Name Teacher Class _____ Date _____

Mass-Mass Problems

Solving mass-mass problems usually involves these steps:

1. Convert given masses in grams to moles.
2. Use coefficients in the balanced equation to establish mole ratios between the substances involved in the problem.
3. Calculate the number of moles of the required substance.
4. Convert that number of moles to mass in grams.

Examples

How many moles of F_2 are there in 60.0 g of F_2? (F = 19.0 g/mole)

mole mass of $F_2 = 2 \times 19.0$ g/mole = 38.0 g/mole

$$\frac{60.0 \text{ g}}{38.0 \text{ g/mole}} = 1.58 \text{ moles}$$

In the following reaction, how many moles of F_2 are needed to produce 1.5 moles of HF?

$$H_2 + F_2 \rightarrow 2HF$$

mole ratio of F_2 to HF = 1:2

1:2 = ?:1.5 ? = .75

How many grams of HF is .75 moles of HF? (H = 1.0 g/mole)

mole mass of HF = 1.0 g/mole + 19.0 g/mole = 20 g/mole

.75 moles × 20 g/mole = 15 g

Solve the following problems. Show your work.

1. Given the equation $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ answer the following questions.

   a. How many moles of N_2 are there in 200 g of N_2? (N = 14.0 g/mole)

   ~~MM = m/n = 200g~~

   $n = \frac{m}{MM} = \frac{200\text{ g}}{28.0\text{g/n}} = 7.14\text{ n}$

   1a. 7.14 n

   b. How many moles of NH_3 could be produced from the above amount of N_2?

   $N_2 : NH_3 = 1 : 2$

   $\frac{2\ NH_3}{1\ N_2} = \frac{X\ NH_3}{7.14\ N_2}$ 14.3 n

   b. 14.3 n

   c. How many grams of NH_3 would this be? (H = 1.00 g/mole)

   $n = \frac{g}{g/n}$

   $(14.3\text{ n})(17.0\text{g/n}) = 243\text{ g NH}_3$

   c. 243 g

Name Teache Class _____ Date _____

Mass-Mass Problems (*Continued*)

2. Given the equation $2CO + O_2 \rightarrow 2CO_2$ answer the following questions.

   a. How many moles are there in 55.0 g of CO_2?
   (C = 12.0 g/mole; O = 16.0 g/mole)

   $\frac{55.0\text{ g}}{44.0\text{ g/n}} = 1.25\text{ n}$

   2a. 1.25 n

   b. How many moles of CO would be needed to produce this amount of CO_2?

   $\frac{2\text{ CO}}{2\text{ CO}_2} = \frac{X\text{ n CO}}{1.25\text{ CO}_2}$ $\quad X = 1.25\text{ n}$

   b. 1.25 n

   c. How many grams of CO would this be?

   $(1.25\text{ n})(28.0\text{ g/n}) = 35.0\text{ g CO}$

   c. 35.0 g

3. **a.** Write a balanced equation for the reaction of methane (CH_4) with oxygen gas (O_2) to produce carbon dioxide and water.

   3a. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

   b. How many grams of H_2O would be produced from the reaction of 74.6 g of CH_4?
   (C = 12.0 g/mole; H = 1.00 g/mole; O = 16.0 g/mole)

   $\frac{74.6\text{ g CH}_4}{16.0\text{ g/n}} = 4.66\text{ n CH}_4$

   $\frac{2\text{ H}_2\text{O}}{1\text{ CH}_4} = \frac{X\text{ n H}_2\text{O}}{4.66\text{ n CH}_4}$

   $X = 9.32\text{ n H}_2\text{O}$

   $(9.32\text{ n H}_2\text{O})(18.0\text{ g/n}) = 168\text{ g H}_2\text{O}$

   b. 168 g H_2O