Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Chapter 4

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Which of the following compounds is a *weak electrolyte*?

A. HNO_3

B. $NaNO_3$

C. HNO_2

D. $NaNO_2$

____ 2. Which of the following compounds is a *strong electrolyte*?

A. H_2O

B. N_2

C. CH_3COOH (acetic acid)

D. KOH

____ 3. Identify the *major* ionic species present in an aqueous solution of NH_4ClO_4.

A. NH_4^+, Cl^-, $4O^{2-}$

B. N^{3-}, $4H^+$, Cl^-, $4O^{2-}$

C. $4NH^+$, $4ClO^-$

D. NH_4^+, ClO_4^-

____ 4. Identify the *major* ionic species present in an aqueous solution of $FeCl_3$.

A. Fe^+, Cl_3^-

B. Fe^{3+}, Cl_3^{3-}

C. Fe^{3+}, 3 Cl^-

D. Fe^{2+}, 3 Cl^-

____ 5. Based on the solubility rules, which one of the following compounds should be *insoluble* in water?

A. $NaCl$

B. $MgBr_2$

C. $FeCl_2$

D. $AgBr$

____ 6. Based on the solubility rules, which of the following compounds should be *insoluble* in water?

A. Na_2SO_4

B. $BaSO_4$

C. $CuSO_4$

D. $MgSO_4$

____ 7. Based on the solubility rules, which of the following should be *soluble* in water?

A. $CaSO_4$

B. $BaSO_4$

C. $PbSO_4$

D. KK_2SO_4

____ 8. Which of the following will occur when a solution of $Pb(NO_3)_2(aq)$ is mixed with a solution of $KI(aq)$?

A. A precipitate of KNO_3 will form; Pb^{2+} and I^- are spectator ions.

B. No precipitate will form.

C. A precipitate of $Pb(NO_3)_2$ will form; K^+ and I^- are spectator ions.

D. A precipitate of PbI_2 will form; K^+ and NO_3^- are spectator ions.

____ 9. Which of the following will occur when solutions of $CuSO_4(aq)$ and $BaCl_2(aq)$ are mixed?

A. A precipitate of $CuCl_2$ will form; Ba^{2+} and SO_4^{2-} are spectator ions.

B. A precipitate of $CuSO_4$ will form; Ba^{2+} and Cl^- are spectator ions.

C. A precipitate of $BaSO_4$ will form; Cu^{2+} and Cl^- are spectator ions.

D. A precipitate of $BaCl_2$ will form; Cu^{2+} and SO_4^{2-} are spectator ions.

____ 10. Identify the precipitate(s) formed when solutions of $NH_4Cl(aq)$, $AgClO_3(aq)$, and $NaCl(aq)$ are mixed.

A. $AgCl$

B. $AgCl$ and NH_4ClO_3

C. NH_4Cl and $NaClO_3$

D. NH_4ClO_3

____ 11. Identify the precipitate(s) formed when solutions of $Ca(ClO_4)_2(aq)$, $K_2CO_3(aq)$, and $NaNO_3(aq)$ are mixed.

A. $CaCO_3$

B. Na_2CO_3

C. $Ca(NO_3)_2$ and $NaClO_4$

D. $CaCO_3$ and Na_2CO_3

____ 12. Identify the correct *net ionic equation* for the reaction that occurs when solutions of $Pb(NO_3)_2$ and NH_4Cl are mixed.

A. $Pb(NO_3)_2(aq) + 2NH_4Cl(aq) \rightarrow NH_4NO_3(aq) + PbCl_2(s)$

B. $Pb^{2+}(aq) + 2Cl^{-}(aq) \rightarrow PbCl_2(s)$

C. $Pb^{2+}(aq) + 2NO_3^{-}(aq) + 2NH_4^{+}(aq) + 2Cl^{-}(aq) \rightarrow 2NH_4^{+}(aq) + 2NO_3^{-}(aq) + PbCl_2(s)$

D. $NH_4^{+}(aq) + NO_3^{-}(aq) \rightarrow 2NH_4NO_3(s)$

____ 13. Identify the correct *net ionic equation* for the reaction that occurs when solutions of $AgNO_3$ and NH_4Cl are mixed.

