Appendix B

Supplemental Practice Problems

UNIT 1

Chapter 1

1. A student measures the mass of five different ingots of aluminum to be 28.6 g, 28.72 g, 28.5 g, 29.0 g, 28.6 g. What is the average mass of these ingots?

2. Label each as either a physical or a chemical property.
(a) The boiling point of water is 100°C.
(b) Chlorine gas reacts violently with sodium metal.
(c) Bromine has a brown colour.
(d) Sulfuric acid causes burns when it comes in contact with skin.

3. The population of Canada is about 30 million. Express this amount to the correct number of significant digits.

4. How many significant digits are in the following quantities?
(a) 624 students
(b) 22.40 mL of water
(c) 0.00786 g of platinum

5. Round off the following measured quantities to the number of significant digits specified.
(a) 9.276×10^3 m (2 significant digits)
(b) 87.45 g (3 significant digits)
(c) 93.951 kg (3 significant digits)

6. The masses of several samples of titanium were measured to be: 193.67 g; 28.9 g; 78 g; 4.946×10^{-1} kg. These samples were all put into an overflow can together. The water displaced had a volume of 176.1 mL. What is the average density of the titanium pieces?

7. Characterize each of the following occurrences as a physical or as a chemical change.
(a) sugar is heated over a flame and caramelises (turns black)
(b) blood clots
(c) a rubber band is stretched until it snaps
(d) a match burns
(e) a grape is crushed
(f) salt is put on the roads in the winter, melting the ice.

Chapter 2

8. Draw Lewis structures to represent each of the following atoms.
(a) Mg **(b)** K **(c)** Ne
(d) B **(e)** C **(f)** Al

9. Draw Lewis structures to represent each of the following ions.
(a) H^+ **(b)** K^+ **(c)** F^-
(d) S^{2-} **(e)** Al^{3+} **(f)** Br^-

10. Using only a periodic table (not the values for atomic radius), rank the following sets of atoms in order of increasing size.
(a) W, Cr, Mo **(b)** As, Ca, K
(c) I, Cl, F, Br **(d)** Cl, P, Mg
(e) Zn, Cd, Hg

11. Using only a periodic table (not the values for ionization energy), rank the following sets of atoms in order of increasing ionization energy.
(a) Ar, Xe, Ne **(b)** P, Al, Cl
(c) Rb, Li, K **(d)** Mg, Be, Ca

Chapter 3

12. Predict whether each of the following bonds has a primarily ionic or covalent character.
(a) B–F **(b)** C–H
(c) Na–Cl **(d)** Si–O

13. Draw Lewis structures representing the following ionic compounds.
(a) KBr **(b)** CaO
(c) $MgCl_2$ **(d)** Mg_3N_2

14. Draw Lewis structures to represent the following covalent compounds.
(a) F_2 **(b)** CH_4
(c) CO_2 **(d)** CO
(e) NO **(f)** N_2

15. For the previous problem, indicate any polar covalent bonds with a partial negative or positive charge on the appropriate atom.

16. Name each of the following ionic compounds.
(a) $MgCl_2$ **(b)** Na_2O
(c) $FeCl_3$ **(d)** CuO
(e) $AlBr_3$

17. Write the chemical formula for each of the following compounds.
(a) aluminum bromide
(b) magnesium oxide
(c) sodium sulfide
(d) iron(II) oxide
(e) copper(II) chloride

18. Write the formula for each of the following.
(a) sodium hydrogen carbonate
(b) potassium dichromate
(c) sodium hypochlorite
(d) lithium hydroxide
(e) potassium permanganate

19. Name each of the following compounds.
(a) K_2CrO_4 **(b)** NH_4NO_3
(c) Na_2SO_4 **(d)** KH_2PO_4
(e) $Sr_3(PO_4)_2$

20. Name each of the following covalent compounds.

(a) Cl_2O_7 **(b)** H_2O

(c) BF_3 **(d)** N_2O_4

(e) N_2O

21. Write the formula for each of the following compounds.

(a) tetraphosphorus decoxide

(b) nitrogen trichloride

(c) sulfur tetrafluoride

(d) xenon hexafluoride

Chapter 4

22. Balance each of the following skeleton equations. Classify each chemical reaction.

(a) $Fe + Cl_2 \rightarrow FeCl_2$

(b) $FeCl_2 + Cl_2 \rightarrow FeCl_3$

(c) $C_4H_{10}O + O_2 \rightarrow CO_2 + H_2O$

(d) $Al + H_2SO_4 \rightarrow Al_2(SO_4)_3 + H_2$

(e) $N_2O_5 + H_2O \rightarrow HNO_3$

(f) $(NH_4)_2CO_3 \rightarrow NH_3 + CO_2 + H_2O$

23. Write the product(s) of each of the following chemical reactions. Also, identify the reaction type. In the case of no reaction, state NR.

