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Study Guide and Student Solutions Manual

Chemistry for Today
General, Organic, and Biochemistry

EIGHTH EDITION

Spencer L. Seager
Weber State University

Michael R. Slabaugh
Weber State University

Prepared by

Jennifer P. Harris

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Preface

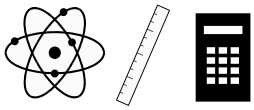
This book is designed to serve as both a reference and a study tool. Each chapter includes a Chapter Outline, Learning Objectives/Assessment statements, Solutions for the Even-numbered End of Chapter (EOC) Exercises, Additional Activities, Answers to the Additional Activities, and Self-Test Questions. The Additional Activities include specific questions for each section as well as a summary activity entitled, "Tying It All Together with a Laboratory Application." The Answers to the Self-Test Questions are at the end of the book.

The EOC Exercises marked with the ☑ symbol are questions identified as "quick checks." Your ability to answer the "quick check" questions correctly indicates how well you have met the learning objectives for the chapter. It is important to remember that your instructor may have additional learning objectives that are not identified in this text.

I hope this book is useful to you and that your experience studying chemistry is positive. The subject matter is fascinating (ask any chemist) and applies to daily life. As with any meaningful scholastic experience, you will need to study. Ideally, using this book will focus that process. If you have questions, comments, or concerns about the book, please, e-mail me at jpharris@gmail.com.

Thank you to all of the people who helped me with this and the previous editions of the book, especially my students, Sylvia Krick, Lynn Carlson, and Ruth Leslie. I also want to thank a few of the many notable chemists in my life: Dr. Fred R. Harris, my husband and best friend; Dr. Barinder Deu, my first high school chemistry teacher; Dr. Debra Feakes, my mentor at Southwest Texas State University (now, Texas State University-San Marcos); and my colleagues both at Portland Community College in Oregon and Citrus Community College in California. Additionally, I want to thank my mom and dad, COL (Ret.) and Mrs. David L. Pointer, and my sister, Colleen E. Parks, MS, RD, LD (dietitian extraordinaire), for their unfailing support.

Chapter 1: Matter, Measurements, and Calculations



CHAPTER OUTLINE

LEARNING OBJECTIVES/ASSESSMENT

When you have completed your study of this chapter, you should be able to:

1. Explain what matter is. (Section 1.1; Exercise 1.2)
2. Explain differences between the terms *physical* and *chemical* as applied to:
    a. Properties of matter (Section 1.2; Exercises 1.10 b & c)
    b. Changes in matter (Section 1.2; Exercises 1.8 a & b)
3. Describe matter in terms of the accepted scientific model. (Section 1.3; Exercise 1.12)
4. On the basis of observation or information given to you, classify matter into the correct category of each of the following pairs:
    a. Heterogeneous or homogeneous (Section 1.4; Exercise 1.22)
    b. Solution or pure substance (Section 1.4; Exercise 1.24)
    c. Element or compound (Section 1.4; Exercise 1.18)
5. Recognize the use of measurement units in everyday activities. (Section 1.5; Exercise 1.28)
6. Recognize units of the metric system, and convert measurements done using the metric system into related units. (Section 1.6; Exercises 1.30 and 1.40)
7. Express numbers using scientific notation, and do calculations with numbers expressed in scientific notation. (Section 1.7; Exercises 1.48 and 1.60)
8. Express the results of measurements and calculations using the correct number of significant figures. (Section 1.8; Exercises 1.64 and 1.66)
9. Use the factor-unit method to solve numerical problems. (Section 1.9; Exercise 1.82)
10. Do calculations involving percentages. (Section 1.10; Exercise 1.92)
11. Do calculations involving densities. (Section 1.11; Exercise 1.98)

SOLUTIONS FOR THE END OF CHAPTER EXERCISES

WHAT IS MATTER? (SECTION 1.1)

☑1.2 All matter occupies space and has mass. Mass is a measurement of the amount of matter in an object. The mass of an object is constant regardless of where the mass is measured. Weight is a measurement of the gravitational force acting on an object. The weight of an object will change with gravity; therefore, the weight of an object will be different at different altitudes and on different planets.

1.4 The distance you can throw a bowling ball will change more than the distance you can roll a bowling ball on a flat, smooth surface. When throwing a ball, gravity pulls the ball toward the ground and air resistance slows its decent. The gravitational force on the moon is approximately $1/6^{th}$ the gravitational force that is present on the earth; therefore, when throwing a ball on the moon, you should be able to throw it further than you can on earth. The moon does not have air resistance. When rolling a ball, friction helps to slow down the ball. If the flat, smooth surface is the same on the earth and the moon, the amount of friction should remain constant.

1.6 The attractive force of gravity for objects near the earth's surface increases as you get closer to the center of the earth (Exercise 1.5). If the earth bulges at the equator, the people at the equator are further from the center of the earth than people at the North Pole. If two people with the same mass were weighed at the equator and at the North Pole, the person at the equator would weigh less than the person at the North Pole because the gravitational force at the North Pole is stronger than the gravitational force at the equator.

PROPERTIES AND CHANGES (SECTION 1.2)

1.8 ☑a. The two pieces of the stick still have the same chemical composition as the original stick. This was a change that did not involve composition; therefore, it is a **physical change**.

