch Video Solution

67. The number of types of bonds between two carbon atoms in calcium carbide is

A. one sigma, two pi

B. one sigma, one pi

C. two sigma, one pi

D. two sigma, two pi

Answer: A

 Watch Video Solution

68. Which of the following pairs of ions are isoelectronic and isostructural?

A. $BeCl_2, XeF_2$

B. Tel_2, XeF_2

C. IBr_2^-, XeF_2

D. IF_3, XeF_2

Answer: C

Watch Video Solution

69. Which one of the following pairs of species have the same bond order?

A. CO, NO

B. O_2, NO^+

C. CN^-, CO

D. N_2, O_2^-

Answer: C

Watch Video Solution

70. Magnesium reacts with an element (x) to form an ionic compound. If the ground state electronic configuration of (X) is $1s^2 2s^2 2p^3$, the simplest formula for this compound is

A. Mg_2X_3

B. MgX_2

C. Mg_2X

D. Mg_3X_2

Answer: D

Watch Video Solution

71. Consider the following species :

CN^+, CN^-, NO and CN

Which one of these will have the highest bond order?

A. NO

B. CN^-

C. CN^+

D. CN

Answer: B

Watch Video Solution

72. Iron carbonyl, $Fe(CO)_5$ is

A. tetranuclear

B. mononuclear

C. trinuclear

D. dinuclear

Answer: B

Watch Video Solution

73. Which one is a wrong statement?

A. The electronic configuration of N atom is

B. An orbital is designated by three quantum numbers while an electron in an atom is designated by four quantum numbers

C. Total orbital angular momentum of electron in 's' orbital is equal to zero

D. The value of m for d_{z^2} is zero

Answer: A

Watch Video Solution

74. According to molecular orbital theory, which of the following will not exist ?

A. He_2^{2+}

B. He_2^{+}

C. H_2^{-}

D. H_2^{2-}

Answer: D

Watch Video Solution

75. Which of the following compounds contain(s) no covalent bond(s)?

$KCl, , PH_3, O_2, B_2H_6, H_2SO_4$

A. KCl, B_2H_6, PH_3

B. KCl, H_2SO_4

C. KCl

D. KCl, B_2H_6

Answer: C

Watch Video Solution

76. Total number of lone pair of electrons in I_3^- ion is

A. 3

B. 6

C. 9

D. 12

Answer: C

Watch Video Solution

77. Which of the following diatomic molecular species has only π at bonds according to molecular orbital theory?

A. C_2

B. Be_2

C. O_2

D. N_2

Answer: A

Watch Video Solution

78. Among the following species, the diamagnetic molecule is :

A. NO

B. O_2

C. CO

D. B_2

Answer: C

Watch Video Solution

79. HF has highest boiling point among hydrogen halides, because it has:

A. lowest ionic character

B. lowest dissociation enthalpy

C. strongest van der Waals' interactions

D. strongest hydrogen bonding.

Answer: D

Watch Video Solution

80. Among the following, the molecule expected to be stabilized by anion formation is :

C_2, O_2, NO, F_2

A. NO

B. O_2

C. C_2

D. F_2

Answer: C

Watch Video Solution

81. Among the following molecules/ions

$C_2^{2-}, N_2^{2-}, O_2^{2-}, O_2$

Which of one diamagnetic and has the shortest bond length?

A. N_2^{2-}

B. O_2

C. C_2^{2-}

D. O_2^{2-}

Answer: C

Watch Video Solution

True Or False Type Questions

1. The formation of a chemical involves an increase in the potential energy of the system.

Watch Video Solution

2. Helium possesses an octet.

Watch Video Solution

3. Only the unpaired electrons present in the outermost shell of an atom are called valence electrons.

Watch Video Solution

4. An ionic bond is formed when the electronegativity difference in the combining atoms is more than 2.

Watch Video Solution

5. A higher value of ionisation energy of the electropositive atom favours the formation of an ionic bond.

Watch Video Solution

6. An ionic compound conducts electricity even in the solid state due to the presence of ions.

Watch Video Solution

7. In Cl_2 molecule, each Cl atom contains only one lone pair of electrons.

Watch Video Solution

8. O_2 molecule is paramagnetic in nature.

Watch Video Solution

9. Covalent compounds possess very high melting and boiling points.

Watch Video Solution

10. Ionic reactions are much faster than the molecular reactions.

Watch Video Solution

11. The bond length in H_2 molecule is 0.174 Å.

Watch Video Solution

12. The bond length of C-C bond is greater than that of C=C bond.

Watch Video Solution

13. Atoms A and B with Lewis structures $:\dot{\underset{\cdot\cdot}{\overset{\cdot\cdot}{A}}}:$ and $:\dot{\underset{\cdot\cdot}{\overset{\cdot\cdot}{B}}}:$ can form a singlet linkage.