A. $AgNO_3(aq) + NH_4Cl(aq) \rightarrow AgCl(s) + NH_4Cl(aq)$

B. $NH_4^{+}(aq) + NO_3^{-}(aq) \rightarrow NH_4NO_3(s)$

C. $AgNO_3(aq) + NH_4Cl(aq) \rightarrow AgCl(s) + NH_4Cl(s)$

D. $Ag^{+}(aq) + Cl^{-}(aq) \rightarrow AgCl(s)$

____ 14. The common constituent in all acid solutions is

A. H_2

B. H^+

C. OH^-

D. H_2SO_4

____ 15. Which of the following compounds is a *weak acid*?

A. HF

B. HCl

C. HBr

D. HI

____ 16. Which of the following compounds is a *strong acid*?

A. HF

B. HI

C. $HClO_2$

D. H_2SO_3

____ 17. Which of the following compounds is a *weak base*?

A. KOH

B. $Sc(OH)_3$

C. NH_3

D. NH_4^+

____ 18. Which of the following ions is a *weak acid*?

A. SO_4^{2-}

B. H_2SO_4

C. HSO_4^-

D. HNO_3

____ 19. Identify the correct *net ionic equation* for the reaction that occurs when solutions of HNO_3 and KOH are mixed?

A. $HNO_3(aq) + KOH(aq) \rightarrow H_2O(l) + KNO_3(aq)$

B. $K^+(aq) + NO_3^-(aq) \rightarrow KNO_3(aq)$

C. $HNO_3(aq) + KOH(aq) \rightarrow H_2O(l) + KNO_3(s)$

D. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

____ 20. The oxidation number of S in K_2SO_4 is

A. +6

B. +4

C. +2

D. –1

____ 21. The oxidation number of Fe in $K_3Fe(CN)_6$ is

A. +3

B. +2

C. +1

D. –3

____ 22. The oxidation number of Cr in $Cr_2O_7^{2-}$ is

A. –12

B. –7

C. –2

D. +6

____ 23. For which one of the following acids is chlorine in the +5 oxidation state?

A. HCl

B. HClO

C. $HClO_2$

D. $HClO_3$

____ 24. The highest possible oxidation number of carbon is

A. +8

B. +6

C. +4

D. +2

____ 25. The oxidation number of N in N_2H_4 is

A. +4

B. –4

C. +2

D. –2

____ 26. Determine the correct oxidation numbers for all three elements in Rb_2SO_3 in the order that the elements are shown in the formula.

A. –2, +6, –2

B. –1, +4, –3

C. +2, +4, –2

D. +1, +4, –2

____ 27. Using the redox reaction below determine which element is oxidized and which is reduced.

$$4NH_3 + 3Ca(ClO)_2 \rightarrow 2N_2 + 6H_2O + 3CaCl_2$$

A. H is oxidized and N is reduced

B. N is oxidized and Cl is reduced

C. N is oxidized and O is reduced

D. Cl is oxidized and O is reduced

____ 28. How many total electrons are transferred in the following reaction?

$4\ P(s) + 5O_2(g) \rightarrow 2P_2O_5(s)$

A. 5

B. 10

C. 15

D. 20

____ 29. Which one of the following is a *redox* reaction?

A. $2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

B. $2KBr(aq) + Pb(NO_3)_2(aq) \rightarrow 2KNO_3(aq) + PbBr_2(s)$

C. $CaBr_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HBr(g)$

D. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

____ 30. Which of the following equations does *not* represent an oxidation-reduction reaction?

A. $3Al + 6HCl \rightarrow 3H_2 + AlCl_3$

B. $2H_2O \rightarrow 2H_2 + O_2$

C. $2NaCl + Pb(NO_3)_2 \rightarrow PbCl_2 + 3NaNO_3$

D. $2NaI + Br_2 \rightarrow 2NaBr + I_2$

____ 31. In the following chemical reaction the *oxidizing agent* is

$5H_2O_2 + 2MnO_4^- + 6H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5O_2$

