Worksheet: Mole/Mass Problems Name Answer Key

Answer each of the following questions using the equation provided. BE SURE TO BALANCE EACH EQUATION BEFORE SOLVING ANY PROBLEMS. SHOW ALL WORK.

1. In a reaction between the elements aluminum and chlorine, aluminum chloride is produced.

$$2\ Al + 3\ Cl_2 \rightarrow 2\ AlCl_3$$

a. 2 moles of Al will react with 3 mole(s) of Cl_2 to produce 2 mole(s) of $AlCl_3$.

b. How many grams of $AlCl_3$ will be produced if 2.50 moles of Al react?

$$2.50 \text{ mol of Al}\left(\frac{2 \text{ mol } AlCl_3}{2 \text{ mol Al}}\right)\left(\frac{133.33 \text{ g } AlCl_3}{1 \text{ mol Al}}\right) = 333.33 \text{ g of } AlCl_3$$

c. How many moles of Cl_2 must react to produce 12.3 g of $AlCl_3$?

$$12.3 \text{ g } AlCl_3\left(\frac{1 \text{ mol } AlCl_3}{133.33 \text{ g } AlCl_3}\right)\left(\frac{3 \text{ mol } Cl_2}{2 \text{ mol } AlCl_3}\right) = 0.138 \text{ mol } Cl_2$$

d. How many grams of aluminum will react with 3.4 moles of chlorine?

$$3.4 \text{ moles } Cl_2\left(\frac{2 \text{ mol Al}}{3 \text{ mol } Cl_2}\right)\left(\frac{26.98 \text{ g Al}}{1 \text{ mol Al}}\right) = 61.15 \text{ g Al}$$

e. If 17 grams of aluminum react, how many moles of aluminum chloride will be produced?

$$17 \text{ g of Al}\left(\frac{1 \text{ mol Al}}{26.98 \text{ g Al}}\right)\left(\frac{2 \text{ mol of } AlCl_3}{2 \text{ mol g Al}}\right) = 0.37 \text{ mol } AlCl_3$$

Answer Key

2. The ammonia (NH_3) used to make fertilizers for lawns and gardens is made by reacting nitrogen and hydrogen according to the following reaction.

$$\_\_N_2 + \underline{3}\,H_2 \rightarrow \underline{2}\,NH_3$$

a. Determine the mass in grams of NH_3 formed from 1.34 moles of nitrogen.

$$1.34\,mol\,N_2\left(\frac{2\,mol\,NH_3}{1\,mol\,N_2}\right)\left(\frac{17.04\,g\,NH_3}{1\,mol\,NH_3}\right) = 45.67\,g\,NH_3$$

b. What is the mass in grams of hydrogen required to react with 1.34 moles of nitrogen?

$$1.34\,mol\,N_2\left(\frac{3\,mol\,H_2}{1\,mol\,N_2}\right)\left(\frac{2.02\,g\,H_2}{1\,mol\,H_2}\right) = 8.12\,g\ of\ H_2$$

c. How many moles of nitrogen are required to produce 11.7 moles of NH_3?

$$11.7\,mol\,NH_3\left(\frac{1\,mol\,N_2}{2\,mol\,NH_3}\right) = 5.85\,mol\,N_2$$

d. How many moles of nitrogen are required to produce 11.7 grams of NH_3?

$$11.7\,g\,NH_3\left(\frac{1\,mol\,NH_3}{17.04\,g\,NH_3}\right)\left(\frac{1\,mol\,N_2}{2\,mol\,NH_3}\right) = 0.343\,mol\,N_2$$

e. How many grams of hydrogen are required to form 3.5 moles of NH_3?

$$3.5\,mol\,NH_3\left(\frac{3\,mol\,H_2}{2\,mol\,NH_3}\right)\left(\frac{2.02\,g\,H_2}{1\,mol\,H_2}\right) = 10.61\,g\,H_2$$

Practice: Mole/Mole and Mole/Mass Problems

Name Answer Key

The first step in the industrial manufacture of nitric acid involves the catalytic oxidation of ammonia according to the following BALANCED equation.

$$4NH_3\,(g) + 5O_2\,(g) \rightarrow 4NO\,(g) + 6H_2O\,(g)$$

How many moles of NO are formed if 824 g of NH_3 react?

$$824\,g\,NH_3\left(\frac{1\,mol\,NH_3}{17.04\,g\,NH_3}\right)\left(\frac{4\,mol\,NO}{4\,mol\,NH_3}\right) = 48.35\,mol\,NO$$

How many grams of water are formed if 2.5 moles of ammonia are oxidized?

$$2.5\,mol\,NH_3\left(\frac{6\,mol\,H_2O}{4\,mol\,NH_3}\right)\left(\frac{18.02\,g\,H_2O}{1\,mol\,H_2O}\right) = 67.57\,g\,H_2O$$

How many moles of oxygen are needed to react with 4.6 moles of ammonia?

$$4.6\,moles\,NH_3\left(\frac{5\,moles\,O_2}{4\,moles\,NH_3}\right) = 5.75\,moles\,O_2$$

Mercury (II) oxide decomposes into mercury and oxygen gas according to the following UNBALANCED equation.

$$2\ HgO \rightarrow 2\ Hg + O_2$$

How many moles of mercury (II) oxide are needed to produce 125 g of oxygen?

$$125\,g\,O_2 \left(\frac{1\,mol\,O_2}{32.00\,g\,O_2}\right)\left(\frac{2\,mol\,HgO}{1\,mol\,O_2}\right) = 7.81\,mol\,HgO$$

How many moles of mercury are produced if 24.5 moles of mercury (II) oxide decompose?

$$24.5\,moles\,HgO \left(\frac{2\,mol\,Hg}{2\,mol\,HgO}\right) = 24.5\,moles\,of\,Hg$$

How many grams of oxygen will be produced if 2.3 moles of mercury are produced?

$$2.3\,moles\,Hg \left(\frac{1\,moles\,O_2}{2\,moles\,Hg}\right)\left(\frac{18.02\,g}{1\,mol\,O_2}\right) = 20.72\,g\,of\,O_2$$