32. What is the average mass, in grams, of one atom of iron ($N_A = 6.022 \times 10^{23}$ mol^{-1})?
    A. 6.02×10^{23} g
    B. 1.66×10^{-24} g
    C. 9.28×10^{-23} g
    D. 55.85 g
    E. 55.85×10^{-23} g

33. What is the mass, in grams, of one arsenic atom ($N_A = 6.022 \times 10^{23}$ mol^{-1})?
    A. 5.48×10^{-23} g
    B. 33.0 g
    C. 74.9 g
    D. 1.24×10^{-22} g
    E. 8.04×10^{21} g

34. What is the mass of one copper atom ($N_A = 6.022 \times 10^{23}$ mol^{-1})?
    A. 1.055×10^{-22} g
    B. 63.55 g
    C. 1 amu
    D. 1.66×10^{-24} g
    E. 9.476×10^{21} g

35. The mass of 1.21×10^{20} atoms of sulfur ($N_A = 6.022 \times 10^{23}$ mol^{-1}) is:
    A. 3.88×10^{21} g
    B. 2.00 mg
    C. 32.06 g
    D. 6.44 mg
    E. 2.00×10^{-4} g

36. The mass of 1.63×10^{21} silicon atoms ($N_A = 6.022 \times 10^{23}$ mol^{-1}) is:
    A. 2.71×10^{-23} g
    B. 4.58×10^{22} g
    C. 28.08 g
    D. 1.04×10^{4} g
    E. 7.60×10^{-2} g

37. Determine the number of ammonia molecules in 4.85 g of ammonia ($N_A = 6.022 \times 10^{23}$ mol^{-1}).
    A. 2.92×10^{23}
    B. 4.73×10^{-25}
    C. 1.24×10^{23}
    D. 5.83×10^{-24}
    E. 1.71×10^{23}

38. What is the mass of 7.80×10^{18} carbon atoms ($N_A = 6.022 \times 10^{23}$ mol^{-1})?
    A. 1.30×10^{-5} g
    B. 6.43×10^{3} g
    C. 7.80×10^{18} g
    D. 1.56×10^{-4} g
    E. 12.01 g

39. What is the mass in grams of 0.250 mol of the common antacid calcium carbonate?
    A. 4.00×10^{2} g
    B. 25.0 g
    C. 17.0 g
    D. 4.00×10^{-2} g
    E. 2.50×10^{-3} g

122. Based on the solubility rules, which of these processes will occur if solutions of $CuSO_4(aq)$ and $BaCl_2(aq)$ are mixed?
A. $CuCl_2$ will precipitate; Ba^{2+} and SO_4^{2-} are spectator ions.
B. $CuSO_4$ will precipitate; Ba^{2+} and Cl^- are spectator ions.
C. $BaSO_4$ will precipitate; Cu^{2+} and Cl^- are spectator ions.
D. $BaCl_2$ will precipitate; Cu^{2+} and SO_4^{2-} are spectator ions.
E. No precipitate will form.

123. Based on the solubility rules, which of these processes will occur when solutions of $ZnSO_4(aq)$ and $MgCl_2(aq)$ are mixed?
A. $ZnCl_2$ will precipitate; Mg^{2+} and SO_4^{2-} will be spectator ions.
B. $ZnSO_4$ will precipitate; Mg^{2+} and Cl^- will be spectator ions.
C. $MgSO_4$ will precipitate; Zn^{2+} and Cl^- will be spectator ions.
D. $MgCl_2$ will precipitate; Zn^{2+} and SO_4^{2-} will be spectator ions.
E. No precipitate will form.

124. In the following reaction, what ions, if any, are spectator ions?

$Pb(NO_3)_2(aq) + 2NaCl(aq) \rightarrow PbCl_2(s) + 2NaNO_3(aq)$
A. $Pb^{2+}(aq)$, $Cl^-(aq)$
B. $Na^+(aq)$, $NO_3^-(aq)$
C. $Pb^{2+}(aq)$, $NO_3^-(aq)$
D. $Na^+(aq)$, $Cl^-(aq)$
E. There are no spectator ions.

