Worksheet: Mole/Mass Problems **Name** *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 _____ mole(s) of Cl_2 to produce _____ mole(s) of $AlCl_3$.

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

$$?\ g\ AlCl_3 = 2.50\ \cancel{mol\ Al} \times \frac{2\ \cancel{mol\ AlCl_3}}{2\ \cancel{mol\ Al}} \times \frac{133.5\ g\ AlCl_3}{1\ \cancel{mol\ AlCl_3}} = 334\ g\ AlCl_3$$

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

$$?\ mol\ Cl_2 = 12.3\ \cancel{g\ AlCl_3} \times \frac{1\ \cancel{mol\ AlCl_3}}{133.5\ \cancel{g\ AlCl_3}} \times \frac{3\ mol\ Cl_2}{2\ \cancel{mol\ AlCl_3}} = 0.138\ mol\ Cl_2$$

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

$$?\ g\ Al = 3.4\ \cancel{mol\ Cl_2} \times \frac{2\ \cancel{mol\ Al}}{3\ \cancel{mol\ Cl_2}} \times \frac{27.0\ g\ Al}{1\ \cancel{mol\ Al}} = 61.2\ g\ Al$$

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

$$?\ mol\ AlCl_3 = 17\ \cancel{g\ Al} \times \frac{1\ \cancel{mol\ Al}}{27.0\ \cancel{g\ Al}} \times \frac{2\ mol\ AlCl_3}{2\ \cancel{mol\ Al}} = 0.63\ mol\ AlCl_3$$

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.

$$\_\_\_N_2 + \_\_3\_\_H_2 \rightarrow \_\_2\_\_NH_3$$

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

$$?\ g\ NH_3 = 1.34\ \cancel{mol\ N_2} \times \frac{2\ \cancel{mol\ NH_3}}{1\ \cancel{mol\ N_2}} \times \frac{17.0\ g\ NH_3}{1\ \cancel{mol\ NH_3}} = 45.6\ g\ NH_3$$

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

$$?\ g\ H_2 = 1.34\ \cancel{mol\ N_2} \times \frac{3\ \cancel{mol\ H_2}}{1\ \cancel{mol\ N_2}} \times \frac{2.0\ g\ H_2}{1\ \cancel{mol\ H_2}} = 8.0\ g\ H_2$$

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

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

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

$$?\ mol\ N_2 = 11.7\ \cancel{g\ NH_3} \times \frac{1\ \cancel{mol\ NH_3}}{17.0\ \cancel{g\ NH_3}} \times \frac{1\ mol\ N_2}{2\ \cancel{mol\ NH_3}} = 0.344\ mol\ N_2$$

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

$$?\ g\ H_2 = 3.5\ \cancel{mol\ NH_3} \times \frac{3\ \cancel{mol\ H_2}}{2\ \cancel{mol\ NH_3}} \times \frac{2.0\ g\ H_2}{1\ \cancel{mol\ H_2}} = 11\ g\ H_2$$