A. H_2O_2

B. MnO_4^-

C. H^+

D. Mn^{2+}

____ 32. Identify the *oxidizing agent* in the following chemical reaction.

$2MnO_4^- + 5H_2SO_3 \rightarrow 2Mn^{2+} + 5SO_4^{2-} + 4H^+ + 3H_2O$

A. MnO_4^-

B. H_2SO_3

C. Mn^{2+}

D. SO_4^{2-}

____ 33. Identify the *reducing agent* in the following chemical reaction.

$5Fe^{2+}(aq) + MnO_4^-(aq) + 8H^+(aq) \rightarrow 5Fe^{3+}(aq) + Mn^{2+}(aq) + 4H_2O(l)$

A. Fe^{2+}

B. MnO_4^-

C. H^+

D. Mn^{2+}

____ 34. What element is *oxidized* in the following chemical reaction?

$3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$

A. Cu

B. H

C. N

D. O

____ 35. What element is *reduced* in the following chemical reaction?

$Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$

A. Cu

B. H

C. S

D. O

____ 36. Predict the products of the following single replacement reaction.

$Fe(s) + CuSO_4(aq) \rightarrow$

A. $Cu(s) + FeSO_4(aq)$

B. $Fe(s) + Cu(s) + SO_4(aq)$

C. $CuS(s) + Fe_2SO_4(aq)$

D. $FeCuSO_4(aq)$

____ 37. Predict the products of the following single replacement reaction.

$Zn(s) + CoCl_2(aq) \rightarrow$

A. No reaction occurs

B. $Co(s) + ZnCl_2(aq)$

C. $CoCl(aq) + ZnCl(aq)$

D. $ZnCo(aq) + Cl_2(g)$

____ 38. Which of the following is an example of a *disproportionation reaction*?

A. $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$

B. $2KBr(aq) + Cl_2(g) \rightarrow 2KCl(aq) + Br_2(l)$

C. $2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$

D. $CaBr_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HBr(g)$

____ 39. Which of the following represents a *precipitation reaction*?

A. $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

B. $CaBr_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HBr(g)$

C. $2KNO_3(s) \rightarrow 2KNO_2(s) + O_2(g)$

D. $2KBr(aq) + Cl_2(g) \rightarrow 2KCl(aq) + Br_2(l)$

____ 40. Which of the following represents an *acid-base neutralization reaction*?

A. $2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

B. $SO_2(g) + H_2O(l) \rightarrow H_2SO_3(g)$

C. $LiOH(aq) + HNO_3(aq) \rightarrow LiNO_3(aq) + H_2O(l)$

D. $2KBr(aq) + Cl_2(g) \rightarrow 2KCl(aq) + Br_2(l)$

____ 41. Which of the following represents a *combustion reaction*?

A. $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$

B. $LiOH(aq) + HNO_3(aq) \rightarrow LiNO_3(aq) + H_2O(l)$

C. $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

D. $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

____ 42. What type of reaction is the following?

$Ca(OH)_2(s) + 2\ HNO_3(aq) \rightarrow Ca(NO_3)_2(aq) + 2\ H_2O(l)$

A. Combination reaction

B. Acid-base neutralization reaction

C. Hydrogen displacement reaction

D. Disproportionation reaction

____ 43. What mass of $C_6H_{12}O_6$ (glucose) is needed to prepare 450. mL of a 0.650 M solution of glucose in water?

A. 0.293 g

B. 293 g

C. 0.692 g

D. 52.7 g

____ 44. What mass of K_2CO_3 is needed to prepare 200. mL of a solution having a potassium ion concentration of 0.150 M?

A. 4.15 g

B. 10.4 g

C. 13.8 g

D. 2.07 g

____ 45. A 50.0 mL sample of 0.436 M NH_4NO_3 is diluted with water to a total volume of 250.0 mL. What is the ammonium nitrate concentration in the resulting solution?

A. 21.8 M

B. 0.459 M

C. 2.18×10^{-2} M

D. 8.72×10^{-2} M

____ 46. A 4.691 g sample of $MgCl_2$ is dissolved in enough water to give 750. mL of solution. What is the magnesium ion concentration in this solution?

A. 3.70×10^{-2} M

B. 1.05×10^{-2} M

C. 6.57×10^{-2} M

D. 4.93×10^{-2} M

____ 47. 35.0 mL of 0.255 M nitric acid is added to 45.0 mL of 0.328 M $Mg(NO_3)_2$. What is the concentration of nitrate ion in the final solution?

