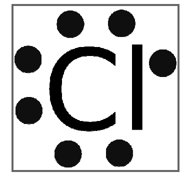
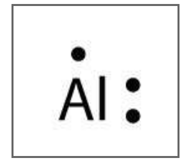
100 Bonding Questions - ANSWERS

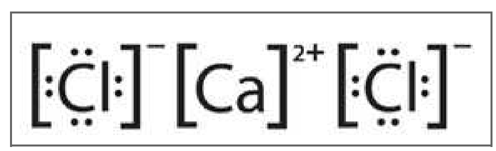
1. 3. nonmetals check table S
2. Chlorine atom in the ground state at right



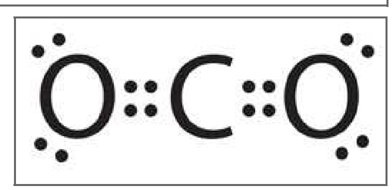
3. 2. fluorine check table S
4. Aluminum atom at right.



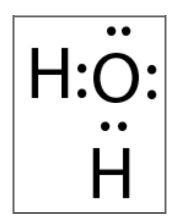
5. 4. bromine (has highest electronegativity of the group)
6. Highest electronegativity? 1. H (2.2 on table S)
7. 1. electronegativity
8. 3. the number of valence electrons in the atom
9. Sulfur becomes sulfide, S^{-2}, radius increases.
10. As two chlorine atoms combine to form a molecule, energy is 2. released
11. 2. The chlorine atom gains an electron, and its radius becomes larger.
12. 2. A chemical bond is formed and energy is released.
13. skip this one, of course
14. 3. nitrogen (electronegativity is just 3.0)
15. 2. It becomes a positive ion and its radius decreases.
16. In the ground state boron has just 3 valence electrons, three dots only
17. 1. N nitrogen has a 3.0 electronegativity, the highest of the group
18. Calcium chloride at right.



19. Carbon dioxide at right.

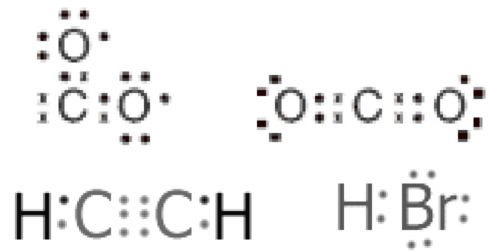


20. Water at right.
21. Aluminum phosphide at right.



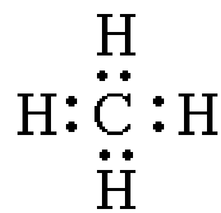
22. 3. CaO only CaO has ionic bonds here
23. 1. NaCl is the only ionic compound here
24. N_2 shares 3 pairs of electrons
25. 4. six N_2 shares six electrons in total.
26. 2. an ionic bond transfers electrons.
27. 1. 6 because C_2H_2 is ethyne, and the carbons are triple bonded
28. 1. Group 1 there are no unknown elements. If it bonds like M_2O it must make a +1 cation, since there are 2 of them for each -2 oxide. That makes it group 1 where the metals make +1.

29. 4. CO_2 is straight and is a nonpolar molecule.
It has radial symmetry. (it's not bent ever!)

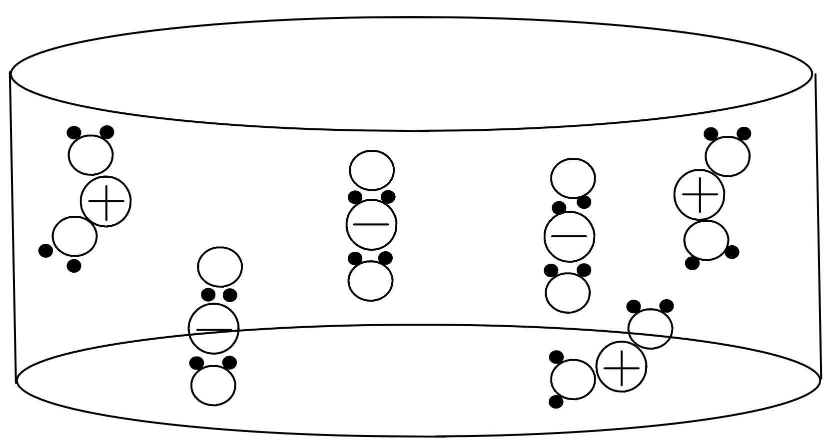


30. calcium oxide, CaO, at right
31. hydrogen monobromide, HBr, at right
32. ethane, C_2H_2, at right