(a) $MgCO_{3(s)} \rightarrow$
(The magnesium carbonate is heated.)

(b) $Ca_{(s)} + Cl_{2(g)} \rightarrow$

(c) $NH_4CO_{3(aq)} + KOH_{(aq)} \rightarrow$
(Group I ions, hydrogen ions, and ammonium ions always form soluble ionic compounds.)

(d) $I_{2(aq)} + KBr_{(aq)} \rightarrow$

(e) $Na_2CO_{3(aq)} + MgCl_{2(aq)} \rightarrow$
(Carbonate compounds form precipitates except when they contain ions from Group I, hydrogen, or ammonium. Group I ions form soluble ionic compounds.)

(f) $K_{(s)} + O_{2(g)} \rightarrow$

24. Balance the following chemical equation.
$BiCl_3 + NH_3 + H_2O \rightarrow Bi(OH)_3 + NH_4Cl$

25. Balance the equation.
$NiSO_4 + NH_3 + H_2O \rightarrow Ni(NH_3)_6(OH)_2 + (NH_4)_2SO_4$

26. Complete and balance if necessary, each of the following nuclear equations.

(a) $^{237}_{92}U \rightarrow {}^{0}_{-1}e +$ ____

(b) $^{231}_{90}Th \rightarrow {}^{231}_{91}Pa +$ ____

(c) $^{215}_{84}Po \rightarrow {}^{4}_{2}He +$ ____

27. Write a balanced nuclear equation for each of the following.

(a) Radon-233 decays with the emission of an alpha particle.

(b) Actinium-228 decays with the emission of a beta particle.

28. Complete and balance each of the following nuclear equations.

(a) $^{23}_{11}Na +$ ____ $\rightarrow {}^{23}_{12}Mg + {}^{1}_{0}n$

(b) $^{96}_{42}Mo + {}^{4}_{2}He \rightarrow {}^{100}_{43}Tc +$ ____

(c) ____ $+ {}^{1}_{1}H \rightarrow {}^{29}_{14}Si + {}^{0}_{0}?$

(d) $^{209}_{83}Bi +$ ____ $\rightarrow {}^{210}_{84}Po + {}^{1}_{0}n$

UNIT 2

Chapter 5

29. Gallium exists as two isotopes, Ga-69 and Ga-71.

(a) How many protons and neutrons are in each isotope?

(b) If Ga-69 exists in 60.0% relative abundance, estimate the average atomic mass of gallium using the mass numbers of the isotopes.

30. Rubidium exists as two isotopes: Rb-85 has a mass of 84.9117 u and Rb-87 has a mass of 86.9085 u. If the average atomic mass of rubidium is 85.4678, determine the relative abundance of each isotope.

31. You have 10 mL of isotopically labelled water, ^3H_2O. That is, the water is made with the radioactive isotope of hydrogen, tritium, ^3H. You pour the 10 mL of tritium-labelled water into an ocean and allow it to thoroughly mix with all the bodies of water on the earth. After the tritium-labelled water mixes thoroughly with the earth's ocean water, you remove 100 mL of ocean water. Estimate how many molecules of ^3H_2O will be in this 100 mL sample. (Assume that the average depth of the ocean is 5 km. The earth's surface is covered roughly two-thirds with water. The radius of the earth is about 6400 km.)

32. Calculate the molar mass of each of the following compounds.

(a) $Al_2(CrO_4)_3$

(b) $C_4H_9SiCl_3$ (n-butyltrichlorosilane, an intermediate in the synthesis of silicones)

(c) $Cd(ClO_3)_2 \cdot 2H_2O$ (cadmium chlorate dihydrate, an oxidizing agent)

33. How many atoms are contained in 3.49 moles of manganese?

34. How many atoms are there in 8.56 g of sodium?

35. What is the mass of 5.67×10^{23} molecules of pentane, C_5H_{12}?

36. Consider a 23.9 g sample of ammonium carbonate, $(NH_4)_2CO_3$.

(a) How many moles are in this sample?

