General Chemistry II Problem Set 1

1. Define electronegativity.

2. Draw the complete molecular structure (showing all atoms and bonds) and use electronegativity differences to show the major partial charges found on individual atoms in the following molecules:
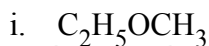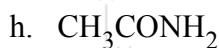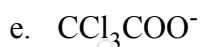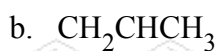
   a. HCl

   b. C_4H_9Li

   c. CH_3OH

   d. OF_2

   e. CH_3COOH
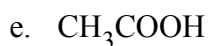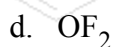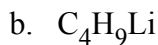
3. Write the complete electron configuration for each of the following: P, N, and Cu^+.

4. Draw Lewis structures for each of the following show all bonds, nonbonding pairs, atoms, and nonzero formal charges:

   a. $N(CH_3)_4^+$

   b. CH_2CHCH_3

   c. $CH_2OHCHOHCH_2OH$

   d. Glycerol

   e. CCl_3COO^-

   f. CF_2HCHO

   g. NH_2NH_2

   h. CH_3CONH_2

   i. $C_2H_5OCH_3$

5. Draw the Lewis structure for each of the following molecules; identify the hybridization and the bond angles for each carbon or oxygen atom.

   a. C_2H_2

   b. C_2H_4

c. C_2H_6

d. H_2CO
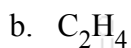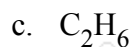
6. N-octane and 2,2,4-trimethyl pentane both have the same molecular formula C_8H_{18}.

   a. Draw the molecular structure for each of these compounds showing all bonds and atoms.

   b. Look up the boiling points for each of these and explain why they are different; to support your answer, include a diagram showing the attractions that have to be broken for these individual substances to boil.

   c. Compare the vapor pressures of these two substances and fully support your prediction.

7. Use the exponential portion of the Arrhenius equation to:

   a. Calculate the fractions of gaseous argon atoms that have a kinetic energy greater than 10 kJ/mole at a temperature of 10,000 K and at a temperature of 298K.

   b. Calculate the fractions of gaseous argon atoms that have a kinetic energy greater than 500 kJ/mole at a temperature of 10,000 K and at a temperature of 298K.

8. Sketch a kinetic molecular distribution plot for two temperatures and shade in the areas having a kinetic energy greater than an arbitrary activation energy. Then use this illustration to clearly explain why chemical reactions occur faster at higher temperatures.

9. Draw Lewis structures for the given bases and their respective conjugate acids:

   a. Trimethyl amine.

   b. Cyanide ion.

   c. Hydrogen phosphate ion.

   d. Carbonate ion

10. Draw Lewis structures for the given acids and their respective conjugate bases:

    a. Phosphoric acid

    b. Carbonic acid.

    c. Butanoic acid

11. Use the Henderson-Hasselbalch equation to determine the relative amounts of acetic acid and the acetate ion at each of the given pH's:

    a. pH = 1.4

    b. pH = 5.6.

c. pH = 4.74

12. Look up the two pKas for alanine and use your understanding of the Henderson-Hasselbalch equation to draw the Lewis structure for the most concentrated form of alanine at each of the following pHs:

a. pH = 1.0

b. pH = 7.4

c. pH = 11.0