125. Select the precipitate that forms when the following reactants are mixed.

$Na_2CO_3(aq) + BaCl_2(aq) \rightarrow$
A. Ba_2CO_3
B. $BaCO_3$
C. NaCl
D. $NaCl_2$
E. BaO

126. Select the precipitate that forms when the following reactants are mixed.

$Mg(CH_3COO)_2(aq) + LiOH(aq)$
A. $LiCH_3COO$
B. $Li(CH_3COO)_2$
C. MgOH
D. $Mg(OH)_2$
E. CH_3OH

127. Select the precipitate that forms when aqueous ammonium sulfide reacts with aqueous copper (II) nitrate.
A. CuS
B. Cu_2S
C. NH_4NO_3
D. $NH_4(NO_3)_2$
E. $CuSO_4$

128. Select the precipitate that forms when aqueous lead (II) nitrate reacts with aqueous sodium sulfate.
A. $NaNO_3$
B. Na_2NO_3
C. $PbSO_4$
D. Pb_2SO_4
E. PbS

136. What is the chemical formula of the salt produced by the neutralization of hydrobromic acid with magnesium hydroxide?
   A. MgBr
   B. Mg_2Br_3
   C. $MgBr_2$
   D. Mg_3Br_2
   E. Mg_2Br l

137. What is the chemical formula of the salt produced by the neutralization of nitric acid with calcium hydroxide?
   A. $CaNO_3$
   B. $Ca_2(NO_3)_3$
   C. $Ca_3(NO_3)_2$
   D. Ca_2NO_3
   E. $Ca(NO_3)_2$

138. What is the chemical formula of the salt produced by the neutralization of sodium hydroxide with sulfuric acid?
   A. Na_2SO_4
   B. $Na_2(SO_4)_3$
   C. $Na(SO_4)_2$
   D. $NaSO_3$
   E. Na_3SO_4

139. What is the chemical formula of the salt produced by the neutralization of potassium hydroxide with sulfuric acid?
   A. KSO_3
   B. $K_2(SO_4)_3$
   C. K_2SO_4
   D. $K(SO_4)_2$
   E. KSO_4

140. Which of the following is a weak acid?
   A. H_2SO_4
   B. HNO_3
   C. HF
   D. HBr
   E. HCl

141. Which of the following is a strong acid?
   A. H_3PO_4
   B. HNO_3
   C. HF
   D. CH_3COOH
   E. H_2O

142. Which of the following is a strong base?
   A. NH_3
   B. $Ca(OH)_2$
   C. $Al(OH)_3$
   D. $B(OH)_3$
   E. CH_3OH

143. Which of the following is a weak base?
   A. NH_3
   B. $Ca(OH)_2$
   C. $Ba(OH)_2$
   D. NaOH
   E. CH_3COOH

44. Calculate the mass in grams of 8.35×10^{22} molecules of CBr_4.
A. 0.0217 g
B. 0.139 g
C. 7.21 g
D. 12.7 g
E. 46.0 g

Burdge - 003 Chapter... #44

45. The number of hydrogen atoms in 0.050 mol of $C_3H_8O_3$ is:
A. 3.0×10^{22} H atoms
B. 1.2×10^{23} H atoms
C. 2.4×10^{23} H atoms
D. 4.8×10^{23} H atoms
E. None of the answers is correct.

Burdge - 003 Chapter... #45

46. What is the mass of 0.0250 mol of P_2O_5?
A. 35.5 g
B. 5676 g
C. 0.0250 g
D. 1.51×10^{22} g
E. 3.55 g

Burdge - 003 Chapter... #46

47. Calculate the mass of 3.00 moles of CF_2Cl_2.
A. 3.00 g
B. 174 g
C. 363 g
D. 1.81×10^{24} g
E. 40.3

Burdge - 003 Chapter... #47

48. Gadolinium oxide, a colorless powder which absorbs carbon dioxide from the air, contains 86.76 mass % Gd. Determine its empirical formula.
A. Gd_2O_3
B. Gd_2O_2
C. Gd_3P_4
D. Gd_4O_3
E. GdO

Burdge - 003 Chapter... #48

49. Hydroxylamine nitrate contains 29.17 mass % N, 4.20 mass % H, and 66.63 mass % O. Determine its empirical formula.
A. HNO
B. H_2NO_2
C. HN_6O_{16}
D. $HN_{16}O_7$
E. H_2NO_3