(b) How many formula units are in this sample?

(c) How many atoms are in this sample?

Chapter 6

37. Pyridine, C_5H_5N, is a slightly yellow liquid with a nauseating odour. It is flammable and toxic by ingestion and inhalation. Pyridine is used in the synthesis of vitamins and drugs, and has many other uses in industrial chemistry. Determine the percentage composition of pyridine.

38. Bromine azide is an explosive compound that is composed of bromine and nitrogen. A sample of bromine azide was found to contain 2.35 g Br and 1.24 g N.

(a) Calculate the percentage by mass of Br and N in bromine azide.

(b) Calculate the empirical formula of bromine azide.

(c) The molar mass of bromine azide is 122 g/mol. Determine its molecular formula.

39. Progesterone is a female hormone. It is 80.2% C, 9.62% H and 10.2% O by mass.

(a) Determine the empirical formula of progesterone.

(b) From the given data, is it possible to determine the molecular formula of progesterone? Explain your answer.

40. Potassium tartrate is a colourless, crystalline solid. It is 34.6% K, 21.1% C, 1.78% H, 42.4% O by mass.

(a) Calculate the empirical formula of potassium tartrate.

(b) If the molar mass of potassium tartrate is 226 g/mol, what is the molecular formula of potassium tartrate?

41. Menthol is a compound that contains C, H and O. It is derived from peppermint oil and is used in cough drops and chest rubs. When 0.2393 g of menthol is subjected to carbon-hydrogen combustion analysis, 0.6735 g of CO_2 and 0.2760 g of H_2O are obtained.

(a) Determine the empirical formula of menthol.

(b) If each menthol molecule contains one oxygen atom, what is the molecular formula of menthol?

42. Glycerol, $C_3H_8O_3$, also known as glycerin, is used in products that claim to protect and soften skin. Glycerol can be purchased at the drug store. If 0.784 g of glycerol is placed in a carbon-hydrogen combustion analyzer, what mass of CO_2 and H_2O will be expected?

43. Calculate the percentage by mass of water in potassium sulfite dihydrate, $K_2SO_3 \cdot 2H_2O$.

44. What mass of water is present in 24.7 g of cobaltous nitrate hexahydrate, $Co(NO_3)_2 \cdot 6H_2O$?

45. A chemist requires 1.28 g of sodium hypochlorite, NaOCl, to carry out an experiment, but only has sodium hypochlorite pentahydrate, $NaOCl \cdot 5H_2O$ in the lab. How many grams of the hydrate should the chemist use?

Chapter 7

46. Consider the equation corresponding to the decomposition of mercuric oxide.

$2HgO_{(s)} \rightarrow 2Hg_{(l)} + O_{2(g)}$

What mass of liquid mercury is produced when 5.79 g of mercuric oxide decomposes?

47. Examine the following equation.

$C_3H_{8(g)} + 5\ O_{2(g)} \rightarrow 3\ CO_{2(g)} + 4\ H_2O_{(g)}$

(a) What mass of propane, C_3H_8, reacting with excess oxygen, is required to produce 26.7 g of carbon dioxide gas?

(b) How many oxygen molecules are required to react with 26.7 g of propane?

48. Metal hydrides, such as strontium hydride, SrH_2, react with water to form hydrogen gas and the corresponding metal hydroxide.

$SrH_{2(s)} + 2H_2O_{(l)} \rightarrow Sr(OH)_{2(s)} + 2H_{2(g)}$

(a) When 2.50 g of SrH_2 is reacted with 8.03×10^{22} molecules of water, what is the limiting reagent?

(b) What mass of strontium hydroxide will be produced?

49. Consider the following successive reactions.

reaction (1): $A \rightarrow B$

reaction (2): $B \rightarrow C$

If reaction (1) proceeds with a 45% yield and reaction (2) has a 70% yield, what is the overall yield for the reactions that convert A to C?

50. Disposable cigarette lighters contain liquid butane, C_4H_{10}. Butane undergoes complete combustion to carbon dioxide gas and water vapour according to the skeleton equation below:

$C_4H_{10(l)} + O_{2(g)} \rightarrow CO_{2(g)} + H_2O_{(l)}$

A particular lighter contains 5.00 mL of butane, which has a density of 0.579 g/mL.

