Chapter: Chemical Equations and Reactions

PART I  In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

_____ 1. The production of a slightly soluble solid compound in a double-displacement reaction results in the formation of a
   a. gas.
   b. precipitate.
   c. combustion reaction.
   d. halogen.

_____ 2. To balance a chemical equation, it is permissible to adjust the
   a. coefficients.
   b. subscripts.
   c. formulas of the products.
   d. number of products.

_____ 3. In a chemical equation, the symbol \((aq)\) indicates that the substance is
   a. water.
   b. dissolved in water.
   c. an acid.
   d. insoluble.

_____ 4. The tendency for a replacement reaction to occur increases as the
   a. interval between any two elements in the activity series decreases.
   b. temperature decreases.
   c. valence electrons are used up.
   d. interval between any two elements in the activity series increases.

_____ 5. The coefficients in a chemical equation
   a. indicate the number of moles of each substance that react.
   b. show the number of grams of each substance that react.
   c. are the molar masses of the substances.
   d. show the valence electrons for each atom.

_____ 6. If metal X is lower than metal Y in the activity series, then
   a. X will replace ions of Y in solution.
   b. Y will replace ions of X in solution.
   c. Y will form oxides only indirectly.
   d. X will react with cold water.
7. In a reaction, the ions of two compounds exchange places in aqueous solution to form two new compounds. This reaction is called a
a. synthesis reaction.
b. decomposition reaction.
c. single-displacement reaction.
d. double-displacement reaction.

8. The use of a double arrow in a chemical equation indicates that the reaction
a. is reversible.
b. requires heat.
c. is written backward.
d. has not been confirmed in the laboratory.

PART II Write the correct term (or terms) in the space provided.

9. A small whole number that appears in front of a formula in a chemical equation is called a(n) ____________________.

10. In a chemical equation, the symbol (l) indicates that the substance is ____________________.

11. The products re-form the original reactants in a(n) ____________________.

12. The general equation for a synthesis reaction is ____________________.

13. The general equation for a decomposition reaction is ____________________.

14. The general equation for a single-displacement reaction is ____________________.

15. The general equation for a double-displacement reaction is ____________________.

16. Oxides of active metals, such as CaO, react with water to form ____________________.
17. A substance combines with oxygen, releasing a large amount of energy as heat and light, in a(n) _____________________.

18. The decomposition of a substance by an electric current is called _____________________.

19. A(n) ________________________ orders the elements by the ease with which they undergo certain chemical reactions.

20. A(n) ________________________ uses symbols and formulas to represent the names and relative amounts of reactants and products in a chemical reaction.

21. The law of ________________________ must be satisfied for a chemical equation to be balanced.

22. A(n) ________________________ product is sometimes indicated by an arrow pointing upward.

23. The symbol $\rightarrow$ means that the reactants are _____________________.

**PART III  Write the answers to the following questions in the space provided.**

24. How are a word equation and a formula equation alike? How do they differ from a chemical equation?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

25. What are three observations that indicate a chemical change may be taking place?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

**PART IV  Write a word equation for each chemical reaction in the space provided.**

26. $2\text{ZnS}(s) + 3\text{O}_2(g) \rightarrow 2\text{ZnO}(s) + 2\text{SO}_2(g)$
Chapter Test B, continued

27. \(2\text{NaI} + \text{Cl}_2 \rightarrow 2\text{NaCl} + \text{I}_2\)

Write a formula equation for each word equation in the space provided.

28. \(\text{magnesium} + \text{oxygen} \rightarrow \text{magnesium oxide}\)

29. \(\text{calcium carbonate} \rightarrow \text{calcium oxide} + \text{carbon dioxide}\)

On the line to the left, identify each chemical equation as a \textit{synthesis}, \textit{decomposition}, \textit{single-displacement}, or \textit{double-displacement} reaction.

30. \(\text{2H}_2\text{O}(l) \rightarrow \text{2H}_2(g) + \text{O}_2(g)\)

31. \(\text{Cl}_2(g) + 2\text{KBr}(aq) \rightarrow 2\text{KCl}(aq) + \text{Br}_2(l)\)

32. \(\text{CaO}(s) + \text{H}_2\text{O}(l) \rightarrow \text{Ca(OH)}_2(s)\)

33. \(\text{HCl}(aq) + \text{NaOH}(aq) \rightarrow \text{NaCl}(aq) + \text{H}_2\text{O}(l)\)

Balance the following formula equations in the space provided.