A. 0.481 M

B. 0.296 M

C. 0.854 M

D. 1.10 M

____ 48. 17.5 mL of a 0.1050 M Na_2CO_3 solution is added to 46.0 mL of 0.1250 M NaCl. What is the concentration of sodium ion in the final solution?

A. 0.205 M

B. 0.119 M

C. 0.539 M

D. 0.148 M

____ 49. A 350. mL solution of 0.150 M HNO_3(aq) is mixed with a solution of 230. mL of 0.240 M HCl(aq). How many moles of H^+(aq) are present in the final solution?

A. 0.0525 moles H^+

B. 0.108 moles H^+

C. 0.186 moles H^+

D. 0.0539 moles H^+

____ 50. When 38.0 mL of 0.1250 M H_2SO_4 is added to 100. mL of a solution of PbI_2, a precipitate of PbSO4 forms. The $PbSO_4$ is then filtered from the solution, dried, and weighed. If the recovered $PbSO_4$ is found to have a mass of 0.0471 g, what was the concentration of iodide ions in the original solution?

A. 3.10×10^{-4} M

B. 1.55×10^{-4} M

C. 6.20×10^{-3} M

D. 3.11×10^{-3} M

____ 51. What volume (mL) of a 0.3428 M HCl(aq) solution is required to completely neutralize 23.55 mL of a 0.2350 M $Ba(OH)_2$(aq) solution?

A. 55.34 mL

B. 11.07 mL

C. 16.14 mL

D. 32.29 mL

____ 52. One method of determining the concentration of hydrogen peroxide (H_2O_2) in a solution is through titration with the iodide ion. The net ionic equation for this reaction is

$H_2O_2 + 2I^- + 2H^+ \rightarrow I_2 + 2H_2O$

A 50.00 mL sample of a hydrogen peroxide solution is found to react completely with 37.12 mL of a 0.1500 M KI solution. What is the concentration of hydrogen peroxide in the sample?

A. 5.568×10^{-2} M

B. 0.2227 M

C. 0.1010 M

D. 0.4041 M

____ 53. Lithium metal dissolves in water to yield hydrogen gas and aqueous lithium hydroxide. What is the final concentration of hydroxide ions when 5.500 g of lithium metal is dropped into 750. mL of water?

A. 1.06 M

B. 0.528 M

C. 2.11 M

D. 0.792 M

____ 54. When solid iron(II) hydroxide is added to water, the resulting solution contains 1.4×10^{-3}g of dissolved iron(II) hydroxide per liter of solution. What is the hydroxide ion concentration in this solution?

A. 7.8×10^{-6} M

B. 1.6×10^{-5} M

C. 2.5×10^{-10} M

D. 3.1×10^{-5} M

____ 55. A 250. mL sample of 0.0328M HCl is partially neutralized by the addition of 100. mL of 0.0245M NaOH. Find the concentration of hydrochloric acid in the resulting solution.