(a) How many grams of O_2 are required to combust all of the butane?

(b) How many molecules of water will be produced?

(c) Air contains 21.0% O_2 by volume. What mass of air is required to combust 5.00 mL of butane?

51. If the following reaction proceeds with a 75% yield, how much diborane, B_2H_6, will be produced when 23.5 g of sodium borohydride, $NaBH_4$ reacts with 50.0 g of boron trifluoride, BF_3?

$NaBH_{4(s)} + BF_{3(g)} \rightarrow B_2H_{6(g)} + NaBH_{4(s)}$

UNIT 3

Chapter 8

52. What is the molar concentration of the solution made by dissolving 1.00 g of solid sodium nitrate, $NaNO_3$, in enough water to make 315 mL of solution?

53. What volume of 4.00×10^{-2} mol/L calcium nitrate solution, $Ca(NO_3)_{2(aq)}$ will contain 5.0×10^{-2} mol of nitrate ions?

54. By the addition of water, 80.0 mL of 4.00 mol/L sulfuric acid, H_2SO_4, is diluted to 400.0 mL. What is the molar concentration of the sulfuric acid after dilution?

55. How many moles of NaOH are in 100.0 mL of 0.00100 mol/L NaOH solution?

56. If a burette delivers 20 drops of solution per 1.0 mL, how many moles of $HCl_{(aq)}$ are in one drop of a 0.20 mol/L HCl solution?

57. What is the mass percent concentration of nicotine in the body of a 70 kg person smokes a pack of cigarettes (20 cigarettes) in one day? Assume that there is 1.0 mg of nicotine per cigarette, and that all the nicotine is absorbed into the person's body.

58. The blood of an average adult contains about 2.0 L of red blood cells. The hemoglobin present in these cells contains approximately 0.33% iron by mass. Make a reasonable guess about the density of red blood cells, and use this value to estimate the mass of iron present in the red blood cells of an average adult.

59. Ozone is a highly irritating gas that reduces the lung capability of healthy people in concentrations as low as 0.12 ppm. Older photocopy machines could generate ozone gas and they were often placed in closed rooms with little air circulation. Calculate the volume of ozone gas that would result in a concentration of 0.12 ppm in a room with dimensions of 5.0 m × 4.0 m × 3.0 m.

60. Human blood serum contains about 3.4 g/L of sodium ions. What is the molar concentration of Na^+ in blood serum?

Chapter 9

61. Write the net ionic equation for the reaction between aqueous solutions of barium chloride and sodium sulfate. Be sure to include the state of each reactant and product.

62. Write the net ionic equation for the reaction between aqueous sodium hydroxide and aqueous nitric acid. Be sure to include the state of each reactant and product.

63. What are the spectator ions when solutions of Na_2SO_4 and $Pb(NO_3)_2$ are mixed?

64. Iron(II) sulfate reacts with potassium hydroxide in aqueous solution to form a precipitate.

(a) What is the net ionic equation for this reaction?

(b) Which ions are spectator ions?

65. Write the balanced molecular and net-ionic equations for the following reactions:

(a) $Na_3PO_{4(aq)} + Ca(OH)_{2(aq)} \rightarrow NaOH_{(aq)} + Ca_3(PO_4)_{2(s)}$

(b) $Zn_{(s)} + Fe_2(SO_4)_{3(aq)} \rightarrow ZnSO_{4(aq)} + Fe_{(s)}$

Chapter 10

66. Name each of the following acids. Indicate whether each one is a strong or weak acid.

(a) $H_2SO_{4(aq)}$ **(b)** $HNO_{3(aq)}$

(c) $HBr_{(aq)}$ **(d)** $HCl_{(aq)}$

(e) $HF_{(aq)}$

67. A sample of lemon juice was found to have a pH of 2.50. What is the concentration of hydronium ions in the lemon juice?

68. How many millilitres of sodium hydroxide solution are required to neutralize 20 mL of 1.0 mol/L acetic acid if 32 mL of the same sodium hydroxide solution neutralized 20 mL of 1.0 mol/L hydrochloric acid?