Watch Video Solution

14. Dipole moment is a scalar quantity and is given by $m = q \times r$.

Watch Video Solution

15. All molecules with polar bonds have dipole moment.

Watch Video Solution

16. The repulsive interaction between two lone pairs is less than that between two bond pairs.

Watch Video Solution

17. π- molecular orbital always contains a nodal plane which divides the orbital into two halves.

Watch Video Solution

18. The orbitals of an atom having large difference in energy cannot take part in hybridisation.

Watch Video Solution

19. Noble gases are soluble in water due to dipole induced dipole interaction.

Watch Video Solution

20. The mobile electrons in a metal occupy specified positions in the lattice and are not delocalised.

Watch Video Solution

21. A bonding molecular orbital is formed when the electron waves of the combining atoms are in phase.

Watch Video Solution

22. In a bonding molecular orbital, the electron density is almost zero between the nuclei of the combining atoms.

Watch Video Solution

23. The maximum number of electrons that can be accommodated in a molecular orbital is two.

Watch Video Solution

24. H_2^+ ion contains one electron in bonding and one in antibonding molecular orbitals.

Watch Video Solution

25. For N_2 molecule, $N_b = 8$ and $N_a = 2$.

Watch Video Solution

Fill In The Blanks Type Questions

1. Atoms combine together to acquire stable electronic configurations similar to those of.....

Watch Video Solution

2. The number of dots in a Lewis symbol signifies the number of ..... in the ..... shell of the atom.

Watch Video Solution

3. The valency of a phosphide ion is .....

Watch Video Solution

4. When gaseous ions condense together to form a crystal, the energy is ..... This energy is called ..... energy.

Watch Video Solution

5. Covalent compounds may exhibit ..... isomerism because covalent bonds are ..... and .....

Watch Video Solution

6. An ethylene molecule contains ..... covalent bonds.

Watch Video Solution

7. dipole moment is a ..... quantity.

Watch Video Solution

8. CO_2 molecule is regarded as a ... . molecule although it contains ..... polar bonds.

Watch Video Solution

9. Why ionic bond is considered as an extreme case of polar covalent bond?

Watch Video Solution

10. Polarisation is favoured when cation is ..... and anion is

Watch Video Solution

11. Hydrogen bond energy is around ..... kJ mol^{-1}

Watch Video Solution

12. Paramagnetism is shown by the molecules which have

Watch Video Solution

13. Fill in the blanks by chossing the appropriate word/words from those given in the brackets:

(increases, ionic radius, CH_2, same, sigma, ionic, 14, 2, decreases, 16, CH_3, pi, covalent, ionic)

When N_2 goes to N_2^+, the N-N bond distance _____ and when O_2 goes to O_2^+ the O-O bond distance _____

Watch Video Solution

14. Molecular orbitals can best be approximated by the .....combination of ..... orbitals.

Watch Video Solution

15. According to Bohr's theory, the angular momentum of an electron in 5^{th} orbit is

Watch Video Solution

16. The bond multiplicity leads to ..... in bond distance.

Watch Video Solution

17. A π-molecular orbital is formed by the ..... overlapping of atomic orbitals.

Watch Video Solution

18. A molecule is unstable when the bond order is .. ..or .....

Watch Video Solution

19. Among N_2^+, N_2^- and N_2^{2-} the least stable ion is .....

Watch Video Solution

20. The bond order of O_2^{2-} ion is ..... and the ion is ..... magnetic in nature.

Watch Video Solution

21. Assertion :-The formation of a chemical bond involves a decrease in the potential energy of the system.

Reason :- According to Lewis, the formation of a chemical bond involves the gain, loss or sharing of electrons.