A. 0.00700 M

B. 0.0164 M

C. 0.0383 M

D. 0.0230 M

Short Answer

1. Define the terms *solution, solute*, and *solvent*.

2. Identify the following compound as a *strong electrolyte, weak electrolyte*, or *nonelectrolyte*: $Al(NO_3)_3$

3. Identify the following compound as a *strong electrolyte*, *weak electrolyte*, or *nonelectrolyte*: NH_4NO_3

4. Identify the following compound as a s*trong electrolyte, weak electrolyte*, or *nonelectrolyte*: H_2CO_3

5. Identify the following compound as a *strong electrolyte, weak electrolyte,* or *nonelectrolyte*: NH_3.

6. Identify the precipitate(s) formed when solutions of $Na_3PO_4(aq)$, $Ca(NO_3)_2(aq)$, and $NH_4ClO_3(aq)$ are mixed.

7. Give an example of a *monoprotic acid*.

8. Give an example of a *diprotic acid*.

9. Give an example of a *triprotic acid*.

10. Identify the element being *oxidized* in the following reaction.

$$4Al + 3O_2 \rightarrow 2Al_2O_3$$

11. Identify the element being *reduced* in the following reaction.

$4Al + 3O_2 \rightarrow 2Al_2O_3$

12. Identify the *oxidizing agent* in the following reaction.

$$4Al + 3O_2 \rightarrow 2Al_2O_3$$

13. Identify the *reducing agent* in the following reaction.

$$4Al + 3O_2 \rightarrow 2Al_2O_3$$

14. Identify the *oxidizing agent* in the following reaction.

$$2KBr + F_2 \rightarrow Br_2 + 2KF$$

15. Identify the *reducing agent* in the following reaction.

$$2KBr + F_2 \rightarrow Br_2 + 2KF$$

16. Determine the oxidation number of each of the elements in $BaNaPO_4$?

17. Batteries in our cars generate electricity by the following chemical reaction.

$Pb + PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O$

Which substance is *reduced* in this process?

18. Batteries in our cars generate electricity by the following chemical reaction.

$$Pb + PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O$$

What is the *reducing agent* in this process?

19. Batteries in our cars generate electricity by the following chemical reaction.

$Pb + PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O$

Which substance is *oxidized* in this process?

20. Batteries in our cars generate electricity by the following chemical reaction.

$$Pb + PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O$$

What is the oxidizing agent in this process?

21. Categorize the following reaction as an *acid-base neutralization, precipitation, combination, decomposition, combustion, displacement, or disproportionation* reaction.

$$CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(g)$$

22. Categorize the following reaction as an *acid-base neutralization, precipitation, combination, decomposition, combustion, displacement, or disproportionation* reaction.

$Ba(C_2H_3O_2)_2(aq) + Na_2CO_3(aq) \rightarrow BaCO_3(s) + 2\ NaC_2H_3O_2(aq)$

23. Categorize the following reaction as an *acid-base neutralization, precipitation, combination, decomposition, combustion, displacement, or disproportionation* reaction.

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

24. Categorize the following reaction as an *acid-base neutralization, precipitation, combination, decomposition, combustion, displacement, or disproportionation* reaction.

$H_2SO_4(aq) + 2\ KOH(aq) \rightarrow 2\ H_2O(l) + K_2SO_4(aq)$

25. What is the molarity of a solution that contains 5.0 moles of solute in 2.00 liters of solution?

26. The solubility of $Ba(NO_3)_2$ is 130.5 grams per liter at 0°C. How many moles of dissolved salt are present in 4.0 liters of a saturated solution of $Ba(NO_3)_2$ at 0°C?

27. What is the molar concentration of chloride ions in a solution prepared by mixing 100. mL of 2.0 M KCl with 50. mL of a 1.5 M $CaCl_2$ solution?

28. What volume of concentrated nitric acid (15.0 M) is required to make 100. mL of a 3.0 M nitric acid solution?

29. During a titration the following data were collected. A 10. mL portion of an unknown monoprotic acid solution was titrated with 1.0 M NaOH; 40. mL of the base were required to neutralize the sample. What is the molarity of the acid solution?

30. If 145 grams of potassium nitrate were added to water to make 1,500 mL of solution.What would the molarity of the resulting solution be?

31. During a titration the following data were collected. A 50.0 mL portion of an HCl solution was titrated with 0.500 M NaOH; 200. mL of the base was required to neutralize the sample. How many grams of HCl are present in 500. mL of this acid solution?

32. Which substance is acting as a Brønsted acid in the following reaction?

$HSO_4^- + NH_4^+ \rightarrow H_2SO_4 + NH_3$

33. Identify the Brønsted acid in the following reaction.

$HSO_4^- + NH_4^+ \rightarrow H_2SO_4 + NH_3$

34. Write the balanced molecular and net ionic equations for the reaction that would occur between $CaCl_2(aq)$ and $Na_2CO_3(aq)$. Be sure to include the correct states in your final equations. If no reaction is expected, write "no reaction."

35. Write the balanced molecular and net ionic equations for the reaction that would occur between Al(s) and $Co(NO_3)_2(aq)$. Be sure to include the correct states in your final equations. If no reaction is expected, write "no reaction."

36. A piece of copper metal was added to an aqueous solution of silver nitrate, and within a few minutes it was observed that a grey crystalline solid formed on surface of the copper. The solution turned a blue color characteristic of copper(II) ions.Write the balanced chemical equation for this reaction.

