CHEMISTRY

BOOKS - OMEGA PUBLICATION

CHEMICAL BONDING AND MOLECULAR STRUCTURE

Questions

1. Explain the formation of a chemical bond.

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2. What are Lewis symbols?

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3. Give the significance of Lewis symbols.

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4. Draw the electron dot structure of H_2O and NH_3.

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5. Draw the Lewis dot structure of sulphuric acid (H_2SO_4).

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

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7. Who gave the octet rule?

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8. how are cactus adapted to survive in a desert?

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9. Noble gases are almost inert. Why do they form compounds with fluorine and oxygen

only ?

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10. Define covalent bond with an example.

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11. Define coordinate bond. Give two examples.

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12. What is meant by te model of an atom?

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13. Calculate the formal charge on each O-atom in O_3.

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

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15. Define ionic or electrovalent bond wirh an example.

16. Explain the factors which influence the stability of ionic bond.

17. Define lattice enthalpy of an ionic solid. Also give an example.

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

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19. Define bond length.

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20. Define the following terms: Covalent radius.

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21. Define the following terms: Vander waal's radius.

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22. Define bond angle. Give an example.

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23. Arrange H_2O, NH_3 and CH_4 in the decreasing order of bond angle.

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24. Define the term bond enthlphy. Give its unit.

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25. Define bond order.

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26. How stability of a molecule can be determined or measured?

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27. Define resonance.

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28. Explain the important aspects of resonace with reference to the CO_3^{2-} ion.

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29. Draw the electron dot structures for: F_2

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30. What are polar and non-polar covalent bonds ?

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31. Define dipole moment.

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32. What is the unit of magnetic dipole moment?

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33. Give two applications of dipole moment.

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34. The dipole moment of CO_2 is zero. Why?

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35. Explain: why N_2 and F_2 are non-polar and HF is polar?

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36. The dipole moment of BeF_2 is zero. Why?

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37. Explain why BeH_2 molecule has a zero dipole moment although the Be-H bonds are polar:

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38. Write the bond angle and geometry of BeF_2 molecule.

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39. Which out of NH_3 and NF_3 have higher dipole moment and why?

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40. Discuss the Fajan's rules in terms of partial covalent character of ionic bonds.

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41. Explain the postulates of VSEPR theory.

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42. Explain the shape of BF_3 and SiF_4 molecules according ro VSEPR theory.

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43. With the help of VSEPR theory, explain the shaps of PCl_5 molecule.

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44. With the help of VSEPR theory, explain the shaps of SF_6 molecule.

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45. Why is NH_3 more basic than PH_3 ?

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46. What do you undersand by bond pairs and lone pairs of electrons? Illustrate by giving

example of each type.

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47. Why NF_3 is pyramidal while BF_3 is triangular planar though both are tetra atomic?

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48. Explain the shape of ammonia (NH_3) molecule by using VSEPR theory.

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49. What is the shape of SO_2 molecule ?

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50. CO_2 is non-polar, while H_2O is polar. What conclusion do you draw about their structures?

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51. Although both CO_2 and H_2O are triatomic but the shape of H_2O molecule is bent while that of CO_2 is linear. Explain on the basis of dipole moment.

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52. Discuss the shape of following molecules using the VSEPR model. $BeCl_2, BCl_3, SiCl_4, AsF_5, H_2S, PH_3.$

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53. Although geometries of NH_3 and H_2O molecules are distorted tetrahedral, bond angle in water is less than that of ammonia. Discuss.

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54. Who introduce the valence bond theory?

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55. Discuss the main postulates of valence bond theory.

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56. Explain the formation of H2 molecule on the basis of valence bond theory.

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57. What is overlapping of atomic orbitals?

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58. Name two flowers with separated sepals?

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59. What is covalent bond?

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60. What is sigma bond ?How is it formed?

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61. How π bond formation takes place?

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62. Give difference between sigma (σ) bond and pi (π) bond.