A. If both Assertion and Reason are CORRECT and Reason is the CORRECT explanation of the Assertion

B. If both Assertion and Reason are CORRECT but Reason is not the CORRECT explanation of the Assertion.

C. If Assertion is CORRECT but Reason is INCORRECT.

D. If Assertion is INCORRECT but Reason is CORRECT.

Answer: B

Watch Video Solution

22. Assertion :- A low value of ionisation energy of the electropositive atom facilitates the formation of ionic bond.

Reason :- When the ionisation energy is less, the electropositive atom has a greater tendency to lose electron to form a cation.

A. If both Assertion and Reason are CORRECT and Reason is the CORRECT explanation of

the Assertion

B. If both Assertion and Reason are CORRECT but Reason is not the CORRECT explanation of the Assertion.

C. If Assertion is CORRECT but Reason is INCORRECT.

D. If Assertion is INCORRECT but Reason is CORRECT.

Answer: A

 Watch Video Solution

23. Assertion :- CH_4 obeys the octet rule.

Reason :- During the formation of CH_4 molecules, carbon atom achieves an octet.

A. If both Assertion and Reason are CORRECT and Reason is the CORRECT explanation of the Assertion

B. If both Assertion and Reason are CORRECT but Reason is not the CORRECT explanation of the Assertion.

C. If Assertion is CORRECT but Reason is INCORRECT.

D. If Assertion is INCORRECT but Reason is CORRECT.

Answer: D

 Watch Video Solution

24. Assertion :- The observed bond angle in NH_3 molecule is less than $109^\circ 28'$.

Reason :-In ammonia molecule, the bond pair-

bond pair repulsion is more than the lone pair-bond pair repulsion

A. If both Assertion and Reason are CORRECT and Reason is the CORRECT explanation of the Assertion

B. If both Assertion and Reason are CORRECT but Reason is not the CORRECT explanation of the Assertion.

C. If Assertion is CORRECT but Reason is INCORRECT.

D. If Assertion is INCORRECT but Reason is CORRECT.

Answer: C

25. Assertion :-The o-bond is stronger as compared to a π-bond.

Reason :-The axial overlapping of atomic orbitals is much more as compared to their sidewise overlapping.

A. If both Assertion and Reason are CORRECT and Reason is the CORRECT explanation of the Assertion

B. If both Assertion and Reason are CORRECT but Reason is not the CORRECT explanation of the Assertion.

C. If Assertion is CORRECT but Reason is INCORRECT.

D. If Assertion is INCORRECT but Reason is CORRECT.

Answer: A

Watch Video Solution

26. Assertion :-The acetylene molecule is linear in shape.

Reason :- The hybrid state of both the carbon atoms in acetylene is sp^2.

A. If both Assertion and Reason are CORRECT and Reason is the CORRECT explanation of the Assertion

B. If both Assertion and Reason are CORRECT but Reason is not the CORRECT explanation of the Assertion.

C. If Assertion is CORRECT but Reason is INCORRECT.

D. If Assertion is INCORRECT but Reason is CORRECT.

Answer: C

Watch Video Solution

27. Assertion :- The net dipole moment of BF_3 is zero.

Reason :- The net dipole moment of a molecule depends upon its geometry.

A. If both Assertion and Reason are CORRECT and Reason is the CORRECT explanation of the Assertion

B. If both Assertion and Reason are CORRECT but Reason is not the CORRECT explanation of the Assertion.

C. If Assertion is CORRECT but Reason is INCORRECT.

D. If Assertion is INCORRECT but Reason is CORRECT.

Answer: B

Watch Video Solution

28. Assertion :-Structures $:\overset{\cdot\cdot}{N}^{-}=\overset{+}{N}=\overset{\cdot\cdot}{O}:$ and $:\overset{\cdot\cdot}{N}^{-}=\overset{\cdot\cdot}{O}=\overset{+}{N}:$ can not be regarded as the canonical forms of

N_2O resonance hybrid.

Reason :-The two structures involve a change in the relative positions of atoms.

(a)If both Assertion and Reason are CORRECT and Reason is the CORRECT explanation of the Assertion

(b)If both Assertion and Reason are CORRECT but Reason is not the CORRECT explanation of the Assertion.

