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12 STOICHIOMETRY

Practice Problems

In your notebook, solve the following problems.

SECTION 12.1 THE ARITHMETIC OF EQUATIONS

Use the 3-step problem-solving approach you learned in Chapter 1.

1. An apple pie needs 10 large apples, 2 crusts (top and bottom), and 1 tablespoon of cinnamon. Write a balanced equation that fits this situation. How many apples are needed to make 25 pies?
2. Two moles of potassium chloride and three moles of oxygen are produced from the decomposition of two moles of potassium chlorate, $KClO_3(s)$. Write the balanced equation. How many moles of oxygen are produced from 12 moles of potassium chlorate?
3. Using the equation from problem 2, how many moles of oxygen are produced from 14 moles of potassium chlorate?
4. Two molecules of hydrogen react with one molecule of oxygen to produce two molecules of water. How many molecules of water are produced from 2.0×10^{23} molecules of oxygen? How many moles of water are produced from 22.5 moles of oxygen?

SECTION 12.2 CHEMICAL CALCULATIONS

1. Calculate the number of moles of hydrogen chloride produced from 10 moles of hydrogen.

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

2. Calculate the number of moles of chlorine needed to form 14 moles of iron(III) chloride.

$$2Fe(s) + 3Cl_2(g) \rightarrow 2FeCl_3(s)$$

3. Calculate the number of grams of nitrogen dioxide that are produced from 4 moles of nitric oxide.

$$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$$

4. Calculate the mass of oxygen produced from the decomposition of 75.0 g of potassium chlorate.

$$2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$$

5. Calculate the mass of silver needed to react with chlorine to produce 84 g of silver chloride. (*Hint:* Write a balanced equation first.)
6. How many liters of carbon monoxide at STP are needed to react with 4.80 g of oxygen gas to produce carbon dioxide?

$$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$$

7. Calculate the number of liters of oxygen gas needed to produce 15.0 liters of dinitrogen trioxide. Assume all gases are at the same conditions of temperature and pressure.

$$2N_2(g) + 3O_2(g) \rightarrow 2N_2O_3(g)$$

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8. A volume of 7.5 L of hydrogen gas at STP was produced from the single-replacement reaction of zinc with nitric acid. Calculate the mass of zinc needed for this reaction.

SECTION 12.3 LIMITING REAGENT AND PERCENT YIELD

1. How many moles of water can be made from 4 moles of oxygen gas and 16 moles of hydrogen gas? What is the limiting reagent?

2. Calculate the mass of water produced from the reaction of 24.0 g of H_2 and 160.0 g of O_2. What is the limiting reagent?

3. The burning of 18.0 g of carbon produces 55.0 g of carbon dioxide. What is the theoretical yield of CO_2? Calculate the percent yield of CO_2.

4. Calculate the percent yield of $Cl_2(g)$ in the electrolytic decomposition of hydrogen chloride if 25.8 g of HCl produces 13.6 g of chlorine gas.

5. One method for reclaiming silver metal from silver chloride results in a 94.6% yield. Calculate the actual mass of silver that can be produced in this reaction if 100.0 g of silver chloride is converted to silver metal.

$$2AgCl(s) \rightarrow 2Ag(s) + Cl_2(g)$$

6. What is the actual amount of magnesium oxide produced when excess carbon dioxide reacts with 42.8 g of magnesium metal? The percent yield of $MgO(s)$for this reaction is 81.7%.

$$2Mg(s) + CO_2(g) \rightarrow 2MgO(s) + C(s)$$