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63. How many σ and π bonds are present in naphthalene?

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64. Give difference between sigma (σ) bond and pi (π) bond.

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65. What is the total number of sigma & pi bond in the following molecule C2H2

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

C_2H_4

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

C_2H_6

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68. Define hybridisation. List main objectives of hybridisation.

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69. What are the important condition for hybridisation?

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70. Which hybrid orbitals are used by carbon atoms in the following molecule?

$H_3C - CH_3$

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71. What are hybridisation states of each carbon atom in the following compound : CH3-CH=CH2

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72. Which hybrid orbitals are used by carbon atoms in the following molecule?

$CH_3 - CHO$

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73. Which hybrid orbitals are used by carbon atoms in the following molecule?

$CH_3 - COOH$

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74. Which hybrid orbitals are used by carbon atoms in the following molecule?

$CH_3 - CH_2 - OH$

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75. Using hybridisation, explain the shape of BF_3 molecule.

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76. By using hybridisation, explain the shape of CH_4 molecule.

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77. By using hydridisation, explain the shape of NH_3 molecule.

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78. By using hybridisation, explain the shape of H_2O molecule.

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79. Discuss sp hybridisation in ethyne (C_2H_2) molecule.

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80. Discuss sp^2 hybridisation in ethene (C_2H_4) molecule.

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81. Discuss sp^2 hybridisation in ethene (C_2H_4) molecule.

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82. Give the shape of PCl_5 By using hybridisation.

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83. Explain the geometry of SF_6 by using hybridisation.

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84. Describe the change in hybridisation (if any) of the Al atom in the reaction $AlCl_3 + Cl^- \rightarrow AlCl_4^-$

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85. Discuss the magnetic nature of molecules on the basis of molecular orbital theory.

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86. For a reaction : $X \rightarrow Y$, what is the significance of plus and minus signs in the following expression ?

rate=$\frac{-d[X]}{dt} = \frac{+d[Y]}{dt}$

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87. Explain the formation of molecular orbitals by linear combination of atomic orbitals (LCAO).

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88. What are the various condition for the combination of atomic orbitals?

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89. What are the different methods of increasing the number of molecular collisions per second in a gas?

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90. What is electronic configuration of atoms ?

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91. How stability of a molecule can be determined or measured?

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92. Define bond order.

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93. Define bond length.

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94. Discuss the bonding in oxygen (O_2) molecule by molecular orbital theory.

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95. Distinguish between bonding and antibonding molecular orbitals. .

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96. Discuss the bonding in homonuclear diatomic molecular hydrogen (H_2).

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97. Discuss the bonding in He_2 molecule.

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98. On the basis of molecular orbital theory discuss the formation of carbon molecule.

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99. Discuss the bonding in oxygen (O_2) molecule by molecular orbital theory.

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

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101. Give the molecular orbital diagram for F2 molecule.

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102. With the help of molecular orbital theory, draw the molecular orbital energy level diagram for N_2^+ ion molecule. Also calculate its bond order and predictits magnetic behaviour.

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103. In the reaction $M + O_2 \rightarrow MO_2$ (superoxide), the metal M is

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104. Name the most electronegative elements?

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105. Define hydrogen bond.

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106. What is the cause of formation of hydrogen bond?

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107. Discuss the different types of hydrogen bonds with example.

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108. PH_3 has lower boiling point than NH_3. Why?

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Multiple Choice Questions

1. A crystal has highest meltiing point. It is

A. covalent

B. ionic

C. metallic

D. molecular

Answer: B

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2. Which one of the following has the shortest carbon carbon bond length?

A. Benzene

B. Ethene

C. Ethyne

D. Ethane

Answer: C

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3. The percentage of s- character in the hybrid orbitals sp, sp^2 and sp^3 follows the pattern

A. $sp^3 > sp^2 > sp$

B. $sp > sp^2 > sp^3$

C. $sp = sp^2 > sp^3$

D. $sp = sp^2 = sp^3$

Answer: B

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4. In the co-ordinate valency

A. electrons are equally shared by the atoms

B. electrons of one atom are shared by two atoms

C. hydrogen bond is formed.

D. none of the above.

Answer: B

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5. Which of the following has a net dipole moment?