37. A piece of lead metal was added to an aqueous solution of copper(II) nitrate, and within a few minutes it was observed that the lead turned black and crumbled. The characteristic blue solution of copper (II) ions had faded.. (NOTE: Lead forms a 2+ ion when it reacts.)Write the balanced chemical equation for this reaction.

38. A piece of zinc metal was added to an aqueous solution of lead(II) nitrate. After some time it was observed that the zinc metal appeared to fall apart and a solid had accumulated at the bottom of the reaction vessel.

    Write the net ionic equation for this reaction.

39. The following experiments were carried out and observations recorded.

    Expt. #1: copper metal was added to an aqueous solution of silver nitrate

    Observation: The copper become coated with a substance.

    Expt. #2: lead metal was added to an aqueous solution of copper(II) nitrate

    Observation: The lead turned black and crumbled.

    Expt. #3: zinc metal was added to an aqueous solution of lead(II) nitrate

    Observation: The zinc appeared to fall apart.

    Rank the metals from most active to least active.

True/False
Indicate whether the statement is true or false.

____ 1. Sugar dissolves in water, therefore it is a strong electrolyte.

____ 2. Silver chloride (AgCl) has an extremely low solubility in water; therefore, it is a weak electrolyte.

____ 3. Most compounds containing chlorides, bromides, and iodides are soluble except those containing Ag^+, Hg_2^{2+}, and Pb^{2+}.

____ 4. The following equation is an example of a net ionic equation.

$Na^+(aq) + Br^-(aq) + Ag^+(aq) + NO_3^-(aq) \rightarrow AgBr(s) + Na^+(aq) + NO_3^-(aq)$

____ 5. The oxidation number of iodine increases by 6 in the following reaction.

$2MnO_4^- + I^- + H_2O \rightarrow 2MnO_2 + IO_3^- + 2OH^-$

____ 6. A weak acid or a weak base ionizes completely.

Chapter 4

Answer Section

MULTIPLE CHOICE

1. ANS: C PTS: 1 DIF: Easy REF: Section: 4.1
   OBJ: EK.2.A.3
2. ANS: D PTS: 1 DIF: Easy REF: Section: 4.1
   OBJ: EK.2.A.3
3. ANS: D PTS: 1 DIF: Easy REF: Section: 4.1
   OBJ: EK.3.C.1
4. ANS: C PTS: 1 DIF: Easy REF: Section: 4.1
   OBJ: EK.3.C.1
5. ANS: D PTS: 1 DIF: Easy REF: Section: 4.2
   OBJ: EK.3.C.1
6. ANS: B PTS: 1 DIF: Easy REF: Section: 4.2
   OBJ: EK.3.C.1
7. ANS: D PTS: 1 DIF: Easy REF: Section: 4.2
   OBJ: EK.3.C.1
8. ANS: D PTS: 1 DIF: Medium REF: Section: 4.2
   OBJ: EK.3.C.1
9. ANS: C PTS: 1 DIF: Medium REF: Section: 4.2
   OBJ: EK.3.C.1
10. ANS: A PTS: 1 DIF: Medium REF: Section: 4.2
    OBJ: EK.3.C.1
11. ANS: A PTS: 1 DIF: Medium REF: Section: 4.2
    OBJ: EK.3.C.1
12. ANS: B PTS: 1 DIF: Medium REF: Section: 4.2
    OBJ: EK.3.A.1
13. ANS: D PTS: 1 DIF: Medium REF: Section: 4.2
    OBJ: EK.3.A.1
14. ANS: B PTS: 1 DIF: Easy REF: Section: 4.3
    OBJ: EK.3.B.2
15. ANS: A PTS: 1 DIF: Easy REF: Section: 4.3
    OBJ: EK.3.B.2
16. ANS: B PTS: 1 DIF: Easy REF: Section: 4.3
    OBJ: EK.3.B.2
17. ANS: C PTS: 1 DIF: Easy REF: Section: 4.3
    OBJ: EK.3.B.2
18. ANS: C PTS: 1 DIF: Easy REF: Section: 4.3
    OBJ: EK.3.B.2
19. ANS: D PTS: 1 DIF: Medium REF: Section: 4.3
    OBJ: EK.3.A.1
20. ANS: A PTS: 1 DIF: Medium REF: Section: 4.4
    OBJ: EK.3.B.3

