**Supplementary Material- 20-item Test Questionnaire**

1. **What is the attractive force that holds two atoms together?**
2. chemical bond
3. electromagnetism
4. gravity
5. nuclear force
6. **When atoms bond, they do so to achieve:**
7. decreased stability.
8. a higher energy state.
9. a lower energy state and increased stability.
10. no change in either the stability or energy state.
11. **Which of the following would form an ionic bond?**
12. K and Ca
13. N and O
14. Al and He
15. Mg and Cl
16. **Which is NOT a property of ionic bonds?**
17. electron sharing
18. electron transfer
19. losing of electrons
20. gaining of electrons
21. **What primarily causes elements to form ionic bonds?**
22. sharing of electrons
23. repulsion of electrons
24. formation of covalent bonds
25. attraction of opposite charges
26. **Ammonium (NH4+) and chlorite (ClO2-) are examples of what types of ions?**
27. monoatomic anions
28. monoatomic cations
29. polyatomic ions
30. ternary compounds
31. **When K+ and I- combine, a(n) \_\_\_\_\_\_\_\_\_ bond results.**
32. covalent
33. ionic
34. metallic
35. polyatomic
36. **What type of chemical bond is formed between a metal and a nonmetal?**
37. covalent bond
38. ionic bond
39. metallic bond
40. polar covalent bond
41. **Why do atoms share electrons in a covalent bond?**
42. They have opposite charges.
43. They have similar electronegativities.
44. One atom is much larger than the other.
45. They are trying to become positively charged ions.
46. **Covalent bonds form between what types of elements?**
47. between metals
48. between nonmetals
49. between a metal and a nonmetal
50. between a metal and two nonmetals
51. **A triple bond involves the sharing of \_\_\_\_\_ of electrons.**
52. one pair
53. two pairs
54. three pairs
55. four pairs
56. **What is shared in a covalent bond?**
57. electrons
58. neutrons
59. photons
60. protons
61. **How many bonds should there be between two nitrogen atoms?**
62. 1
63. 2
64. 3
65. 4
66. **Sometimes, both the hydrogen and chlorine atoms need a single electron for them to be stable. Thus, they need to share their electrons to form a covalent bond. What do you call this property?**
67. electronegativity
68. solubility in water
69. electrical conductivity
70. brittleness and hard texture
71. **Because the electrons in a metallic solid are \_\_\_\_\_\_\_\_\_\_, the metal can be bent into shapes or drawn into wires.**
72. fixed in position
73. able to move around
74. tightly bound to protons
75. restricted to certain orbits
76. **I can hit metal with a hammer without the metal shattering or breaking because of this property called \_\_\_\_\_\_\_.**
77. ductility
78. electrical conductivity
79. malleability
80. thermal conductivity
81. **Which of the following is NOT a property of metals associated with metallic bonds?**
82. brittleness
83. ductility
84. malleability
85. thermal conductivity
86. **It refers to the metal's ability to be drawn into thin, long wires.**
87. ductility
88. electrical conductivity
89. malleability
90. thermal conductivity
91. **In metallic bonding, what is the role of the electrons?**
92. They create more electrons.
93. They move freely throughout the metal lattice.
94. They form covalent bonds with other electrons.
95. They repel each other, causing the metal to be malleable.
96. **What type of bond is formed between metal atoms?**
97. covalent bond
98. ionic bond
99. metallic bond
100. polar covalent bond