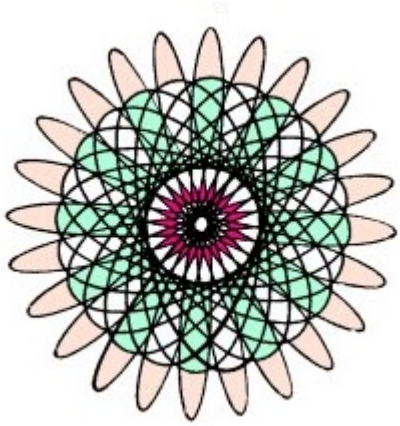

5.7 End-of-Chapter Material

ADDITIONAL EXERCISES

1. How many molecules of O_2 will react with 6.022×10^{23} molecules of H_2 to make water? The reaction is $2H_2(g) + O_2(g) \rightarrow 2H_2O(\ell)$.

2. How many molecules of H_2 will react with 6.022×10^{23} molecules of N_2 to make ammonia? The reaction is $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$.

3. How many moles are present in 6.411 kg of CO_2? How many molecules is this?

4. How many moles are present in 2.998 mg of SCl_4? How many molecules is this?

5. What is the mass in milligrams of 7.22×10^{20} molecules of CO_2?

6. What is the mass in kilograms of 3.408×10^{25} molecules of SiS_2?

7. What is the mass in grams of 1 molecule of H_2O?

8. What is the mass in grams of 1 atom of Al?

9. What is the volume of 3.44 mol of Ga if the density of Ga is 6.08 g/mL?

10. What is the volume of 0.662 mol of He if the density of He is 0.1785 g/L?

11. For the chemical reaction

    $2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(\ell)$

    assume that 13.4 g of C_4H_{10} reacts completely to products. The density of CO_2 is 1.96 g/L. What volume in liters of CO_2 is produced?

12. For the chemical reaction

    $2GaCl_3(s) + 3H_2(g) \rightarrow 2Ga(\ell) + 6HCl(g)$

    if 223 g of $GaCl_3$ reacts completely to products and the density of Ga is 6.08 g/mL, what volume in milliliters of Ga is produced?

13. Calculate the mass of each product when 100.0 g of CuCl react according to the reaction

    $2CuCl(aq) \rightarrow CuCl_2(aq) + Cu(s)$

What do you notice about the sum of the masses of the products? What concept is being illustrated here?

14. Calculate the mass of each product when 500.0 g of $SnCl_2$ react according to the reaction

    $2SnCl_2(aq) \rightarrow SnCl_4(aq) + Sn(s)$

    What do you notice about the sum of the masses of the products? What concept is being illustrated here?

15. What mass of CO_2 is produced from the combustion of 1 gal of gasoline? The chemical formula of gasoline can be approximated as C_8H_{18}. Assume that there are 2,801 g of gasoline per gallon.

16. What mass of H_2O is produced from the combustion of 1 gal of gasoline? The chemical formula of gasoline can be approximated as C_8H_{18}. Assume that there are 2,801 g of gasoline per gallon.
17. A chemical reaction has a theoretical yield of 19.98 g and a percent yield of 88.40%. What is the actual yield?

18. A chemical reaction has an actual yield of 19.98 g and a percent yield of 88.40%. What is the theoretical yield?

19. Given the initial amounts listed, what is the limiting reagent, and how much of the other reactants are in excess?

$$\underset{35.0\,g}{P_4} + \underset{12.7\,g}{3NaOH} + \underset{9.33\,g}{3H_2O} \rightarrow 2Na_2HPO_4 + PH_3$$

20. Given the initial amounts listed, what is the limiting reagent, and how much of the other reactants are in excess?

$$\underset{46.3\,g}{2NaCrO_2} + \underset{88.2\,g}{3NaBrO_4} + \underset{32.5\,g}{2NaOH} \rightarrow 3NaBrO_3 + 2Na_2CrO_4 + H_2O$$

21. Verify that it does not matter which product you use to predict the limiting reagent by using both products in this combustion reaction to determine the limiting reagent and the amount of the reactant in excess. Initial amounts of each reactant are given.

$$\underset{26.3\,g}{C_3H_8} + \underset{21.8\,g}{5O_2} \rightarrow 3CO_2(g) + 4H_2O(\ell)$$

22. Just in case you suspect Exercise 21 is rigged, do it for another chemical reaction and verify that it does not matter which product you use to predict the limiting reagent by using both products in this combustion reaction to determine the limiting reagent and the amount of the reactant in excess. Initial amounts of each reactant are given.

$$\underset{35.0\,g}{2P_4} + \underset{12.7\,g}{6NaOH} + \underset{9.33\,g}{6H_2O} \rightarrow 3Na_2HPO_4 + 5PH_3$$

ANSWERS

1. 1.2044×10^{24} molecules

3. 145.7 mol; 8.77×10^{25} molecules

5. 52.8 mg

7. 2.99×10^{-23} g

9. 39.4 mL

11. 20.7 L

13. 67.91 g of $CuCl_2$; 32.09 g of Cu. The two masses add to 100.0 g, the initial amount of starting material, demonstrating the law of conservation of matter.

15. 8,632 g

17. 17.66 g

19. The limiting reagent is NaOH; 21.9 g of P_4 and 3.61 g of H_2O are left over.

21. Both products predict that O_2 is the limiting reagent; 20.3 g of C_3H_8 are left over.