A. CCl_4

B. BF_3

C. NH_3

D. CO_2

Answer: C

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6. Which of the following is diamagnetic?

A. O_2

B. O_2^+

C. O_2^-

D. O_2^{2-}

Answer: D

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7. In which one of the following sp^2 hybridisation?

A. BeF_2

B. BF_3

C. C_2H_2

D. NH_3

Answer: B

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8. The shape of sulphate ion is

A. square planar

B. tetrahedral

C. trigonal bipyramidal

D. hexagonal

Answer: B

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9. The bond order for a species with the configuration, $\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* s^2, \pi 2p_x^1$ will be

A. 1

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

C. zero

D. 1

Answer: B

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10. Which of the following is paramagnetic?

A. NO^+

B. O_2^-

C. CN^-

D. CO

Answer: B

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11. Compare the relative stability of the following species and indicate their magnetic properties O_2, O_2^+, O_2^- (superoxide), O_2^{2-} (peroxide).

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: D

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12. Which one shows maximum hydrogen bonding?

A. H_2O

B. H_2Se

C. H_2S

D. HF

Answer: A

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13. The weakest amoung the following types of bonds is

A. ionic

B. covalent

C. metallic

D. hydrogen- bond

Answer: D

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14. According to Fajan's rules covalent bonding is favourable by

A. small cation and large anion

B. small cation and small anion

C. large cation and large anion

D. large cation and large anion

Answer: A

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15. The number of π bonds in structure given are $(NC)_2C = C(CN)_2$

A. 1

B. 9

C. 5

D. unpredictable.

Answer: B

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16. Which of the following compound is covalent?

A. H_2

B. CaO

C. KCl

D. Na_2S

Answer: A

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17. Antibonding MO is formed by

A. addition of atomic orbitals

B. substraction of atomic orbitals

C. multiplication of atomic orbitals

D. none of these

Answer: B

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18. In a hononuclear molecules, which of the following set of orbitals is degenerate?

A. $\sigma 2s \quad \text{and} \quad \sigma 1s$

B. $\pi 2px \quad \text{and} \quad \pi 2py$

C. $\pi 2px \quad \text{and} \quad \sigma 2pz$

D. $\sigma 2pz \quad \text{and} \quad \pi 2px$

Answer: B

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19. Covalent compounds are soluble in

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20. Which of the following has the largest de Broglie wavelength (all have eual velocity)?

A. PH_3

B. NH_3

C. H_2O

D. BF_3

Answer: D

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21. The bond angle H-N-H in ammonia molecule is

A. $120^\circ 28'$

B. 60°

C. 90°

D. 109°

Answer: D

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22. The pyramidal geometry is associated with

A. CH_4

B. NH_3

C. H_2O

D. CO_2

Answer: B

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23. In the resonating structure of benzene, the number of σ and π bonds are

A. 3π and 12σ

B. 3σ and 12π

C. 6π and 6σ

D. 12π and 12σ

Answer: A

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24. The number of π bonds in structure given are $(NC)_2C = C(CN)_2$

A. 6

B. 3

C. 4

D. 5

Answer: D

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25. The structure of PF_5 molecule is

A. tetrahedral

B. square planar

C. trigonal bipyramidal

D. pentagonal bipyramidal

Answer: C

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26. Among the following compounds which exists as dimer? .

A. BCl_3

B. $AlCl_3$

C. $CHCl_3$

D. CO_2

Answer: B

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27. How many σ and π bonds are in $CH_2 = CH_2$?

A. 4σ and 2π bonds

B. 6σ and 0π bonds

C. 5σ and 1π bonds

D. none of these.

Answer: C

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