34. \(\text{AgNO}_3 + \text{CuCl}_2 \rightarrow \text{AgCl} + \text{Cu(NO}_3)_2\)

35. \(\text{PbO}_2 \rightarrow \text{PbO} + \text{O}_2\)

36. \(\text{Zn(OH)}_2 + \text{CH}_3\text{COOH} \rightarrow \text{Zn(CH}_3\text{COO})_2 + \text{H}_2\text{O}\)
PART V Using the activity series table, predict whether each of the following reactions will occur. Write *no reaction* for those that will not occur. For the reactions that will occur, write the products and balance the equations in the space provided.

**Activity Series of the Elements**

<table>
<thead>
<tr>
<th>Metals</th>
<th>Halogens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li</td>
<td>F₂</td>
</tr>
<tr>
<td>Rb</td>
<td>Cl₂</td>
</tr>
<tr>
<td>K</td>
<td>Br₂</td>
</tr>
<tr>
<td>Ba</td>
<td>I₂</td>
</tr>
<tr>
<td>Sr</td>
<td></td>
</tr>
<tr>
<td>Ca</td>
<td></td>
</tr>
<tr>
<td>Na</td>
<td></td>
</tr>
<tr>
<td>Mg</td>
<td></td>
</tr>
<tr>
<td>Al</td>
<td></td>
</tr>
<tr>
<td>Mn</td>
<td></td>
</tr>
<tr>
<td>Zn</td>
<td></td>
</tr>
<tr>
<td>Cr</td>
<td></td>
</tr>
<tr>
<td>Fe</td>
<td></td>
</tr>
<tr>
<td>Cd</td>
<td></td>
</tr>
<tr>
<td>Co</td>
<td></td>
</tr>
<tr>
<td>Ni</td>
<td></td>
</tr>
<tr>
<td>Sn</td>
<td></td>
</tr>
<tr>
<td>Pb</td>
<td></td>
</tr>
<tr>
<td>H₂</td>
<td></td>
</tr>
<tr>
<td>Sb</td>
<td></td>
</tr>
<tr>
<td>Bi</td>
<td></td>
</tr>
<tr>
<td>Cu</td>
<td></td>
</tr>
<tr>
<td>Hg</td>
<td></td>
</tr>
<tr>
<td>Ag</td>
<td></td>
</tr>
<tr>
<td>Pt</td>
<td></td>
</tr>
<tr>
<td>Au</td>
<td>Forming oxides only</td>
</tr>
</tbody>
</table>

37. Mg(s) + steam → _________

38. Pt(s) + O₂(g) → _________

39. Cl₂(g) + MgBr₂(aq) → _________

40. Zn(s) + HCl(aq) → _________

41. Cr(s) + H₂O(l) → _________

42. Ni(s) + CuCl₂(aq) → _________

43. Ni(s) + H₂O(l) → _________

44. Mg(s) + Co(NO₃)₂(aq) → _____
10. $-1$
11. $+2$
12. $+4$
13. $\text{SiO}_2$
14. $\text{Cl}_4$
15. $\text{Sn(CrO}_4)_2$
16. $\text{Ba(OH)}_2$
17. phosphorus(III) iodide
18. dinitrogen tetroxide
19. iron(II) nitrite
20. carbon tetrachloride
21. carbon monoxide
22. copper(II) carbonate
23. $\text{CaCl}_2$, calcium chloride
24. $\text{PbCrO}_4$, lead(II) chromate
25. $\text{Al}_2(\text{SO}_4)_3$, aluminum sulfate
26. $\text{Sn}_3(\text{PO}_4)_4$, tin(IV) phosphate
27. cyanide ion
28. oxide ion
29. hydroxide ion
30. $\text{S}^{2-}$
31. $\text{Cu}^+$
32. $\text{CO}_3^{2-}$
33. $\text{H}_2$, $+1$; $\text{O}$, $-1$
34. $\text{C}_2$, $+4$; $\text{O}$, $-2$
35. $\text{N}_2$, $-3$; $\text{H}_2$, $+1$
36. 323.5 g/mol
37. 134.45 amu
38. 47.27% Cu, 52.73% Cl
39. 43.2 g
40. $\text{CF}_4$
41. $\text{C}_4\text{H}_{10}$
42. $\text{C}_2\text{H}_6$

