Name: KEY
Date: 12/1/08

Chemistry
Mass Ratios & Percent Composition WS

I. *Determine the ratio of elemental masses in the following compounds:*

1. What is the mass ratio of strontium to chlorine in strontium chloride? $SrCl_2$

$\frac{Sr}{Cl_2} : \frac{Cl_2}{Cl_2}$ $\quad \frac{87.62}{70.906} = 1.236 : 1$

2. What is the mass ratio of copper to sulfur in copper (I) sulfide? Cu_2S

$\frac{Cu_2}{S} : \frac{S}{S}$ $\quad \frac{127.092}{32.065} = 3.964 : 1$

3. What is the mass ratio of lithium to phosphorus in lithium phosphate? Li_3PO_4

$\frac{Li_3}{P} : \frac{P}{P}$ $\quad \frac{20.823}{30.974} = 0.672 : 1$

4. What is the mass ratio of oxygen to sulfur in sulfur trioxide? SO_3

$\frac{O_3}{S} : \frac{S}{S}$ $\quad \frac{47.998}{32.065} = 1.497 : 1$

5. What is the mass ratio of nitrogen to oxygen in ammonium nitrite? NH_4NO_3

$\frac{2N}{O_2} : \frac{O_3}{O_3}$ $\quad \frac{28.014}{47.998} = 0.584 : 1$

II. *Determine the percent composition by mass of each element in the following compounds:*

6. sodium bromide $NaBr$

$\%Na = \frac{Na}{NaBr} \times 100\% = \frac{22.990}{102.894} \times 100\% = 22.343\%$ Na in NaBr

$\%Br = 100\% - \%Na =$ 77.657% Br in NaBr

7. zinc sulfate $ZnSO_4$

$\%Zn = \frac{Zn}{ZnSO_4} \times 100\% = \frac{65.39}{161.453} \times 100\% =$ 40.501% Zn in $ZnSO_4$

$\%S = \frac{S}{ZnSO_4} \times 100\% = \frac{32.065}{161.453} \times 100\% =$ 19.860% S in $ZnSO_4$

$\%O = \frac{O_4}{ZnSO_4} \times 100\% = \frac{63.998}{161.453} \times 100\% =$ 39.639% O in $ZnSO_4$

8. dinitrogen tetroxide N_2O_4

$\%N = \frac{N_2}{N_2O_4} \times 100\% = \frac{28.014}{92.011} \times 100\% =$ **30.446% N in N_2O_4**

$\%O = 100\% - \%N = 100\% - 30.446\% =$ **69.554% O in N_2O_4**

9. ammonium carbonate $(NH_4)_2CO_3$

$\%N = \frac{N_2}{(NH_4)_2CO_3} \times 100\% = \frac{28.014}{96.086} \times 100\% =$ **29.155% N in $(NH_4)_2CO_3$**

$\%H = \frac{H_8}{(NH_4)_2CO_3} \times 100\% = \frac{8.064}{96.086} \times 100\% =$ **8.392% H in $(NH_4)_2CO_3$**

$\%C = \frac{C}{(NH_4)_2CO_3} \times 100\% = \frac{12.011}{96.086} \times 100\% =$ **12.500% C in $(NH_4)_2CO_3$**

$\%O = 100.000\% - 29.155\% - 8.392\% - 12.500\% =$ **49.953% O in $(NH_4)_2CO_3$**

III. *Determine the empirical formula for each of the following compounds by using its percent composition by mass (see Sample Problem 7-13 on p.193):*

10. 83.0% potassium, 17.0% oxygen – assume 100g total (1% = 1g)

$83.0\text{ g K} \left| \frac{1\text{ mol K}}{39.098\text{ g K}} \right. = \frac{2.123\text{ mol K}}{1.063} = 1.997 \approx 2\text{ K's}$ (1.063 ← divide by smallest)

$17.0\text{ g O} \left| \frac{1\text{ mol O}}{15.999\text{ g O}} \right. = \frac{1.063\text{ mol O}}{1.063} = 1\text{ O}$

empirical formula: K_2O

11. 2.06% hydrogen, 32.69% sulfur, 65.25% oxygen

$2.06\text{ g H} \left| \frac{1\text{ mol}}{1.0079\text{ g}} \right. = \frac{2.044\text{ mol}}{1.019} = 2.006 \approx 2\text{ H}$

$32.69\text{ g S} \left| \frac{1\text{ mol}}{32.065\text{ g}} \right. = \frac{1.019\text{ mol}}{1.019} = 1\text{ S}$

$65.25\text{ g O} \left| \frac{1\text{ mol}}{15.999\text{ g}} \right. = \frac{4.078\text{ mol}}{1.019} = 4.002 \approx 4\text{ O}$

empirical formula: H_2SO_4

12. 40.0% carbon, 6.71% hydrogen, 53.3% oxygen

$40.0\text{ g C} \left| \frac{1\text{ mol}}{12.011\text{ g}} \right. = \frac{3.330\text{ mol}}{3.330} = 1\text{ C}$

$6.71\text{ g H} \left| \frac{1\text{ mol}}{1.0079\text{ g}} \right. = \frac{6.657\text{ mol}}{3.330} \approx 2\text{ H}$

$53.3\text{ g O} \left| \frac{1\text{ mol}}{15.999\text{ g}} \right. = \frac{3.331\text{ mol}}{3.330} \approx 1\text{ O}$

empirical formula: CH_2O