21. ANS: A PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
22. ANS: D PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
23. ANS: D PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
24. ANS: C PTS: 1 DIF: Easy REF: Section: 4.4
OBJ: EK.3.B.3
25. ANS: D PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
26. ANS: D PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
27. ANS: B PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
28. ANS: D PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
29. ANS: A PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
30. ANS: C PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
31. ANS: B PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
32. ANS: A PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
33. ANS: A PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
34. ANS: A PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
35. ANS: C PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
36. ANS: A PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.C.1
37. ANS: B PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.C.1
38. ANS: C PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
39. ANS: B PTS: 1 DIF: Easy REF: Section: 4.2
OBJ: EK.3.C.1
40. ANS: C PTS: 1 DIF: Easy REF: Section: 4.3
OBJ: EK.3.B.2
41. ANS: A PTS: 1 DIF: Easy REF: Section: 4.4
OBJ: EK.3.B.1
42. ANS: B PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.2
43. ANS: D PTS: 1 DIF: Medium REF: Section: 4.5
OBJ: EK.2.A.3
44. ANS: D PTS: 1 DIF: Medium REF: Section: 4.5
OBJ: EK.2.A.3

45. ANS: D PTS: 1 DIF: Easy REF: Section: 4.5
OBJ: EK.2.A.3
46. ANS: C PTS: 1 DIF: Medium REF: Section: 4.5
OBJ: EK.2.A.3
47. ANS: A PTS: 1 DIF: Difficult REF: Section: 4.5
OBJ: EK.2.A.3
48. ANS: D PTS: 1 DIF: Difficult REF: Section: 4.5
OBJ: EK.2.A.3
49. ANS: B PTS: 1 DIF: Difficult REF: Section: 4.5
OBJ: EK.2.A.3
50. ANS: D PTS: 1 DIF: Difficult REF: Section: 4.6
OBJ: EK.2.A.3
51. ANS: D PTS: 1 DIF: Medium REF: Section: 4.7
OBJ: EK.2.A.3
52. ANS: A PTS: 1 DIF: Medium REF: Section: 4.8
OBJ: EK.2.A.3
53. ANS: A PTS: 1 DIF: Medium REF: Section: 4.8
OBJ: EK.2.A.3
54. ANS: D PTS: 1 DIF: Difficult REF: Section: 4.5
OBJ: EK.2.A.3
55. ANS: B PTS: 1 DIF: Difficult REF: Section: 4.7
OBJ: EK.2.A.3

SHORT ANSWER

1. ANS:
A *solution* is a homogeneous mixture of two or more substances.

The substance present in a smaller amount is called the *solute*, while the substance present in the larger amount is called the *solvent*.

PTS: 1 DIF: Easy REF: Section: 4.1 OBJ: EK.2.A.3

2. ANS:
strong electrolyte

PTS: 1 DIF: Easy REF: Section: 4.1 OBJ: EK.2.A.3

3. ANS:
strong electrolyte

PTS: 1 DIF: Easy REF: Section: 4.1 OBJ: EK.2.A.3

4. ANS:
weak electrolyte

PTS: 1 DIF: Easy REF: Section: 4.3 OBJ: EK.2.A.3

5. ANS:
weak electrolyte

PTS: 1 DIF: Medium REF: Section: 4.1 OBJ: EK.2.A.3

6. ANS:
$Ca_3(PO_4)_2$

PTS: 1 DIF: Medium REF: Section: 4.2 OBJ: EK.3.C.1

7. ANS:
HNO_3 (for example)

PTS: 1 DIF: Easy REF: Section: 4.3 OBJ: EK.3.B.2

8. ANS:
H_2CO_3 (for example)

PTS: 1 DIF: Easy REF: Section: 4.3 OBJ: EK.3.B.2

9. ANS:
H_3PO_4

PTS: 1 DIF: Easy REF: Section: 4.3 OBJ: EK.3.B.2

10. ANS:
Al

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.3

11. ANS:
O

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.3

12. ANS:
O_2

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.3

13. ANS:
Al

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.3

14. ANS:
F_2

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.3

15. ANS:
Br^- (or KBr)

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.3

16. ANS:
the oxidation number of Ba +2; the oxidation number of Na is +1; the oxidation number of P is +5; the oxidation number of O is –2