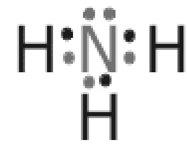
33. N_2 has a triple covalent bond
34. 3. H-F is the most polar bond (greatest electronegativity difference between the atoms.
35. 4. Carbon can form single, double, and triple covalent bonds itself.
36. 4. covalent. In Br_2 there is a single nonpolar covalent bond.
37. 3. ionic are the bonds that electrons are transferred
38. 2. covalent and is formed by the sharing of two valence electrons in Br_2
39. 4. shared between two atoms are Covalent bonds
40. 1. polar covalent are the bonds between H and O in water



41. 4. CH_3OH has only covalent bonds, the others are all ionic.
42. 3. the carbon + hydrogen valence electrons (only valence electrons in all dot diagrams)
43. 3. NH_3 - polar covalent is the only correctly paired compound with its bonding.
44. 1. $CaCO_3$ has both ionic and covalent bonds
45. 2. CCl_4 has radial symmetry, which offsets the polar bonds due to EN differences.
46. 3. electronegativity (difference) between atoms in a molecule determines bond polarity
47. 1. CH_4 is the only nonpolar molecule (radial symmetry) (polar bonds but nonpolar molecule)
48. 2. HF The strongest forces of attraction due to greatest difference in electronegativity values
49. In every case, the +side of water (the Hydrogen) moves towards the negative nitrates, and the negative oxygen side moves towards the potassium cation (below)
50. CCl_4 is classified as a nonpolar molecule because although the bonds are polar, the molecule has radial symmetry, which "balances" the molecule, making it nonpolar.



51. NH_3 has stronger intermolecular forces because the ammonia exhibits hydrogen bonding (super strong dipole attraction) between molecules while the chlorine has nonpolar bonds and the molecule has radial symmetry, making it nonpolar as well.
There is hardly any attraction between the chlorines.



52. Ammonia molecule at right.

53. KCl is ionic while the previous three molecules are all molecular.
Ionic bonds form when transferring electrons, covalent bonds form by sharing electrons. .

54. 4. CO_2 is nonpolar, the others are all polar.

55. 1. H_2O Greatest difference in electronegativity means strongest polarity.

56. 2. nonpolar, with a symmetrical distribution of charge

57. 4. caused by unequal charge distribution makes $NH_{3(L)}$ hold closely together

58. 4. NH_3 has the highest boiling point because it has hydrogen bonding between molecules.

59. Argon has a 2-8-8 electron configuration, only the sulfur when sharing 2 electrons has 2-8-8.

60. CO_2 is a nonpolar molecule because it has radial symmetry. The double polar covalent bonds are "offset" by this molecular shape. Nonpolar, don't forget!

61. carbon and oxygen have a difference in electronegativity, so their bonds are polar. In the F_2 bond there is no electronegativity difference, it's a non polar bond, in a nonpolar molecule

62. Chlorine electron-dot diagram at right.

63. NaCl is ionic because sodium transfers one electron to the chlorine, they bond due to a great difference in charge (which is very strong)

64. 4. tin Metals are both malleable and can conduct electricity.

65. 1. covalent Bromine makes a single nonpolar covalent bond in Br_2

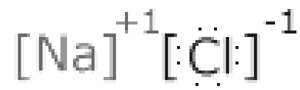
66. HCl is an acid, which means it will ionize in water. The few molecules that do not would still dissolve in water, as the molecules does not have radial symmetry. Water is polar, and like dissolves like. As for the H_2, that is a nonpolar molecule, it's not soluble in water.

67. This is likely a molecular compound or a nonmetal.

68. The low melting point makes it molecular, not ionic. Ionic compounds have very high melting points. If it's an element, metals conduct electricity well, & their melting points tend to be higher than nonmetals.

69. The electrons are not mobile as in metals, or when put into water, since it does not dissolve well, it's likely not ionic. Soluble ionic compounds are excellent electrolytes.

70. 2. copper Metallic bonding occurs between atoms of a metal



71. 3. mobile electrons make metals conduct electricity well.

72. 1. $Hg_{(L)}$ contains metallic bonds, it's the only metal in the group

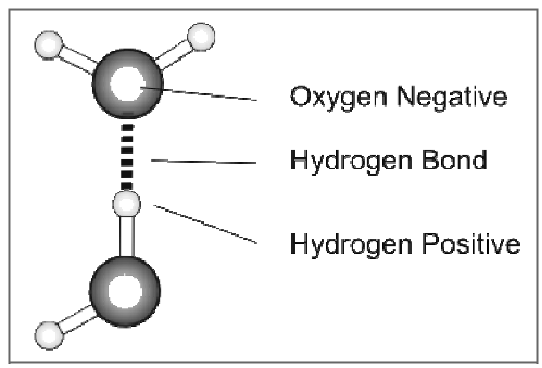
73. 3. brittleness Nonmetallic solids are NOT malleable, ductile, and are non-conductors of
74. 3. Iron + oxygen $\rightarrow$ rust is the only chemical example here. The rest are physical.
75. 3. low melting point is characteristic in a molecular substances
76. 1. an ionic compound when solid do not conduct (electrons are locked in ions) but when melted (molten) these ions come loose, like they do in aqueous solutions.

