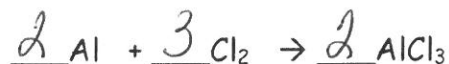


Answer each of the following questions using the equation provided. BE SURE TO BALANCE EACH EQUATION BEFORE SOLVING ANY PROBLEMS. SHOW ALL WORK.

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



- a. 2 moles of Al will react with 3 mole(s) of Cl₂ to produce 2 mole(s) of AlCl₃.

- b. How many grams of AlCl₃ will be produced if 2.50 moles of Al react?

$$2.50 \text{ mol of Al} \left(\frac{2 \text{ mol AlCl}_3}{2 \text{ mol Al}} \right) \left(\frac{133.33 \text{ g AlCl}_3}{1 \text{ mol Al}} \right) = 333.33 \text{ g AlCl}_3$$

- c. How many moles of Cl₂ must react to produce 12.3 g of AlCl₃?

$$12.3 \text{ g AlCl}_3 \left(\frac{1 \text{ mol AlCl}_3}{133.33 \text{ g AlCl}_3} \right) \left(\frac{3 \text{ mol Cl}_2}{2 \text{ mol AlCl}_3} \right) = 0.138 \text{ mol Cl}_2$$

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

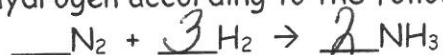
$$3.4 \text{ moles Cl}_2 \left(\frac{2 \text{ mol Al}}{3 \text{ mol Cl}_2} \right) \left(\frac{26.98 \text{ g Al}}{1 \text{ mol Al}} \right) = 61.15 \text{ g Al}$$

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

$$17 \text{ g of Al} \left(\frac{1 \text{ mol Al}}{26.98 \text{ g Al}} \right) \left(\frac{2 \text{ mol of AlCl}_3}{2 \text{ mol Al}} \right) = 0.37 \text{ mol AlCl}_3$$

Answer Key

2. The ammonia (NH₃) used to make fertilizers for lawns and gardens is made by reacting nitrogen and hydrogen according to the following reaction.



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

$$1.34 \text{ mol N}_2 \left(\frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} \right) \left(\frac{17.04 \text{ g NH}_3}{1 \text{ mol NH}_3} \right) = 45.67 \text{ g NH}_3$$

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

$$1.34 \text{ mol N}_2 \left(\frac{3 \text{ mol H}_2}{1 \text{ mol N}_2} \right) \left(\frac{2.02 \text{ g H}_2}{1 \text{ mol H}_2} \right) = 8.12 \text{ g of H}_2$$

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

$$11.7 \text{ mol NH}_3 \left(\frac{1 \text{ mol N}_2}{2 \text{ mol NH}_3} \right) = 5.85 \text{ mol N}_2$$

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

$$11.7 \text{ g NH}_3 \left(\frac{1 \text{ mol NH}_3}{17.04 \text{ g NH}_3} \right) \left(\frac{1 \text{ mol N}_2}{2 \text{ mol NH}_3} \right) = 0.343 \text{ mol N}_2$$

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

$$3.5 \text{ mol NH}_3 \left(\frac{3 \text{ mol H}_2}{2 \text{ mol NH}_3} \right) \left(\frac{2.02 \text{ g H}_2}{1 \text{ mol H}_2} \right) = 10.61 \text{ g H}_2$$

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



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

$$824\text{g NH}_3 \left(\frac{1\text{mol NH}_3}{17.04\text{g NH}_3} \right) \left(\frac{4\text{mol NO}}{4\text{mol NH}_3} \right) = 48.35\text{ mol NO}$$

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

$$2.5\text{ mol NH}_3 \left(\frac{6\text{mol H}_2\text{O}}{4\text{mol NH}_3} \right) \left(\frac{18.02\text{g H}_2\text{O}}{1\text{mol H}_2\text{O}} \right) = 67.57\text{ g H}_2\text{O}$$

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

$$4.6\text{ moles NH}_3 \left(\frac{5\text{ moles O}_2}{4\text{ moles NH}_3} \right) = 5.75\text{ moles O}_2$$

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



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

$$125 \text{ g O}_2 \left(\frac{1 \text{ mol O}_2}{32.00 \text{ g O}_2} \right) \left(\frac{2 \text{ mol HgO}}{1 \text{ mol O}_2} \right) = 7.81 \text{ mol HgO}$$

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

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

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

$$2.3 \text{ moles Hg} \left(\frac{1 \text{ moles O}_2}{2 \text{ moles Hg}} \right) \left(\frac{32.00 \text{ g}}{1 \text{ mol O}_2} \right) = 36.8 \text{ g of O}_2$$