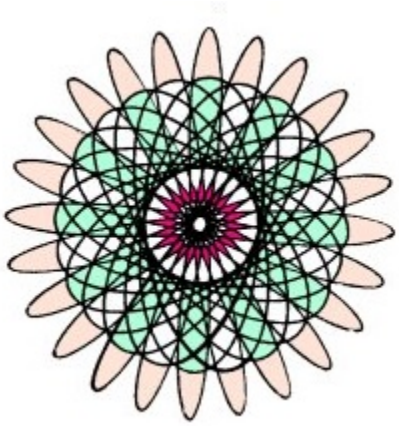

4.7 End-of-Chapter Material

ADDITIONAL EXERCISES

1. Chemical equations can also be used to represent physical processes. Write a chemical reaction for the boiling of water, including the proper phase labels.

2. Chemical equations can also be used to represent physical processes. Write a chemical reaction for the freezing of water, including the proper phase labels.

3. Explain why
   $4Na(s) + 2Cl_2(g) \rightarrow 4NaCl(s)$
   should not be considered a proper chemical equation.

4. Explain why
   $H_2(g) + 1/2O_2(g) \rightarrow H_2O(\ell)$
   should not be considered a proper chemical equation.

5. Does the chemical reaction represented by
   $3Zn(s) + 2Al(NO_3)_3(aq) \rightarrow 3Zn(NO_3)_2(aq) + 2Al(s)$
   proceed as written? Why or why not?

6. Does the chemical reaction represented by
   $2Au(s) + 2HNO_3(aq) \rightarrow 2AuNO_3(aq) + H_2(g)$
   proceed as written? Gold is a relatively useful metal for certain applications, such as jewelry and electronics. Does your answer suggest why this is so?

7. Explain what is wrong with this double-replacement reaction.
   $NaCl(aq) + KBr(aq) \rightarrow NaK(aq) + ClBr(aq)$

8. Predict the products of and balance this double-replacement reaction.
   $Ag_2SO_4(aq) + SrCl_2(aq) \rightarrow ?$

9. Write the complete and net ionic equations for this double-replacement reaction.
   $BaCl_2(aq) + Ag_2SO_4(aq) \rightarrow ?$

10. Write the complete and net ionic equations for this double-replacement reaction.

    $Ag_2SO_4(aq) + SrCl_2(aq) \rightarrow ?$

11. Identify the spectator ions in this reaction. What is the net ionic equation?

    $NaCl(aq) + KBr(aq) \rightarrow NaBr(aq) + KCl(aq)$

12. Complete this reaction and identify the spectator ions. What is the net ionic equation?

    $3H_2SO_4(aq) + 2Al(OH)_3(s) \rightarrow ?$

13. Can a reaction be a composition reaction and a redox reaction at the same time? Give an example to support your answer.

14. Can a reaction be a combustion reaction and a redox reaction at the same time? Give an example to support your answer.

15. Can a reaction be a decomposition reaction and a redox reaction at the same time? Give an example to support your answer.

16. Can a reaction be a combustion reaction and a double-replacement reaction at the same time? Give an example to support your answer.

17. Why is CH_4 not normally considered an acid?

18. Methyl alcohol has the formula CH_3OH. Why would methyl alcohol not normally be considered a base?

19. What are the oxidation numbers of the nitrogen atoms in these substances?
    a. N_2
    b. NH_3
    c. NO
    d. N_2O
    e. NO_2
    f. N_2O_4
    g. N_2O_5
    h. $NaNO_3$

20. What are the oxidation numbers of the sulfur atoms in these substances?
    a. SF_6
    b. Na_2SO_4
    c. K_2SO_3
    d. SO_3
    e. SO_2
    f. S_8
    e. Na_2S

21. Disproportion is a type of redox reaction in which the same substance is both oxidized and reduced. Identify the element that is disproportionating and indicate the initial and final oxidation numbers of that element.
    $2CuCl(aq) \rightarrow CuCl_2(aq) + Cu(s)$

22. Disproportion is a type of redox reaction in which the same substance is both oxidized and reduced. Identify the element that is disproportionating and indicate the initial and final oxidation numbers of that element.
    $3Cl_2(g) + 6OH^-(aq) \rightarrow 5Cl^-(aq) + ClO_3^-(aq) + 3H_2O(\ell)$

ANSWERS

1. $H_2O(\ell) \rightarrow H_2O(g)$

3. The coefficients are not in their lowest whole-number ratio.

5. No; zinc is lower in the activity series than aluminum.

7. In the products, the cation is pairing with the cation, and the anion is pairing with the anion.

9. Complete ionic equation: $Ba^{2+}(aq) + 2Cl^{-}(aq) + 2Ag^{+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s) + 2AgCl(s)$

   Net ionic equation: The net ionic equation is the same as the complete ionic equation.

11. Each ion is a spectator ion; there is no overall net ionic equation.

13. Yes; $H_2 + Cl_2 \rightarrow 2HCl$ (answers will vary)

15. Yes; $2HCl \rightarrow H_2 + Cl_2$ (answers will vary)

17. It does not increase the H^+ ion concentration; it is not a compound of H^+.

19. a. 0
    b. −3
    c. +2
    d. +1

e. +4

f. +4

g. +5

h. +5

21. Copper is disproportionating. Initially, its oxidation number is +1; in the products, its oxidation numbers are +2 and 0, respectively.