(c)If Assertion is CORRECT but Reason is INCORRECT.

(d)If Assertion is INCORRECT but Reason is CORRECT.

A. If both Assertion and Reason are CORRECT and Reason is the CORRECT explanation of the Assertion

B. If both Assertion and Reason are CORRECT but Reason is not the CORRECT explanation of the Assertion.

C. If Assertion is CORRECT but Reason is INCORRECT.

D. If Assertion is INCORRECT but Reason is CORRECT.

Answer: A

Watch Video Solution

29. Assertion :-Among O_2^+, O_2, O_2^- and O_2^{2-} species, O_2 is most stable.

Reason :- The bond order of O_2 is 2.

a. If both Assertion and Reason are CORRECT and Reason is the CORRECT explanation of the Assertion

b. If both Assertion and Reason are CORRECT but Reason is not the CORRECT explanation of the Assertion.

c. If Assertion is CORRECT but Reason is INCORRECT.

d. If Assertion is INCORRECT but Reason is CORRECT.

A. If both Assertion and Reason are CORRECT and Reason is the CORRECT explanation of the Assertion

B. If both Assertion and Reason are CORRECT but Reason is not the CORRECT explanation of the Assertion.

C. If Assertion is CORRECT but Reason is INCORRECT.

D. If Assertion is INCORRECT but Reason is CORRECT.

Answer: D

Watch Video Solution

Ncert Text Book Exercises With Hints And Solutions

1. Explain the formation of a chemical bond.

Watch Video Solution

2. Write Lewis dot symbols for atoms of the following elements:

Mg, Na, B, O, N, Br.

Watch Video Solution

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

Watch Video Solution

4. Draw the Lewis structures for the following molecules and ions :

$H_2S, SiCl_4, BeF_2, CO_3^{2-}, HCOOH$

Watch Video Solution

5. Define octet rule . Write its significance and limitations .

Watch Video Solution

6. Write the favourable factors for the formation of ionic bond .

Watch Video Solution

7. Discuss the shape of the following molecules using the VSEPR model : $BeCl_2$, BCl_3

Watch Video Solution

8. Although geometries of NH_3 and H_2O molecules are distorted tetrahedral, bond angle in

water is less than that of ammonia. Discuss.

Watch Video Solution

9. How do you express the bond length in terms of bond order?

Watch Video Solution

10. Define the bond length.

Watch Video Solution

11. Explain the structure of CO_3^{2-} ion in terms of resonance

Watch Video Solution

12. H_3PO_3 can be represented by structures 1 and 2 shown below. Can these two structures be taken as the canonical forms of the resonance hybrid representing H_3PO_3? If not, give reasons for the same.

Watch Video Solution

13. Write the resonance structures for SO_3 and NO_3^-

Watch Video Solution

14. Use Lewis symbols to show electron transfer between the following atoms to form cations and anions :

K and S

Watch Video Solution

15. Use Lewis symbols to show electron transfer between the following atoms to form cations and anions :

Ca and O

Watch Video Solution

16. Use Lewis symbols to show electron transfer between the following atoms to form cations and anions :

Al and N

Watch Video Solution

17. Although both CO_2 and H_2O are triatomic molecules, the shape of H_2O molecule is bent while that of CO_2 is linear. Explain this on the basis of dipole moment.

Watch Video Solution

18. a) Discuss the significance/applications of dipole moment.

b) Represent diagrammatically the bond moments and the resultant dipole moment in CO_2, NF_3 and $CHCl_3$

Watch Video Solution

19. Define electronegativity. How does it differ from electron gain enthalpy?

Watch Video Solution

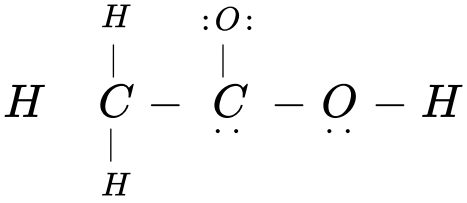
20. Explain with the help of suitable example polar covalent bond.

Watch Video Solution

21. Arrange the bonds in order of increasing ionic character in the molecules : LiF, K_2O, N_2, SO_2 and ClF_3.

Watch Video Solution

22. The skeletal structure of CH_3COOH as shown below is correct but some of the bonds are shown incorrectly. Write the correct Lewis structure for acetic acid.



