100 Practice Numerical Problems with Answers

Section A: Basic Concepts (1–20)

1. Calculate the formal charge on O in H_2O.
   Answer: 0
2. Calculate bond order in O_2.
   Answer: 2
3. Bond order of N_2 molecule?
   Answer: 3
4. Number of bonds in CO_2?
   Answer: 2 double bonds
5. Hybridization of carbon in CH_4?
   Answer: sp^3
6. Bond angle in NH_3?
   Answer: 107°
7. Dipole moment of CO_2?
   Answer: 0 Debye
8. Hybridization of $BeCl_2$?
   Answer: sp
9. Shape of BF_3?
   Answer: Trigonal planar
10. Bond order of NO^+?
    Answer: 3
11. Lone pairs in NH_3?
    Answer: 1
12. Bond angle in H_2O?
    Answer: 104.5°
13. Shape of CH_4?
    Answer: Tetrahedral
14. Hybridization in C_2H_2?
    Answer: sp
15. Bond order of F_2?
    Answer: 1
16. Shape of SF_6?
    Answer: Octahedral
17. Bond angle in CO_2?
    Answer: 180°

18. Number of π bonds in C_2H_4?
    Answer: 1
19. Number of σ bonds in CH_4?
    Answer: 4
20. Bond order of O_2^-?
    Answer: 1.5

Section B: Lattice Energy & Ionic Bonding (21–40)

21. Calculate lattice energy using Born-Haber data (given values).
    Answer: Depends on data
22. Charge product of NaCl?
    Answer: +1 × -1 = -1
23. Which has higher lattice energy: MgO or NaCl?
    Answer: MgO
24. Coulombic force proportional to?
    Answer: q_1q_2/r^2
25. Lattice energy trend: LiF vs LiCl?
    Answer: LiF higher
26. Radius effect on lattice energy?
    Answer: Inverse relation
27. Charge effect on lattice energy?
    Answer: Direct relation
28. Lattice energy unit?
    Answer: kJ/mol
29. Strongest ionic bond among NaCl, KCl, CsCl?
    Answer: NaCl
30. Highest lattice energy: Al_2O_3 or NaCl?
    Answer: Al_2O_3
31. Born exponent relates to?
    Answer: Repulsion
32. Madelung constant significance?
    Answer: Crystal structure
33. Lattice energy increases with?
    Answer: Charge
34. Smallest ion among Na^+, K^+, Li^+?
    Answer: Li^+
35. Highest melting point ionic compound?
    Answer: MgO
36. Energy needed to separate ions?
    Answer: Lattice energy
37. Ionic bond strength depends on?
    Answer: Charge and distance

38. Larger anion → lattice energy?
    Answer: Decreases
39. Ionic radius trend down group?
    Answer: Increases
40. Electrostatic attraction formula constant?
    Answer: Coulomb's constant

Section C: Dipole Moment (41–60)

41. Formula for dipole moment?
    Answer: $\mu = q \times d$
42. Unit of dipole moment?
    Answer: Debye
43. Dipole moment of symmetrical molecule?
    Answer: Zero
44. NH_3 dipole moment?
    Answer: Non-zero
45. HCl dipole moment direction?
    Answer: Toward Cl
46. Polar molecule example?
    Answer: H_2O
47. Nonpolar molecule example?
    Answer: CO_2
48. Dipole moment depends on?
    Answer: Charge and distance
49. Larger electronegativity difference → μ?
    Answer: Increases
50. μ of CH_4?
    Answer: 0
51. μ of SO_2?
    Answer: Non-zero
52. μ of BF_3?
    Answer: 0
53. μ indicates?
    Answer: Polarity
54. Unit conversion (C·m to Debye)?
    Answer: 1 D = 3.336×10^{-30} C·m
55. μ of linear symmetric molecule?
    Answer: 0
56. Vector sum concept applies?
    Answer: Yes
57. Dipole moment increases with bond length?
    Answer: Yes

58. Dipole moment zero means?
    Answer: Nonpolar
59. CO dipole moment small due to?
    Answer: Back bonding
60. μ highest in HF among HX?
    Answer: Yes

Section D: Molecular Orbital Theory (61–80)

61. Bond order formula?
    Answer: (Nb - Na)/2
62. Bond order of He_2?
    Answer: 0
63. Magnetic nature of O_2?
    Answer: Paramagnetic
64. Magnetic nature of N_2?
    Answer: Diamagnetic
65. Electrons in σ1s orbital of H_2?
    Answer: 2
66. Antibonding orbital symbol?
    Answer: σ*
67. Bond order of O_2^{2-}?
    Answer: 1
68. Stability proportional to?
    Answer: Bond order
69. MO diagram includes?
    Answer: Bonding & antibonding
70. Degenerate orbitals?
    Answer: Equal energy
71. Bond order of NO?
    Answer: 2.5
72. Paramagnetism due to?
    Answer: Unpaired electrons
73. Diamagnetism due to?
    Answer: Paired electrons
74. Bond order of B_2?
    Answer: 1
75. π bonding from which orbitals?
    Answer: p orbitals
76. σ bond stronger than π?
    Answer: Yes
77. MO filling follows?
    Answer: Aufbau principle

78. Hund’s rule applies?
    Answer: Yes
79. Pauli principle applies?
    Answer: Yes
80. Bond order fractional means?
    Answer: Intermediate stability

Section E: Miscellaneous Numericals (81–100)

81. Calculate formal charge on N in NH_4^+.
    Answer: +1
82. Bond order relation to bond length?
    Answer: Inverse
83. Hybridization in PCl_5?
    Answer: sp^3d
84. Shape of XeF_4?
    Answer: Square planar
85. Lone pairs in XeF_4?
    Answer: 2
86. Bond angle in PCl_5?
    Answer: 90° & 120°
87. Hybridization in SF_4?
    Answer: sp^3d
88. Shape of SF_4?
    Answer: See-saw
89. Lone pairs in SF_4?
    Answer: 1
90. Hybridization in IF_7?
    Answer: sp^3d^3
91. Shape of IF_7?
    Answer: Pentagonal bipyramidal
92. Bond order vs stability?
    Answer: Direct
93. Strongest bond in N_2 or O_2?
    Answer: N_2
94. Number of electrons in valence shell?
    Answer: Depends on element
95. Electron pair repulsion order?
    Answer: LP-LP > LP-BP > BP-BP
96. Bond angle decreases with lone pairs?
    Answer: Yes
97. Maximum covalency of sulfur?
    Answer: 6

98. Octet rule exceptions?
Answer: Yes
99. Polar bond vs polar molecule?
Answer: Different
100. Bond energy relation to bond order?
Answer: Direct