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.

\[2\text{Al} + 3\text{Cl}_2 \rightarrow 2\text{AlCl}_3\]

a. 2 moles of Al will react with \_2\_ mole(s) of Cl\_2 to produce \_3\_ mole(s) of AlCl\_3.

b. How many grams of AlCl\_3 will be produced if 2.50 moles of Al react?

\[? \text{ g AlCl}_3 = 2.50 \text{ mol Al} \times \frac{2 \text{ mol AlCl}_3}{2 \text{ mol Al}} \times \frac{133.5 \text{ g AlCl}_3}{1 \text{ mol AlCl}_3} = 334 \text{ g AlCl}_3\]

c. How many moles of Cl\_2 must react to produce 12.3 g of AlCl\_3?

\[? \text{ mol Cl}_2 = 12.3 \text{ g AlCl}_3 \times \frac{1 \text{ mol AlCl}_3}{133.5 \text{ g AlCl}_3} \times \frac{3 \text{ mol Cl}_2}{2 \text{ mol AlCl}_3} = 0.138 \text{ mol Cl}_2\]

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

\[? \text{ g Al} = 3.4 \text{ mol Cl}_2 \times \frac{2 \text{ mol Al}}{3 \text{ mol Cl}_2} \times \frac{27.0 \text{ g Al}}{1 \text{ mol Al}} = 61.2 \text{ g Al}\]

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

\[? \text{ mol AlCl}_3 = 17 \text{ g Al} \times \frac{1 \text{ mol Al}}{27.0 \text{ g Al}} \times \frac{2 \text{ mol AlCl}_3}{2 \text{ mol Al}} = 0.63 \text{ mol AlCl}_3\]
2. The ammonia (NH₃) used to make fertilizers for lawns and gardens is made by reacting nitrogen and hydrogen according to the following reaction.

\[ \text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3 \]

a. Determine the mass in grams of NH₃ formed from 1.34 moles of nitrogen.

\[ ? \text{ g NH}_3 = 1.34 \text{ mol N}_2 \times \frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} \times \frac{17.0 \text{ g NH}_3}{1 \text{ mol NH}_3} = 45.6 \text{ g NH}_3 \]

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

\[ ? \text{ g H}_2 = 1.34 \text{ mol N}_2 \times \frac{3 \text{ mol H}_2}{1 \text{ mol N}_2} \times \frac{2.0 \text{ g H}_2}{1 \text{ mol H}_2} = 8.0 \text{ g H}_2 \]

c. How many moles of nitrogen are required to produce 11.7 moles of NH₃?

\[ ? \text{ mol N}_2 = 11.7 \text{ mol NH}_3 \times \frac{1 \text{ mol N}_2}{2 \text{ mol NH}_3} = 5.85 \text{ mol N}_2 \]

d. How many moles of nitrogen are required to produce 11.7 grams of NH₃?

\[ ? \text{ mol N}_2 = 11.7 \text{ g NH}_3 \times \frac{1 \text{ mol NH}_3}{17.0 \text{ g NH}_3} \times \frac{1 \text{ mol N}_2}{2 \text{ mol NH}_3} = 0.344 \text{ mol N}_2 \]

e. How many grams of hydrogen are required to form 3.5 moles of NH₃?

\[ ? \text{ g H}_2 = 3.5 \text{ mol NH}_3 \times \frac{3 \text{ mol H}_2}{2 \text{ mol NH}_3} \times \frac{2.0 \text{ g H}_2}{1 \text{ mol H}_2} = 11 \text{ g H}_2 \]