69. What are the concentrations of hydrogen ions and hydroxide ions in a solution that has a pH of 5?

70. What is the pH of a 1.0×10^{-5} mol/L $Ca(OH)_2$ (calcium hydroxide) solution?

71. How many moles of calcium hydroxide will be neutralized by one mole of hydrochloric acid, according to the following equation?
$Ca(OH)_{2(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + 2H_2O(l)$

72. In an experiment, 50.0 mL of 0.0800 mol/L NaOH is titrated by the addition of 0.0500 mol/L HNO_3. What is the hydroxide ion concentration after 30.0 mL of HNO_3 solution has been added?

73. A100 mL volume of 0.200 mol/L HCl was placed in a flask. What volume of 0.400 mol/L NaOH solution must be added to bring the solution to a pH of 7.0?

74. What is the pH of a solution in which 2.0×10^{-4} mol of HCl is dissolved in enough distilled water to make 300 mL of solution?

75. What is the pH of a solution containing 2.5 g of NaOH dissolved in 100 mL of water?

76. For each of the following reactions, identify the acid, the base, the conjugate base, and the conjugate acid:

(a) $HF_{(aq)} + NH_{3(aq)} \rightarrow NH4^+_{(aq)} + F^-_{(aq)}$

(b) $Fe(H_2O)_6{}^{3+}_{(aq)} + H_2O_{(l)} \rightarrow Fe(H_2O)_5(OH)_2{}^+_{(aq)} + H_3O^+_{(aq)}$

(c) $NH_4{}^+_{(aq)} + CN^-_{(aq)} \rightarrow HCN_{(aq)} + NH_{3(aq)}$

(d) $(CH_3)_3N_{(aq)} + H_2O_{(l)} \rightarrow (CH_3)_3NH^+_{(aq)} + OH^-_{(aq)}$

77. A solution was prepared by mixing 70.0 mL of 4.00 mo/L $HCl_{(aq)}$ and 30.0 mL of 8.00 mol/L $HNO_{3(aq)}$. Water was then added until the final volume was 500 mL. Calculate $[H^+]$ and find the pH of the solution.

UNIT 4

Chapter 11

78. The gas in a large balloon occupies 30.0 L at a pressure of 300 kPa. If the temperature is kept constant at 300 K, what volume will the balloon be at a pressure of 1200 kPa?

79. A gas occupies a 2.0 L container at 25°C and 300 kPa pressure. If the gas is transferred to a 3.0 L container at the same temperature, what will be the new pressure?

80. If the volume of a given amount of gas is tripled while the temperature remains constant, what will be the new pressure of the gas, relative to the initial pressure?

81. To what temperature must an ideal gas at 27°C be cooled to reduce its volume by one third? In other words, the new volume will be $\frac{2}{3}$ the original volume.

82. If 2.0 L of gas in a piston at 400 K is expanded to 3.0 L while keeping the pressure constant, what is the final temperature of the gas in kelvins?

83. If a certain mass of gas occupies 55 cm^3 at 303 K and 780 mm Hg, what is its volume in L at SATP?

84. If 1.00 L of helium gas at 20°C and 100 kPa is forced into a 250 mL container and subjected to a pressure of 400.0 kPa, what will be the new temperature of the gas?

85. A mixture of gases contains equal masses of H_2, O_2 and CH_4. If the partial pressure of CH_4 is 80 kPa, what is the partial pressure of H_2?

86. The volume of an automobile tire does not change appreciably when the car is driven. Before starting on a journey, a tire contains air at 220 kPa and 20°C. After being driven for an hour, the tire and the air in it become warmer and the pressure increases to 240 kPa. What is the temperature of the air inside the tire?

87. The gases inside a balloon exerted a total pressure of 150.0 kPa on the walls of the balloon. Seventy-five percent of the gas was nitrogen and twelve percent was oxygen. There was also some water vapour, which exerted a pressure of 2.4 kPa and some carbon dioxide. Calculate the pressure exerted by the CO_2 gas.

Chapter 12

88. A container holds one mole of gaseous neon at a certain temperature and pressure. A second, identical container holds gaseous nitrogen at three times the pressure and twice the temperature (in kelvins). How many moles of neon are in the second container?

89. If the mass of a gas is tripled and the pressure is quadrupled while the temperature is constant, by what factor will the volume of the gas change?

90. A cylinder with a volume of 25.0 L contains carbon dioxide at a pressure of 120 kPa and a temperature of 25°C. How much carbon dioxide is in the cylinder?

