Chapter 10 Study Questions

1. What is a chemical bond? Why do atoms form chemical bonds? How are covalent bonds and ionic bonds different? How are they the same?

2. How is the valence of an atom related to the number of bonds it usually forms?

3. What types of substances contain covalent bonds?

4. List the atoms in each of the following sets in order of increasing electronegativity:
   a) N, As, P b) O, Li, C c) Mg, K, B

5. Choose the bond from each pair which is *most* polar.
   a) Cl — Cl, H — Cl b) O — C, F — C

6. Which of the following are made of molecules?
   a) H_2O b) $C_6H_{12}O_6$ c) NaCl d) O_2

7. For each of the following atoms, indicate whether it forms a positive or a negative ion, and include the ion charge.
   a) Na b) Ba c) Cl d) S e) Al

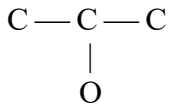
8. For each of the following ions, give its electron configuration, another ion with the same configuration and a noble gas with the same configuration: a) O^{2-} b) Sc^{3+}

9. Draw Lewis structures for the following molecules or ions:
   a) H_2S b) Br_2 c) NH_2F d) CH_2I_2 e) CO_3^{2-}
   f) P_2Cl_2 g) N_2O_4

10. For each of the compounds (a) - (e) in question 10, indicate their *electron* and *molecular* geometry.

11. For each of the compounds (a) - (d) in question 10, indicate whether the molecule is polar or nonpolar.

12. Add hydrogen atoms and electrons in order to complete the Lewis structure of the following compound: C_3H_6O (acetone; nail polish remover)



Summary of Chapter 10: Chemical Bonding

Chemical bonds
Octet/duet rule
Ionic bonding
Ions from main group elements
Monatomic and polyatomic ions
Covalent Bonding
Molecules
Diatomic molecules (memorize)
Lewis Structures: molecules and polyatomic ions
Resonance structures
Electron geometry: tetrahedral, trigonal planar, linear
Molecular geometry: bent, trigonal pyramidal
Electronegativity
Bond polarity
Molecular polarity: polar and nonpolar molecules

Answers to Chapter 10 Study Questions

1. A chemical bond is the force holding atoms together. Atoms form chemical bonds to acquire a stable number of electrons, which is often the same number of electrons as the nearest noble gas. Covalent bonds involve the sharing of valence electrons between atoms, so that *both* atoms act as if they've acquired the shared electrons. In ionic bonds, electrons are NOT shared; a metal atom gives up one or more electrons to form a positive ion, a nonmetal gains one or more electrons to form a negative ion, and then the two ions are attracted to each other due to their opposite charges. Both covalent bonding and ionic bonding are strategies by which an atom attains a stable number of electrons.

2. The number of bonds a nonmetal forms usually = 8 – valence.

3. Covalent bonds are found in molecules (covalent compounds and some nonmetal elements) and in polyatomic ions.

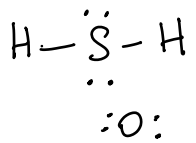
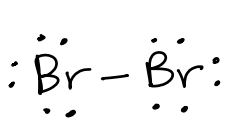
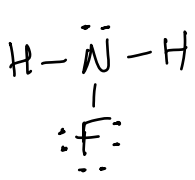
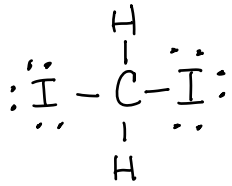
4. a) As < P < N b) Li < C < O c) K < Mg < B

5. a) H — Cl b) F — C

6. (a), (b) & (d) are made of molecules. ((c) is made of ions.)

7. a) positive, +1 b) positive, +2 c) negative, –1 d) negative, –2 e) positive, +3

8. a) $1s^2 2s^2 2p^6$; N^{3-}, F^-, Na^+, Mg^{2+}, Al^{3+}; Ne b) $1s^2 2s^2 2p^6 3s^2 3p^6$; S^{2-}, Cl^-, K^+, Ca^{2+}; Ar

9. a) 
b) 
c) 
d) 
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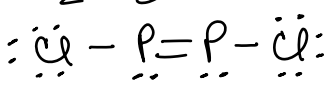
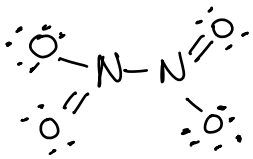
f) P_2Cl_2 
g) N_2O_4 

10. a) tetrahedral, bent b) tetrahedral, linear c) tetrahedral, trigonal pyramid
d) tetrahedral, tetrahedral e) trigonal planar, trigonal planar

11. a) polar b) nonpolar c) polar d) polar

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