Burdge - 003 Chapter... #49

50. Hydroxylamine nitrate contains 29.17 mass % N, 4.20 mass % H, and 66.63 mass O. If its molar mass is between 94 and 98 g/mol, what is its molecular formula?
A. NH_2O_5
B. $N_2H_4O_4$
C. $N_3H_3O_3$
D. $N_4H_8O_2$
E. $N_2H_2O_4$

Burdge - 003 Chapter... #50

62. How many grams of nitrogen are required to react with hydrogen to produce 13.6 g of ammonia?
A. 11.2 g
B. 0.06 g
C. 22.4 g
D. 16.5 g
E. 44.8 g

Burdge - 003 Chapter... #62

63. What mass, in grams, of sodium carbonate is required for complete reaction with 8.35 g of nitric acid to produce sodium nitrate, carbon dioxide, and water?
A. 28.1 g
B. 14.04 g
C. 4.96 g
D. 7.02 g
E. 400.0 g

Burdge - 003 Chapter... #63

64. How many grams of lead (II) chloride are produced when 13.87 g lead (II) nitrate combines with hydrochloric acid to produce lead (II) chloride and nitric acid?
A. 5.82 g
B. 1.19 g
C. 0.086 g
D. 11.65 g
E. 16.52 g

Burdge - 003 Chapter... #64

65. How many grams of calcium are required to react with 7.75 g of water to produce calcium hydroxide and hydrogen gas?
A. 8.62 g
B. 34.5 g
C. 4.31 g
D. 3.48 g
E. 17.2 g

Burdge - 003 Chapter... #65

66. How many grams of oxygen are required to react with calcium to produce 44.8 g calcium oxide?
A. 12.8 g
B. 25.6 g
C. 6.4 g
D. 0.05 g
E. 51.1 g

Burdge - 003 Chapter... #66

67. How many grams of sodium fluoride (used in water fluoridation and manufacture of insecticides) are needed to form 485 g of sulfur tetrafluoride?

$3SCl_2(l) + 4NaF(s) \rightarrow SF_4(g) + S_2Cl_2(l) + 4NaCl(s)$
A. 1940 g
B. 1510 g
C. 754 g
D. 205 g
E. 51.3 g

Burdge - 003 Chapter... #67

95. What is the theoretical yield of aluminum that can be produced by the reaction of 60.0 g of aluminum oxide with 30.0 g of carbon according to the following chemical equation?

$Al_2O_3 + 3C \rightarrow 2Al + 3CO$

A. 30.0 g
B. 7.9 g
C. 101.2 g
D. 45.0 g
E. 31.81 g

Burdge - 003 Chapter... #95

96. When octane (C_8H_{18}) is burned in a particular internal combustion engine, the yield of products (carbon dioxide and water) is 93%. What mass of carbon dioxide will be produced in this engine when 15.0 g of octane is burned with 15.0 g of oxygen gas?

A. 13. g
B. 12. g
C. 21 g
D. 54. g
E. 43. g

Burdge - 003 Chapter... #96

97. One mole of oxygen has a mass of 16.0 g.
FALSE

Burdge - 003 Chapter... #97

98. One mole of methane (CH_4) contains a total of 3×10^{24} atoms.
TRUE

Burdge - 003 Chapter... #98

99. In a correctly balanced equation, the number of reactant molecules must equal the number of product molecules.
FALSE

Burdge - 003 Chapter... #99

100. The limiting reactant is the reactant with the smallest initial mass.
FALSE

Burdge - 003 Chapter... #100

101. The percent yield can be determined by dividing the actual yield by the theoretical yield and multiplying this value by 100%.
TRUE

Burdge - 003 Chapter... #101

102. Which is the correct description of a solution?

A. A heterogeneous mixture of 2 or more substances
B. A homogeneous mixture of 2 or more substances
C. May be gaseous, solid, or liquid
D. A heterogeneous mixture of 2 or more substances that may be gaseous, solid, or liquid
E. A homogeneous mixture of 2 or more substances that may be gaseous, solid, or liquid

Burdge - 004 Chapter... #1

103. What is the substance present in the smallest amount in a solution?

A. salute
B. gas
C. solvent
D. solid
E. solute

Burdge - 004 Chapter... #2

111. Which of these compounds is a *weak electrolyte*?
A. HCl
B. CH_3COOH (acetic acid)
C. $C_6H_{12}O_6$ (glucose)
D. O_2
E. NaCl