91. A closed vessel contains the following gases: 6.0 g of hydrogen, 14 g of nitrogen, and 44 g of carbon dioxide. If the total pressure in the vessel is 400 kPa, what is the partial pressure (in kPa) exerted by the nitrogen in the mixture?

92. One litre of a certain gas has a mass of 2.05 g at SATP. What is the molar mass of this gas?

93. What amount of gas is contained in a 10.0 L flask at a pressure of 180 kPa and a temperature of 300 K?

94. When a spark ignites a mixture of hydrogen gas and oxygen gas, water vapour is formed. What mass of oxygen gas would be required to react completely with 1.00 g of hydrogen?

95. Drinking a solution of baking soda (sodium hydrogen carbonate, $NaHCO_3$) can neutralize excess hydrochloric acid in the stomach in water. A student stirred 5.0 g of baking soda in water and drank the solution, then calculated the size of "burp" expected from the carbon dioxide generated in the following reaction.

$$NaHCO_{3(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$$

Assuming the gas will be at a pressure of 101 kPa, and body temperature is 37°C, what volume of carbon dioxide will be generated?

96. Rutherford proved that alpha particles were helium nuclei. In an experiment 1.82×10^{17} alpha particles were counted by use of a Geiger counter. The resulting helium gas occupied a volume of 7.34×10^{-3} mL at 19°C and 99.3 kPa. Use this information to calculate Avogadro's number.

97. A compound was found to contain 54.5% carbon, 9.10% hydrogen, and 36.4% oxygen. The vapour from 0.082 g of the compound occupied 21.8 mL at 104 kPa and 20°C.

(a) Calculate the empirical formula of the compound.
(b) Calculate the molecular mass of the compound.
(c) Calculate the molecular formula of the compound.

98. A student collected 375 mL of oxygen gas from the decomposition of hydrogen peroxide. The gas was collected over water at 19°C and 100.2 kPa. What mass of oxygen was collected? The vapour pressure of water at 19°C is 2.2 kPa.

99. Examine the reaction below and answer the following questions.

$$C_7H_{16(g)} + 11O_{2(g)} \rightarrow 7CO_{2(g)} + 8H_2O_{(g)}$$

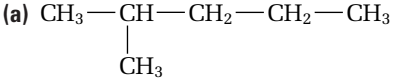
(a) if 10.0 L of $C_7H_{16(g)}$ are burned, what volume of oxygen gas, measured at the same temperature and pressure, is required?
(b) if 200 g of CO_2 are formed, what mass of $C_7H_{16(g)}$ was burned?
(c) if 200 L of CO_2 are formed, measured at STP, what mass of oxygen was consumed?

UNIT 5

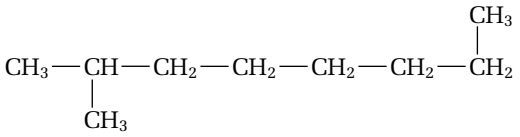
Chapter 13

100. Name each of the following hydrocarbons.

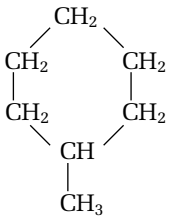
(a)



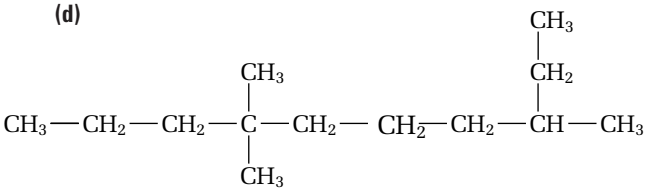
(b)



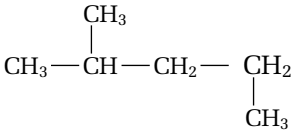
(c)



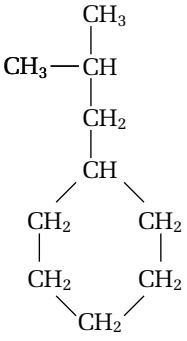
(d)



(e)



(f)



101. Draw condensed structural diagrams for each of the following compounds.

(a) 2-ethyl-1-pentene
(b) 2,6-octadien-4-yne
(c) 2,5-dimethyl-3-hexyne
(d) 2-methyl-3-butene
(e) 2-butyl-3-ethyl-1-cyclobutene
(f) 1,4-dimethylcycloheptane