Watch Video Solution

Watch Video Solution

23. Apart from tetrahedral geometry, another possible geometry for CH_4 is square planar with the four H atoms at the corners of the square and the C atom at its centre. Explain why CH_4 is not square planar ?

Watch Video Solution

24. Explain why BeH_2 molecule has a zero dipole moment although the Be–H bonds are polar.

Watch Video Solution

25. Which out of NH_3 and NF_3 has higher dipole moment and why?

Watch Video Solution

26. What is meant by hybridisation of atomic orbitals? Describe the shapes of sp, sp^2, sp^3 hybrid orbitals.

Watch Video Solution

27. Describe the change in hybridisation (if any) of the Al atom in the following reaction.

$AlCl_3 + Cl^- \rightarrow AlCl_4^-$

Watch Video Solution

28. Is there any change in the hybridisation of B and N atoms as a result of the following reaction?

$BF_3 + NH_3 \rightarrow F_3B.NH_3$

Watch Video Solution

29. Draw diagrams showing the formation of a double bond and a triple bond between C atoms in C_2H_4 and C_2H_2 molecules?

Watch Video Solution

30. What is the total number of sigma and pi bonds in the following molecules?

C_2H_2

Watch Video Solution

31. What is the total number of sigma and pi bonds in the following molecules?

C_2H_4

Watch Video Solution

32. Considering x-axis as the internuclear axis which out of the following will not form a sigma bond and why? (a) 1s and 1s (b) 1s and $2p_x$ (c) $2p_y$ and $2p_y$ (d) 1s and 2s.

Watch Video Solution

33. Which hybrid orbitals are used by carbon atoms in the following molecules?

CH_3-CH_3, (b) $CH_3-CH=CH_2$, (c) CH_3-CH_2-OH, (d) CH_3-CHO (e) CH_3COOH

Watch Video Solution

34. Which hybrid orbitals are used by carbon atoms in the following molecules?

CH_3-CH_3, (b) $CH_3-CH=CH_2$, (c) CH_3-CH_2-OH, (d) CH_3-CHO (e) CH_3COOH

Watch Video Solution

35. Which hybrid orbitals are used by carbon atoms in the following molecules?

CH_3-CH_3, (b) $CH_3-CH=CH_2$, (c) CH_3-CH_2-OH, (d) CH_3-CHO (e) CH_3COOH

Watch Video Solution

36. Which hybrid orbitals are used by carbon atoms in the following molecules?

CH_3-CH_3, (b) $CH_3-CH=CH_2$, (c) CH_3-CH_2-OH, (d) CH_3-CHO (e) CH_3COOH

Watch Video Solution

37. Which hybrid orbitals are used by carbon atoms in the following molecules?

CH_3-CH_3, (b) $CH_3-CH=CH_2$, (c) CH_3-CH_2-OH, (d) CH_3-CHO (e) CH_3COOH

Watch Video Solution

38. What do you understand by bond pairs and lone pairs of electrons? Illustrate by giving one exmaple of each type.

Watch Video Solution

39. Give two differences between a sigma bond and a pi bond.* *

Watch Video Solution

40. Discuss the formation of H_2 molecule on the basis of Valence-bond theory.

Watch Video Solution

41. Write the important conditions required for the linear combination of atomic orbitals to form molecular orbitals.

Watch Video Solution

42. Use molecular orbital theory to explain why the Be_2 molecule does not exist.

Watch Video Solution

43. Compare the relative stability of the following species and indicate their magnetic properties :

O_2, O_2^+, O_2^- (susperoxide) , O_2^{2-} (peroxide)

Watch Video Solution

44. Write the significance of plus and minus sign shown in representing the orbitals.

Watch Video Solution

45. Describe the hybridisation in case of PCI_5. Why are the axial bonds longer as compared to equatorial bonds?

Watch Video Solution

46. Define hydrogen bond. Is it weaker or stronger than the van der Waals' forces?

Watch Video Solution

47. What is meant by the term bond order? Calculate the bond order of N_2, O_2, O_2^+ and O_2^-

Watch Video Solution