Name _____ Test 1
PHYS 0109 Fall 2003

1. (12 pts.) Provide names for the following compounds.

a. $BaSO_3$ barium sulfite b. CI_4 carbon tetraiodide

c. $CuCl_2$ copper(II) chloride d. N_2O_5 dinitrogen pentoxide

2. (12 pts.) Provide formulas for the following compounds.

a. iron(III) nitrate $Fe(NO_3)_3$ b. phosphorous trichloride PCl_3

c. sodium oxide Na_2O d. ammonium bromide NH_4Br

3. (22 pts.) Perform the following conversions (reports answers to the correct number of significant figures).

a. The density of ethanol is 0.7893 g/cm^3. Determine the volume of 33.6 g of ethanol.

$$33.6 \text{ g EtOH} \times \frac{1 \text{ cm}^3 \text{ EtOH}}{0.7893 \text{ g EtOH}} = 42.6 \text{ cm}^3 \text{ EtOH}$$

b. Determine the number of moles of C in 9.034 g of $C_6H_{12}O_6$.

MM = 6(12.011 g) + 12(1.0079 g) + 6(15.9994) = 180.157 g

$$9.034 \text{ g } C_6H_{12}O_6 \times \frac{1 \text{ mol } C_6H_{12}O_6}{180.157 \text{ g } C_{6x}H_{12}O_6} \times \frac{6 \text{ mol C}}{1 \text{ mol } C_6H_{12}O_6} = 0.3009 \text{ mol C}$$

c. Determine the mass of 2.88 mol of UF_6.

MM = (238.029 g) + 6(18.998) = 352.017 g

$$2.88 \text{ mol } UF_6 \times \frac{358.017 \text{ g } UF_6}{1 \text{ mol } UF_6} = 1010 \text{ g}$$

4. (6 pts.) The mass of 10.9 mL of methanol is 8.6219 g. Determine the density of methanol.

8.6219 g / 10.9 mL = 0.791 g/mL

5. (10 pts.) When filled with only water, a certain pycnometer holds 11.2000 g grams of water (d = 0.99823 g/cm^3). When filled with 8.6952 g of metal, only 9.6333 g of water fit in the pycnometer.

a. Determine the volume of the pycnometer.

$$11.2000 \text{ g } H_2O \times \frac{1 \text{ cm}^3 \text{ } H_2O}{0.99823 \text{ g } H_2O} = 11.21986 = 11.220 \text{ cm}^3$$

b. Determine the volume of the metal added to the pycnometer.

11.2000 g H_2O – 9.6333 g H_2O = 1.5667 g H_2O displaced by metal (missing from full container)

$$1.5667 \text{ g } H_2O \times \frac{1 \text{ cm}^3 \text{ } H_2O}{0.99823 \text{ g } H_2O} = 1.569478 = 1.5695 \text{ cm}^3$$

c. Determine the density of the metal.

8.6952 g / 1.569478 cm^3 = 5.54019 = 5.5402 g/cm^3

6. (10 pts.) Determine the average atomic mass of boron. The natural abundance of ^{10}B is 20.000% and a mol of ^{10}B weighs 10.0129 g. The natural abundance of ^{11}B is 80.000% and a mol of ^{11}B weighs 11.00931 g.

ave mass = 0.200000(10.0129) + 0.80000(11.00931)

ave mass = 2.00258 + 8.807448

ave mass = 10.810028 = 10.8100 g/mol

7. (2 pts. ea.) Determine the number of protons in the nucleus of an ^{17}O atom. **8**

Determine the number of neutrons in the nucleus of an ^{17}O atom. **9**

Determine the number of electrons in an $^{17}O^{2-}$ ion. **10**

Identify the element with 17 protons in its nucleus. **Cl**

Determine the charge of the most stable ion formed from the element with an atomic number of 37. **+1**

Which has a greater mass, an electron or a proton?

proton

8. a. (2 pts.) When carbon atoms combine with other non-metals, does an ionic compound or a covalently bonded molecule result? **covalently bonded molcule**

b. (4 pts.) Is an ionic compound characterized by a sharing of electrons? Explain.

No, an ionic compound is characterized by the presence of charged particle (ions). The ions are held together in because of the electrostatic attraction between their opposite charges.

9. (10 pts.) A combustion analysis of a 0.5466 g sample of a molecule made of carbon, hydrogen, and oxygen revealed that the mass of the carbon atoms present in the sample was 0.2850 g and the mass of the hydrogen atoms present was 0.0718 g. The molar mass of the compound is 46.067 g/mol. Determine the empirical and molecular formulas of the compound.

0.5466 g CHO – 0.2850 g C – 0.0718 g H = 0.1898 g O

$$0.2850\text{ g C} \times \frac{1\text{ mol C}}{12.011\text{ g C}} = 0.023738\text{ mol C} \quad /0.011863 \quad \Rightarrow 2.001$$

$$0.0718\text{ g H} \times \frac{1\text{ mol H}}{1.0079\text{ g H}} = 0.071237\text{ mol H} \quad /0.011863 \quad \Rightarrow 6.005$$

Empirical formula C_2H_6O

$$0.1898\text{ g O} \times \frac{1\text{ mol O}}{15.9994\text{ g O}} = 0.011863\text{ mol O} / 0.011863 \quad \Rightarrow 1$$

MM of EF = 2(12.011) + 6(1.0079) + 15.9994 = 46.0688 g
Since the molar mass of the compound is the same as the molar mass of the empirical formula, the empirical formula is the molecular formular

molecular formula C_2H_6O