CH 101 - Practice sheet – 1/27/2014

Practice sheet #1: Fundamentals.

1. Solve the following mathematical operations using the correct amount of significant figures. NO CALCULATORS are allowed. You should be able to solve these by hand.

1a. $35 : 17 + 230 - 9.23104 \times 2.1 =$

1b. $2.13\times10^{-7} + (5.000/2.3)\times10^{-2} + [\log(1.26/12600.)]\times10^{-3} =$

1c. $\sqrt{((641 : 4.0)\times10^{-9})} =$

1d. $\log10^{9.21} + 120 =$

1e. $\ln(e^{-4.265}/e^{2.00}) =$

2. The following molecules were analyzed by Mass spec and elemental analysis and the results are shown below. For each molecule, write the empirical formula and the molecular formula.

2a. MS: m/z: 137.05 (100.0%), 138.05 (7.7%); Elemental Analysis: C, 61.31; H, 5.15; N, 10.21; O, 23.33.

Empirical Formula: _____ Molecular formula: _____

2b. MS: m/z: 138.04 (100.0%), 139.05 (6.6%); Elemental Analysis: C, 52.17; H, 4.38; N, 20.28; O, 23.17.

Empirical Formula: _____ Molecular formula: _____

2c. MS: m/z: 249.94 (100.0%), 251.94 (97.3%), 250.95 (8.8%), 252.95 (8.6%); Elemental Analysis: C, 38.28; H, 2.01; Br, 31.83; F, 15.14; O, 12.75.

Empirical Formula: _____ Molecular formula: _____

2d. MS: m/z: 273.13 (100.0%), 274.13 (19.6%), 275.13 (2.0%), 274.12 (1.1%); Elemental Analysis: C, 79.10; H, 5.53; N, 15.37.

Empirical Formula: _____ Molecular formula: _____

3. Using dimensional analysis, express the following amounts of ethanol (d = 789.00 kg/m^3) in mL (use scientific notations if needed).

3a. 1/8 Gal

3b. 1 lb 6 oz

3c. 3.56 m^3

3d. 2.3012 mol

4. Calculate the amount of moles of:

4a. hydrogen atoms in 2.43 g of ammonia (NH_3)

4b. a sample of nitrogen atoms in a sample of $25.4x10^{18}$ molecules of nitrogen gas (N_2)

5. Complete the table below with the missing amounts for the reactions of combustion of these hydrocarbons: (NOTE: the reactions need to be balanced!)

5a.	$\square\ C_2H_2 + \square\ O_2 \rightarrow \square\ CO_2 + \square\ H_2O$			
Mass	15.0 g			
Molar mass (g/mol)		32.0	44.0	18.0
Number of moles (mol)				

5b.

$\square\ C_8H_{10} + \square\ O_2 \longrightarrow \square\ CO_2 + \square\ H_2O$

Mass		1.20 hg		
Molar mass (g/mol)		32.0	44.0	18.0
Number of moles (mol)				

Note: hg is not a typo, it stands for 1.20 hectograms of oxygen. You may express the masses of the other species in any unit you may find more convenient.

5c.

$\square\ C_6H_6 + \square\ O_2 \longrightarrow \square\ CO_2 + \square\ H_2O$

Mass (g)				
Molar mass (g/mol)		32.0	44.0	18.0
Number of moles (mol)			16.2	

6. For the reaction of combustion of octane (problem 5b), say whether the following amounts of octane and oxygen are in a stoichiometric ratio or there is an excess of a reagent. In this latter case, say which is the limiting reagent.

Amount of octane	Amount of oxygen gas	Stoichiometric ratio (Y/N)	Limiting reagent
12 g	2.1 mol		
13 mol	2.01 mg		
1.5 mol	0.504 kg		
100.1 mg	203 mg		