CHEM 122 Problem Set 3

1. Acetylene, used as a fuel in welding torches, contains 92.3% carbon and 7.7% hydrogen and has a molecular mass of 26 amu. Calculate its empirical and molecular formulas.

2. Benzene has the same composition of carbon and hydrogen as acetylene. Its molecular mass, though, is 78 amu. What is its molecular formula?

3. Ascorbic acid, vitamin C, has the percentage composition 41.4% C, 3.45% H and 55.2% O and a molecular mass of 174 amu. What is its molecular formula?

4. What is the molecular formula of urea if its composition is 20% C, 6.67% H, 46.7% N and 26.7% O and has a molecular mass of 60 amu?

5. Novocaine, a local anesthetic, is composed of 66.1% C, 8.47% H, 11.9% N and 13.6% O and has a molecular mass of 236 amu. What is its molecular formula?

6. For the following, determine 1) the compound name, 2) the compound's molecular mass and 3) the percent water in the compound.

   a. $CaSO_4 \cdot 2H_2O$
   b. $Na_2CO_3 \cdot 10H_2O$
   c. $MgSO_4 \cdot 7H_2O$
   d. $BaCl_2 \cdot 2H_2O$
   e. $CuCl_2 \cdot 2H_2O$
   f. $MnSO_4 \cdot 3H_2O$
   g. $FeSO_4 \cdot 5H_2O$
   h. $LiNO_3 \cdot 3H_2O$
   i. $KAl(SO_4)_2 \cdot 12H_2O$
   j. $CuSO_4 \cdot 5H_2O$

7. Write the dissociation expressions and equilibrium expressions for the dissociation of the following acids (include each individual dissociation and the overall dissociation constants):

   a. HCl
   b. HNO_3
   c. HI
   d. H_2SO_4
   e. H_2SO_3
   f. H_2S
   g. H_3PO_4
   h. H_3PO_3
   i. H_3AsO_4

8. Using the table, right, of electronegativity (EN) values, determine the kind of bond between the following substances – remember if the ΔEN value equals 0, then you have a polar non-covalent bond; if the ΔEN value is greater than zero and

		H 2.1					
Li 1	Be 1.5		B 2	C 2.5	N 3	O 3.5	F 4
Na 0.9	Mg 1.2		Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0
K 0.9	Ca 1.0		Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8
Rb 0.8	Sr 1.0		In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5
Cs 0.7	Ba 0.9						

less than or equal to 2.0, then you have a polar covalent bond; if the ΔEN value is greater than 2.0, then you have an ionic bond.

a. NaCl	b. HI	c. H_2O	d. ICl
e. BF_3	f. KF	g. CsBr	h. NH_3
i. CH_4	j. $BaBr_2$	k. KI	l. NaBr

9. What are the five forms of hydrates?

10. A strong acid yields a _____ conjugate base; a weak acid yields a _____ conjugate base; a strong base yields a _____ conjugate acid; a weak base yields a _____ conjugate acid.