Burdge - 004 Chapter... #10

112. Which of these compounds is a *weak electrolyte*?
A. HCl
B. NH_3
C. $C_6H_{12}O_6$ (glucose)
D. N_2
E. KCl

Burdge - 004 Chapter... #11

113. Which of these compounds is a *nonelectrolyte*?
A. NaF
B. HNO_3
C. CH_3COOH (acetic acid)
D. NaOH
E. $C_6H_{12}O_6$ (glucose)

Burdge - 004 Chapter... #12

114. Which of these compounds is a *nonelectrolyte*?
A. NaOH
B. HNO_3
C. C_2H_6O (ethanol)
D. KF
E. CH_3COOH (acetic acid)

Burdge - 004 Chapter... #13

115. Which one of the following substances is the best electrolyte?
A. CO
B. CH_3Cl
C. CH_4
D. C_2H_5OH
E. HCl

Burdge - 004 Chapter... #14

116. The distinguishing characteristic of all nonelectrolyte solutions is that they
A. contain ions.
B. do not conduct electricity.
C. react with other solutions.
D. always contain acids.
E. conducts heat.

Burdge - 004 Chapter... #15

117. Based on the solubility rules, which one of these compounds should be *insoluble* in water?
A. NaCl
B. $MgBr_2$
C. $FeCl_2$
D. AgBr
E. $ZnCl_2$

Burdge - 004 Chapter... #16

125. Select the precipitate that forms when the following reactants are mixed.

$Na_2CO_3(aq) + BaCl_2(aq) \rightarrow$

A. Ba_2CO_3
B. $BaCO_3$
C. NaCl
D. $NaCl_2$
E. BaO

Burdge - 004 Chapter... #24

126. Select the precipitate that forms when the following reactants are mixed.

$Mg(CH_3COO)_2(aq) + LiOH(aq) \rightarrow$

A. $LiCH_3COO$
B. $Li(CH_3COO)_2$
C. MgOH
D. $Mg(OH)_2$
E. CH_3OH

Burdge - 004 Chapter... #25

127. Select the precipitate that forms when aqueous ammonium sulfide reacts with aqueous copper (II) nitrate.

A. CuS
B. Cu_2S
C. NH_4NO_3
D. $NH_4(NO_3)_2$
E. $CuSO_4$

Burdge - 004 Chapter... #26

128. Select the precipitate that forms when aqueous lead (II) nitrate reacts with aqueous sodium sulfate.

A. $NaNO_3$
B. Na_2NO_3
C. $PbSO_4$
D. Pb_2SO_4
E. PbS

Burdge - 004 Chapter... #27

129. Select the net ionic equation for the reaction between sodium chloride and mercury (I) nitrate.

$2NaCl(aq) + Hg_2(NO_3)_2(aq) \rightarrow NaNO_3(aq) + Hg_2Cl_2(s)$

A. $Na^+(aq) + NO_3^-(aq) \rightarrow NaNO_3(aq)$
B. $Hg_2^{2+}(aq) + 2Cl^-(aq) \rightarrow Hg_2Cl_2(s)$
C. $NaCl(aq) \rightarrow Na^+(aq) + Cl^-(aq)$
D. $Hg_2(NO_3)_2(aq) \rightarrow Hg_2^{2+}(aq) + 2NO_3^-(aq)$
E. $Hg_2^{2+}(aq) \rightarrow Hg_2(s)$

Burdge - 004 Chapter... #28

130. Select the correct set of products for the following reaction.

$Ba(OH)_2(aq) + HNO_3(aq) \rightarrow$

A. $BaN_2(s) + H_2O(l)$
B. $Ba(NO_3)_2(aq) + H_2O(l)$
C. $Ba(s) + H_2(g) + NO_2(g)$
D. $Ba_2O(s) + NO_2(g) + H_2O(l)$
E. No reaction occurs.