PTS: 1 DIF: Easy REF: Section: 4.4 OBJ: EK.3.B.3

17. ANS:
Pb^{4+}

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.3

18. ANS:
Pb

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.3

19. ANS:
Pb

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.3

20. ANS:
PbO_2

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.3

21. ANS:
Combustion

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.1

22. ANS:
Precipitation

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.C.1

23. ANS:
Decomposition

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.1

24. ANS:
Acid-base neutralization

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.B.2

25. ANS:
2.5 M

PTS: 1 DIF: Easy REF: Section: 4.5 OBJ: EK.2.A.3

26. ANS:
2.0 moles

PTS: 1 DIF: Medium REF: Section: 4.5 OBJ: EK.2.A.3

27. ANS:
2.3 M

PTS: 1 DIF: Difficult REF: Section: 4.5 OBJ: EK.2.A.3

28. ANS:
20. mL

PTS: 1 DIF: Medium REF: Section: 4.5 OBJ: EK.2.A.3

29. ANS:
4.0 M

PTS: 1 DIF: Medium REF: Section: 4.7 OBJ: EK.2.A.3

30. ANS:
0.956 M

PTS: 1 DIF: Medium REF: Section: 4.5 OBJ: EK.2.A.3

31. ANS:
36.5 g

PTS: 1 DIF: Medium REF: Section: 4.7 OBJ: EK.3.A.2

32. ANS:
$NH4+$

PTS: 1 DIF: Medium REF: Section: 4.3 OBJ: EK.3.B.2

33. ANS:
H_2O

PTS: 1 DIF: Medium REF: Section: 4.3 OBJ: EK.3.B.2

34. ANS:
Molecular equation: $CaCl_2(aq) + Na_2CO_3(aq) \rightarrow CaCO_3(s) + 2NaCl(aq)$

Net ionic equation: $Ca^{2+}(aq) + CO_3^{2-}(aq) \rightarrow CaCO_3(s)$

PTS: 1 DIF: Medium REF: Section: 4.2 OBJ: EK.3.A.1

35. ANS:
Molecular equation: $2Al(s) + 3Co(NO_3)_2(aq) \rightarrow 2Al(NO_3)_3(aq) + 3Co(s)$
Net ionic equation: $2Al(s) + 3Co^{2+}(aq) \rightarrow 2Al^{3+}(aq) + 3Co(s)$

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.A.1

36. ANS:
$Cu(s) + 2AgNO_3(aq) \rightarrow 2Ag(s) + Cu(NO_3)_2(aq)$

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.C.1

37. ANS:
$Pb(s) + Cu(NO_3)_2(aq) \rightarrow Cu(s) + Pb(NO_3)_2(aq)$

PTS: 1 DIF: Medium REF: Section: 4.4 OBJ: EK.3.C.1

38. ANS:
$Zn(s) + Pb^{2+}(aq) \rightarrow Zn^{2+}(aq) + Pb(s)$

PTS: 1 DIF: Difficult REF: Section: 4.4 OBJ: EK.3.C.1

39. ANS:
most active Zn, next most active Pb, next most active Cu, least active Ag

PTS: 1 DIF: Difficult REF: Section: 4.4 OBJ: EK.3.B.3

TRUE/FALSE

1. ANS: F PTS: 1 DIF: Medium REF: Section: 4.1
OBJ: EK.2.D.1
2. ANS: F PTS: 1 DIF: Medium REF: Section: 4.1
OBJ: EK.2.D.1
3. ANS: T PTS: 1 DIF: Easy REF: Section: 4.2
OBJ: EK.2.D.1
4. ANS: F PTS: 1 DIF: Medium REF: Section: 4.2
OBJ: EK.3.A.1
5. ANS: T PTS: 1 DIF: Medium REF: Section: 4.4
OBJ: EK.3.B.3
6. ANS: F PTS: 1 DIF: Medium REF: Section: 4.3
OBJ: EK.6.A.1