77. Nonpolar molecule exhibit radial symmetry. That's the one to decide molecular polarity.

78. CO_2 has double polar covalent bonds although the molecule is nonpolar: it has radial symmetry.

79. Ozone exhibits resonating bonds since the single bond and the double bond between the three oxygen atoms that make up ozone are unstable. These resonating bonds measure in at 1½ sized rather than a single sized plus a double sized bond.

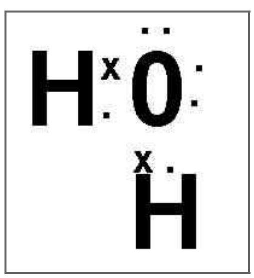
80. Copper (II) sulfate pentahydrate has ionic bonds (Cu^{+2} and SO_4^{-2}), polar covalent bonds (between the sulfur and the oxygen) , and hydrogen bonds holding the water molecules onto the ionic part.



81. Here are just 2 water molecules, but you get the idea.

82. NaCl is at the top right corner of the page.

83. The water below shows X's for the hydrogen valence electrons and dots for the oxygen valence electrons. Oxygen gets the octet.



84. All molecules in groups 17 are diatomic & all are nonpolar molecules because of their radial symmetry. F_2 + Cl_2 are also gases at STP because they have very low intermolecular attractions. The only attractions they have are called electron dispersion attraction, due to the temporary movements of the electrons. They don't have that many electrons. Br_2 has lots of electrons and therefore there is increased attraction between the Br_2 molecules. Br_2 is a liquid at STP with much stronger attractions that the first two elements in the group. Iodine has the most electrons of the four, and the strongest intermolecular attractions of them all. It's a solid at STP.

85. 2 compounds with molecular bonds only would be water and carbon monoxide

86. 2 compounds with ionic bonds only include sodium chloride and magnesium oxide.

87. Cl_2 have a nonpolar bond: NO difference in EN values. HCl has a big difference in EN values

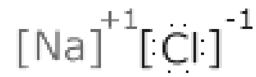
88. Strongest is HF HCl HBr HI

89. 3. C carbon can form single, double, or triple covalent bonds with atoms of the same element

90. 3. $CO_{(G)}$ is the only compound, the rest are elements

91. 2. released   Bonds form, energy is release.

92. 2. ionic bonds transfer electrons



93. 4. shared electrons between two atoms is covalent

94. 1. CO this is our ONLY example of a coordinate covalent bond

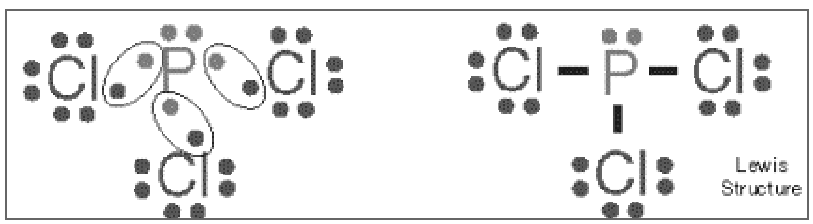
95. 2. $CHCl_3$ does not have radial symmetry and is polar

96. CCl_4 is a nonpolar molecule because it has radial symmetry. The bonds are polar due to difference in electronegativity between carbon and the chlorine. The bond polarity are "balanced" by the radial symmetry.

97. BI_3 boron has 2 unshared electrons (1 pair) + 3 valence electrons. Each of those electrons are shared with three iodine atoms. The iodine atoms each have 7 valence electrons and by sharing with boron, each iodine gets an octet. The boron gets an octet as well:
(2 unshared, plus three pairs of electrons = 8)

98. Sodium chloride is above right

99. Phosphorous trichloride is here.



100. Contrast electron dispersion forces are the weakest intermolecular attractions, due to just the temporary movements of electrons within any atom or compound. Dipole attractions are due to polar bonds (electronegativity differences) in a polar molecule (no radial symmetry). These near constant dipoles (a positive side and a negative side of the polar bonds) makes the molecule into a kind of magnet, with attractions between each other. If the polar bonds were to contain hydrogen, the bond polarity would be even greater, and these super dipole attractions would be called hydrogen bonding instead.
Hydrogen bonding is the same thing as dipole attraction, but one has hydrogen and one does not. That difference is also a strength difference as the hydrogen creates a greater EN difference, forming a "stronger magnet" within these molecules containing hydrogen.

Examples: all molecules and all atoms have electron dispersion attractions. The more electrons, the stronger it is. Dipole attractions are in NO_2, or SCl_2, + PBr_3. Polar bonds in polar molecules.
Hydrogen bonding is found it H_2O, HCl, HF, & HBr molecules. Polar bonds with "H" in polar molecules.