102. Write IUPAC names for each of the following compounds.

(a) C_3H_6 **(b)** C_5H_8 **(c)** C_5H_{10}
(d) C_5H_{12} **(e)** C_6H_{14} **(f)** C_6H_{12}

103. Draw condensed structural diagrams for the following compounds:

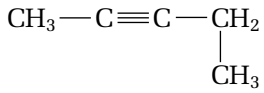
(a) 2,5-dimethylhexane
(b) 3-ethyl-5-methyl-hexane
(c) 2-methyl-4-ethyl-hexane
(d) 2,5-dimethylheptane
(e) 3,6-dimethylheptane
(f) 2,3,4-trimethylpentane

104. Draw and name three structural isomers of C_6H_{14}.

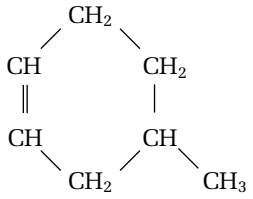
105. Name the following alkenes and alkynes.

(a) $CH_2{=}CH{-}CH_3$

(b)

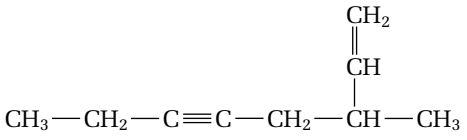


(c)

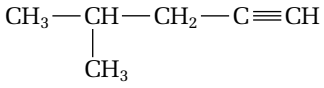


(d) $CH_3{-}CH{=}CH{-}CH_2{-}CH_2{-}C{\equiv}C{-}CH_3$

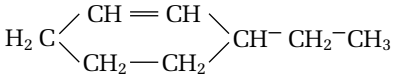
(e)



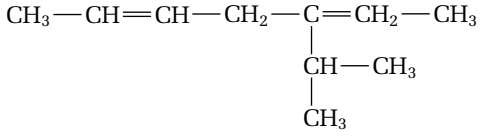
(f)



(g)

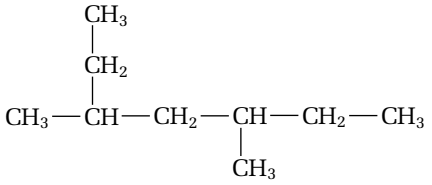


(h)

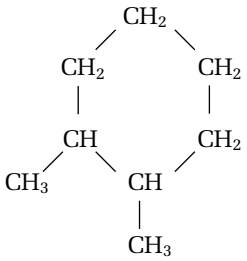


106. Examine the following compounds. Correct any flaws that you see in the structural diagrams.

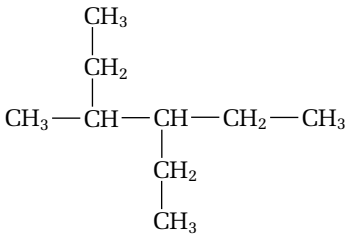
(a) Is this compound 4-ethyl-2-methylpentane?



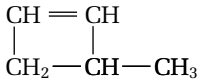
(b) Is this compound 4,5-dimethylhexane?



(c) Is this compound 2-methyl-3-ethylpentane?



(d) Is this compound 1-methyl-3-cyclobutene?



Chapter 14

107. 100 g of ethanol at 25˚C is heated until it reaches 75˚C. How much thermal energy did the ethanol gain? Hint: Use the information in Table 14.2.

108. An unknown material with a mass of 18 g was heated from 22˚C until it reached 232˚C. During this process, the material gained 751 J of energy. What is the heat capacity of the unknown material per gram?

109. A beaker containing 25 g of liquid at room temperature is heated until it gains 5˚C. A second beaker containing 50 g of the same liquid at room temperature is heated until it also gains 5˚C. Which beaker has gained the most thermal energy? Explain.

110. An unknown solid was dissolved in the water of a polystyrene calorimeter in order to find its heat of solution. The following data was recorded:
mass of solid (g) = 5.5
mass of calorimeter water (g) = 120.0
initial temperature of water (˚C) = 21.7
final temperature of solution (˚C) = 32.6

(a) Calculate the heat change of the water.

(b) Calculate the heat change caused by the solid dissolving.

(c) What is the heat of solution per gram of solid dissolved.

111. A 100 -g sample of food is placed in a bomb calorimeter calibrated at 7.23 kJ/˚C. When the food is burned, the calorimeter gains 512 kJ of heat. If the initial temperature of the calorimeter was 19˚C, what is the final temperature of the calorimeter and its contents?