Worksheet: Mole/Mass Problems Name_____

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.

$$\underline{2}\ Al + \underline{3}\ Cl_2 \rightarrow \underline{2}\ AlCl_3$$

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?

$$2.50\ \text{mol Al} \times \frac{2\ \text{mol AlCl}_3}{2\ \text{mol Al}} \times \frac{133.33\text{g AlCl}_3}{1\ \text{mol AlCl}_3} = \boxed{333\text{g AlCl}_3}$$

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

$$123\text{g AlCl}_3 \times \frac{1\ \text{mol AlCl}_3}{133.33\text{g AlCl}_3} \times \frac{3\ \text{mol Cl}_2}{2\ \text{mol AlCl}_3} = \boxed{.138\ \text{mol Cl}_2}$$

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

$$3.4\ \text{mol Cl}_2 \times \frac{2\ \text{mol Al}}{3\ \text{mol Cl}_2} \times \frac{26.98\text{g Al}}{1\ \text{mol Al}} = \boxed{61\text{g Al}}$$

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

$$17\text{g Al} \times \frac{1\ \text{mol Al}}{26.98\text{g Al}} \times \frac{2\ \text{mol AlCl}_3}{2\ \text{mol Al}} = \boxed{1.3\ \text{mol AlCl}_3}$$

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.

$$\underline{1}\ N_2 + \underline{3}\ H_2 \rightarrow \underline{2}\ NH_3$$

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

$$1.34\ \text{mol}\ N_2 \times \frac{2\ \text{mol}\ NH_3}{1\ \text{mol}\ N_2} \times \frac{17.03\ \text{g}\ NH_3}{1\ \text{mol}\ NH_3} = \boxed{45.6\ \text{g}\ NH_3}$$

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

$$1.34\ \text{mol}\ N_2 \times \frac{3\ \text{mol}\ H_2}{1\ \text{mol}\ N_2} \times \frac{2.016\ \text{g}\ H_2}{1\ \text{mol}\ H_2} = \boxed{8.10\ \text{g}\ H_2}$$

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

$$11.7\ \text{mol}\ NH_3 \times \frac{1\ \text{mol}\ N_2}{2\ \text{mol}\ NH_3} = 5.85\ \text{mol}\ N_2$$

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

$$11.7\ \text{g}\ NH_3 \times \frac{1\ \text{mol}\ NH_3}{17.03\ \text{g}\ NH_3} \times \frac{1\ \text{mol}\ N_2}{2\ \text{mol}\ NH_3} = \boxed{.344\ \text{mol}\ N_2}$$

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

$$3.5\ \text{mol}\ NH_3 \times \frac{3\ \text{mol}\ H_2}{2\ \text{mol}\ NH_3} \times \frac{2.016\ \text{g}\ H_2}{1\ \text{mol}\ H_2} = 11\ \text{g}\ H_2$$