C. Problems

Solve the following problems in the space provided. Show your work.

27. How many atoms are contained in 0.25 moles of Fe?

$$\frac{.25 \text{ moles Fe}}{1} \times \frac{55.8 \text{ grams Fe}}{1 \text{ mole Fe}} = 1.4 \times 10^{1} \text{ g Fe} \quad \text{or} \quad 14 \text{ g Fe}$$

28. Find the mass, in grams, of 6.25 mol H_2SO_4.

$$\frac{6.25 \text{ moles } H_2SO_4}{1} \times \frac{98 \text{ grams } H_2SO_4}{1 \text{ mole } H_2SO_4} = 613 \text{ grams } H_2SO_4$$

29. What is the volume, in liters, of 15.0 kg of CO_2 at STP?

$$\frac{15.0 \text{ Kg } CO_2}{1} \times \frac{1000 \text{ g}}{1 \text{ Kg}} \times \frac{1 \text{ mole } CO_2}{44.0 \text{ g } CO_2} \times \frac{22.4 \text{ L } CO_2}{1 \text{ mole } CO_2} = 7.64 \times 10^{3} \text{ L } CO_2$$

30. Determine the molar mass of a compound that has a density of 0.650 g/L at STP.

$$D = \frac{m}{V} \qquad 22.4 \text{ L} \cdot .650 \frac{g}{L} = \frac{m}{22.4 \text{ L}} \cdot \frac{22.4 \text{ L}}{1}$$

$$1.46 \times 10^{1} \text{ g} = m \quad \text{or} \quad 14.6 \text{ g}$$

31. What is the mass, in grams, of 3.75×10^{15} atoms of gold? (3 pts)

$$\frac{3.75 \times 10^{15} \text{ Atoms Au}}{1} \times \frac{1 \text{ mole Au}}{6.02 \times 10^{23} \text{ Atoms Au}} \times \frac{197 \text{ g Au}}{1 \text{ mole Au}} = 1.23 \times 10^{-6} \text{ g Au}$$

32. Calculate the percent composition of $Mg(NO_3)_2$.

$Mg(NO_3)_2 \rightarrow 24.3 + 2(14) + 6(16) = 148.3 \text{ g}$

$$\%\ Mg \rightarrow \frac{24.3 \text{ g Mg}}{148.3 \text{ g } Mg(NO_3)_2} = 16.4\%\ Mg$$

$$\%\ N \rightarrow \frac{28.0 \text{ g N}}{148.3 \text{ g } Mg(NO_3)_2} = 18.9\%\ N$$

$$\%\ O \rightarrow \frac{96.0 \text{ g O}}{148.3 \text{ g } Mg(NO_3)_2} = 64.7\%\ O.$$

33. What is the empirical formula of a compound that is 27.3% C and 72.7% O?

$$\frac{27.3 \text{ g C}}{1} \times \frac{1 \text{ mole C}}{12 \text{ g C}} = \frac{2.275 \text{ mole C}}{2.275} = 1$$

$$\frac{72.7 \text{ g O}}{1} \times \frac{1 \text{ mole O}}{16 \text{ g O}} = \frac{4.54 \text{ mole O}}{2.275} = 2$$

CO_2

34. A compound consisting of 56.38% phosphorus and 43.62% oxygen has a molar mass of 219.9 g/mol. Determine its molecular formula. (4 pts)

$$\frac{56.38 \text{ g P}}{1} \times \frac{1 \text{ mole P}}{30.97 \text{ g P}} = \frac{1.82 \text{ moles P}}{1.82} = 1$$

$$\frac{43.62 \text{ g O}}{1} \times \frac{1 \text{ mol } O_2}{16 \text{ g O}} = \frac{2.73 \text{ moles O}}{1.85} = 1.5$$

P_4O_6

$P_2O_3 = 109.9 \text{ g}$

$$\frac{219.9 \text{ g/mol}}{109.9 \text{ g}} = 2 \text{ mol}$$