**TEST B**

1. b  
2. a  
3. b  
4. d  
5. a  
6. b  
7. d  
8. a  
9. coefficient  
10. liquid  
11. reversible reaction  
12. $A + X \rightarrow AX$  
13. $AX \rightarrow A + X$  
14. $A + BX \rightarrow AX + B$  
15. $AX + BY \rightarrow AY + BX$  
16. metal hydroxides  
17. combustion reaction  
18. electrolysis  
19. activity series  
20. chemical equation  
21. conservation of mass  
22. gaseous  
23. heated  
24. A word equation and a formula equation are both qualitative. Although they both show the reactants and products of a chemical reaction, they give no information about amounts of reactants or products. A chemical equation, however, does show the relative amounts of the reactants and products in a chemical reaction.  
25. Three indications of a chemical reaction are the radiation of heat and light, the production of a gas, and the formation of a precipitate.  
26. zinc sulfide + oxygen $\rightarrow$  
   zinc oxide + sulfur dioxide  
27. sodium iodide + chlorine $\rightarrow$  
   sodium chloride + iodine  
28. $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$  
29. $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$  
30. decomposition reaction  
31. single-displacement reaction  
32. synthesis reaction  
33. double-displacement reaction  
34. $2\text{AgNO}_3 + \text{CuCl}_2 \rightarrow 2\text{AgCl} + \text{Cu(NO}_3)_2$  
35. $2\text{PbO}_2 \rightarrow 2\text{PbO} + \text{O}_2$  
36. $\text{Zn(OH)}_2 + 2\text{CH}_3\text{COOH} \rightarrow$  
   $\text{Zn(CH}_3\text{COO)}_2 + 2\text{H}_2\text{O}$  
37. $\text{Mg(s)} + 2\text{H}_2\text{O(g)} \rightarrow \text{Mg(OH)}_2(\text{aq}) + \text{H}_2(\text{g})$  
38. no reaction  
39. $\text{Cl}_2(\text{g}) + \text{MgBr}_2(\text{aq}) \rightarrow \text{MgCl}_2(\text{aq}) + \text{Br}_2(\text{l})$

8 *Chemical Equations and Reactions,*  
*pp. 65–73*

**TEST A**

1. c  
2. d  
3. a  
4. d  
5. d  
6. d  
7. a  
8. b  
9. b  
10. b  
11. c  
12. c  
13. d  
14. a  
15. d  
16. d  
17. d  
18. b  
19. d  
20. a  
21. b  
22. c  
23. b  
24. a  
25. c
40. \[ \text{Zn}(s) + 2\text{HCl}(aq) \rightarrow \text{ZnCl}_2(aq) + \text{H}_2(g) \]
41. no reaction
42. \[ \text{Ni}(s) + \text{CuCl}_2(aq) \rightarrow \text{NiCl}_2(aq) + \text{Cu}(s) \]
43. no reaction
44. \[ \text{Mg}(s) + \text{Co(NO}_3)_2(aq) \rightarrow \text{Mg(NO}_3)_2(aq) + \text{Co}(s) \]

9 **Stoichiometry,**

pp. 74–83

### TEST A

1. a 2. b
3. a 4. a
5. d 6. c
7. a 8. d
9. b 10. d
11. a 12. c
13. b 14. a
15. b 16. d
17. a 18. c
19. c 20. b
21. d 22. a
23. d 24. a
25. c

### TEST B

1. c 2. b
3. d 4. a
5. a 6. a
7. a 8. b
9. given: mass of \( \text{NH}_3 \) = 500 g
   unknown: mass of \( \text{N}_2 \)
10. given: mass of \( \text{H}_2\text{O} \) = 500 g
    unknown: moles of \( \text{H}_2 \)
11. given: amount of \( \text{CO}_2 \) = 20 mol
    unknown: mass of \( \text{CO} \)
12. given: amount of \( \text{H}_2\text{O} \) = 50 mol
    unknown: moles of \( \text{O}_2 \)
13. given: mass of \( \text{SO}_2 \) = 800 g
    unknown: mass of \( \text{S} \)
14. percentage yield = \( \frac{\text{actual yield}}{\text{theoretical yield}} \times 100 \)
15. moles of \( \text{A} \) \rightarrow \text{moles of B}
16. \( \frac{1}{3} \) mol \( \text{C}_7\text{H}_6\text{O}_3 \)
   138.13 g \( \text{C}_7\text{H}_6\text{O}_3 \)
17. limiting reactant or reagent
18. actual yield
19. excess reactant
20. 70.0 g

10 **States of Matter,**

pp. 84–92

### TEST A

1. b 2. a
3. c 4. b
5. d 6. b
7. c 8. d
9. a 10. c
11. b 12. a
13. c 14. a
15. b 16. d
17. a 18. c
19. c 20. b
21. b 22. b
23. a 24. a
25. d

### TEST B

1. a 2. c
3. a 4. c
5. c 6. c
7. a
8. pressure
9. temperature
10. 760 mm
11. \( V'P' = VP \)
12. kinetic-molecular theory
13. effusion
14. ideal gas
15. diffusion
16. pressure
17. newton
18. barometer
19. partial pressure
20. decrease
21. absolute zero
22. elastic
23. fluids
24. c
25. d

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