CHM 1010 **GAGE**

Problems Involving Moles (No Reactions) Answers

1. a. How many grams of C_2H_6O are in 0.54 moles of C_2H_6O?

$$0.54 \text{ mol } C_2H_6O \times \frac{46 \text{ g } C_2H_6O}{1 \text{ mol } C_2H_6O} = 25 \text{ g } C_2H_6O$$

b. How many atoms of hydrogen are required to form 0.350 mol of C_2H_6O?

$$0.350 \text{ mol } C_2H_6O \times \frac{6 \text{ mol H}}{1 \text{ mol } C_2H_6O} \times \frac{6.02 \times 10^{23} \text{ atoms H}}{1 \text{ mol H}} = 1.26 \times 10^{24} \text{ atoms H}$$

c. How many grams of carbon are in 86.4 g of C_2H_6O?

$$86.4 \text{ g } C_2H_6O \times \frac{2\,(12.0 \text{ g C})}{46.0 \text{ g } C_2H_6O} = 45.1 \text{ g C}$$

2. What is the mass of one molecule of calcium carbonate in amu and grams?

$CaCO_3$ 40.1 amu C + 12.0 amu C + 3 (16.0) amu O = 100.1 amu $CaCO_3$

1 mol $CaCO_3$ = 100.1 g $CaCO_3$ = 6.02×10^{23} molecules of $CaCO_3$

$100.1 \text{ g}/6.02 \times 10^{23} = 1.66 \times 10^{-22}$ g/molecule

3. How many grams of ammonium sulfate can be prepared from 7.81×10^{22} atoms of hydrogen?

$$7.81 \times 10^{22} \text{ atoms H} \times \frac{1 \text{ mol H}}{6.02 \times 10^{23} \text{ atoms H}} \times \frac{1 \text{ mole } (NH_4)_2SO_4}{8 \text{ mol H}} \times \frac{132.1 \text{ g } (NH_4)_2SO_4}{1 \text{ mol } (NH_4)_2SO_4} = 2.14 \text{ g } (NH_4)_2SO_4$$

4. An analysis of a 2.03 gram sample of chromium oxide yields 1.39 grams of chromium. What is the simplest (empirical) formula for this chromium oxide?

2.03 g chromium oxide – 1.39 g Cr = 0.64 g O

$$1.39 \text{ g Cr} \times \frac{1 \text{ mol Cr}}{52.0 \text{ g Cr}} = 0.0267 \text{ mol Cr} \qquad \frac{0.0267}{0.0267} = 1 \quad \times 2 = 2$$

$$0.64 \text{ g O} \times \frac{1 \text{ mol O}}{16.0 \text{ g O}} = 0.040 \text{ mol O} \qquad \frac{0.040}{0.0267} \sim 1.5 \quad \times 2 = 3$$

Formula is Cr_2O_3

5. a. How many atoms of oxygen are in a molecule of muscovite (mica), $KAl_3Si_3O_{10}(OH)_2$? 12 atoms O

b. How many molecules of muscovite can be formed from 3.11×10^{20} atoms of aluminum?

$$3.11 \times 10^{20} \text{ atoms Al} \times \frac{1 \text{ molec musc}}{3 \text{ mol Al}} = 1.04 \times 10^{22} \text{ molec musc}$$

c. How many grams of silicon are in 100.0 grams of muscovite?

$$100.0 \text{ g musc} \times \frac{3(28.1 \text{ g Si})}{398.4 \text{ g musc}} = 21.2 \text{ g Si}$$

d. How many moles of aluminum are in 0.0444 g of muscovite?

$$0.0444 \text{ g musc} \times \frac{1 \text{ mol musc}}{398.4 \text{ g musc}} \times \frac{3 \text{ mol Al}}{1 \text{ mol musc}} = 3.34 \times 10^{-4} \text{ mol Al}$$