Burdge - 004 Chapter... #29

145. Complete the following reaction and identify the Bronsted base:

$NaOH(aq) + HCl(aq) \rightarrow$

A. $Na(aq) + HOCl(aq)$; NaOH is the base
B. $NaCl(aq) + OH^-(aq)$; HCl is the base
C. $NaCl(aq) + OH^-(aq)$; NaOH is the base
D. $H_2O(l) + NaCl(aq)$; HCl is the base
E. $NaCl(aq) + H_2O(l)$; NaOH is the base

Burdge - 004 Chapter... #44

146. Select the net ionic equation for the reaction between lithium hydroxide and hydrobromic acid:

$LiOH(aq) + HBr(aq) \rightarrow H_2O(l) + LiBr(aq)$

A. $LiOH(aq) \rightarrow Li^+(aq) + OH^-(aq)$
B. $HBr(aq) \rightarrow H^+(aq) + Br^-(aq)$
C. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
D. $Li^+(aq) + Br^-(aq) \rightarrow LiBr(aq)$
E. $Li^+(aq) + OH^-(aq) + H^+(aq) + Br^-(aq) \rightarrow H_2O(l) + LiBr(aq)$

Burdge - 004 Chapter... #45

147. Which of the following is oxidized in the following reaction?

$Fe + Ag_2O \rightarrow FeO + 2Ag$

A. Ag
B. Ag_2O
C. Fe
D. FeO
E. 2Ag

Burdge - 004 Chapter... #46

148. Which of the following is reduced in the following reaction?

$Cu(NO_3)_2 + Zn \rightarrow Zn(NO_3)_2 + Cu$

A. $Cu(NO_3)_{-2}$
B. N
C. O
D. Zn
E. NO_3

Burdge - 004 Chapter... #47

149. Which of the following is the oxidizing agent in the following 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+}
E. Fe^{3+}

Burdge - 004 Chapter... #48

150. Which of the following is the reducing agent in the following reaction?

$Mg + NiO_2 + 2H_2O \rightarrow Mg(OH)_2 + Ni(OH)_2$.

A. Mg
B. NiO_2
C. H_2O
D. $Mg(OH)_2$
E. $Ni(OH)_2$

Burdge - 004 Chapter... #49

182. How many moles of $H^+(aq)$ ions are present in 750 mL of 0.65 *M* hydrochloric acid?
A. 1.2 mol
B. 0.98 mol
C. 0.87 mol
D. 0.65 mol
E. 0.49 mol

Burdge - 004 Chapter... #81

183. How many sodium ions are present in 325 mL of 0.850 *M* Na_2SO_4?
A. 1.66×10^{23} Na ions
B. 3.33×10^{23} Na ions
C. 4.99×10^{23} Na ions
D. 6.20×10^{23} Na ions
E. 1.57×10^{24} Na ions

Burdge - 004 Chapter... #82

184. A standard solution of 0.243 *M* NaOH was used to determine the concentration of a hydrochloric acid solution. If 46.33 mL of NaOH is needed to neutralize 10.00 mL of the acid, what is the molar concentration of the acid?
A. 0.0524 *M*
B. 0.888 *M*
C. 1.13 *M*
D. 2.26 *M*
E. 2.43 *M*

Burdge - 004 Chapter... #83

185. Automobile batteries use 3.0 *M* H_2SO_4 as an electrolyte. How much 1.20 *M* NaOH will be needed to neutralize 225 mL of battery acid?

$H_2SO_4(aq) + 2NaOH(aq) \rightarrow 2H_2O(l) + Na_2SO_4(aq)$
A. 0.045 L
B. 0.28 L
C. 0.56 L
D. 0.90 L
E. 1.1 L

Burdge - 004 Chapter... #84

186. Vinegar is a solution of acetic acid, CH_3COOH, dissolved in water. A 5.54-g sample of vinegar was neutralized by 30.10 mL of 0.100 *M* NaOH. What is the percent by weight of acetic acid in the vinegar?
A. 0.184%
B. 1.63%
C. 3.26%
D. 5.43%
E. 9.23%

Burdge - 004 Chapter... #85

187. A 350. mL sample of 0.276M HNO_3 is partially neutralized by 125 mL of 0.0120 M $Ca(OH)_2$. Find the concentration of nitric acid in the resulting solution.
A. 0.210 M
B. 0.00632 M
C. 0.203 M
D. 0.0240 M
E. 0.197 M

Burdge - 004 Chapter... #86