☑b. As the candle burns, it produces carbon dioxide, water, soot, and other products. This is a change that involves composition; therefore, it is a **chemical change**.

c. The pieces of rock salt have the same chemical composition as the original larger piece of rock salt. This was a change that did not involve composition; therefore, it is a **physical change**.

d. Many tree leaves are green in the spring and summer because of the green chlorophyll that is used in photosynthesis to produce energy for the tree. During these seasons, the tree stores the extra energy so that in autumn when the days grow shorter, the chlorophyll is no longer needed. As the leaves in the cell stop producing chlorophyll, the other colors present in the leaves become more visible. This change involves composition; therefore, it is a **chemical change**.

1.10 a. The phase of matter at room temperature is a **physical property** because the composition does not change while making this observation.

☑b. The reaction between two substances is a **chemical property** because the composition of the products differs from the reactants. The products for the reaction between sodium metal and water are sodium hydroxide and hydrogen gas. (Note: Predicting the products for this type of chemical reaction is covered in Section 9.6.)

☑c. Freezing point is a **physical property** because the composition does not change while making this observation.

d. The inability of a material to form new products by rusting is a **chemical property** because rust would have a different chemical composition than gold. Attempting to change the chemical composition of a material is a test of a chemical property regardless of whether the attempt is successful.

e. The color of a substance is a **physical property** because the composition does not change while making this observation.

A MODEL OF MATTER (SECTION 1.3)

☑1.12 a. Yes, the succinic acid molecules have been changed by the process. The molecules of succinic acid released at least one atom each in the form of a gas. Without those atoms, the molecules cannot be succinic acid molecules. Also, if they were still succinic acid molecules, the melting point of the remaining solid would still be 182°C.

b. No, the white solid that remains after heating is not succinic acid. The melting point of succinic acid is 182°C, but the melting point of this new solid is not 182°C.

c. The succinic acid molecules contain more atoms than the molecules of the white solid

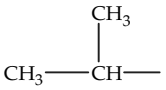
Section 11.6 Review:

(1) no; (2) yes; (3) no, no; (4) no, yes; (5) conformations; (6) no; (7) no

Section 11.7 Review:

(1) The *–ane* ending for saturated hydrocarbons is also contained within the word "*alkane.*"

(2) The *n*- prefix means unbranched and begins with the same letter as "*normal*" which means unbranched.

(3) 

(4)

isopropyl	isobutyl	*t*-butyl	propyl
ethyl	*sec*-butyl	butyl	methyl
ethyl	isopropyl	*sec*-butyl	isobutyl

Section 11.8 Review:

(1) The prefix *cyclo*- is appropriate to describe compounds that contain a ring because it means of a circle or wheel, circular. These compounds are considered "closed chains" because no beginning or end exists.

(2) C_nH_{2n}

Section 11.9 Review:

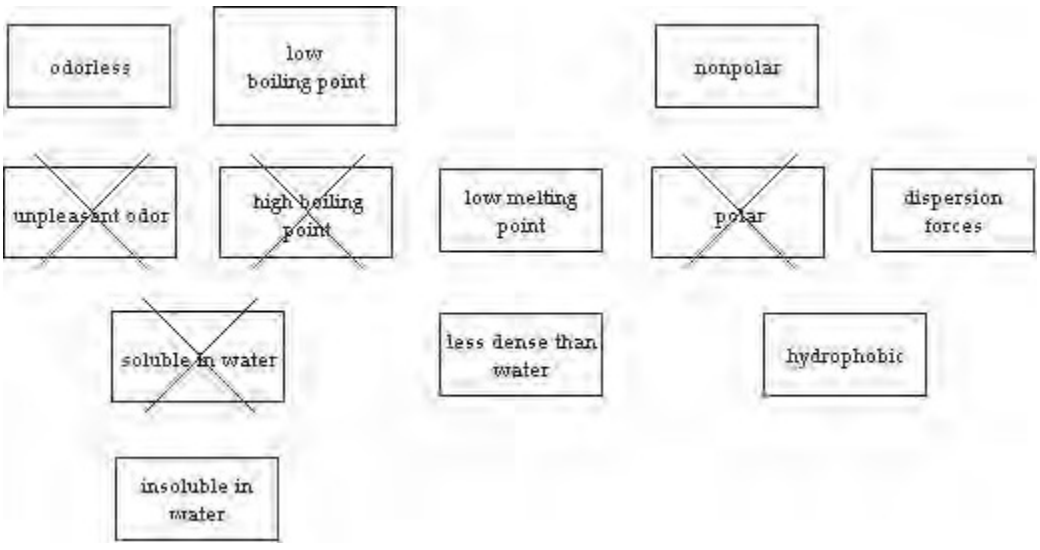
(1) No, the two linked tetrahedrons from the Section 11.6 Review cannot be placed on one of the small triangles in order to represent cyclopropane. The distance between the tetrahedron points is too large. By removing the tetrahedrons from the toothpick and adjusting the adjacent carbon-carbon bond angles to 60°, a representation of cyclopropane can be made.

(2) 90°; (3) 108°; (4) 109.5°; (5) Cyclobutane and cyclopentane can both deviate from a planar arrangement of carbon atoms in order to obtain a more desirable bond angle.

(6) No, cyclopropane cannot deviate from a planar arrangement of carbon atoms because the three carbon atoms automatically form a plane.

(7) *cis*- = on this side of; *trans*- = on the other side of, to the other side of, over, across, through

Section 11.10 Review:



Section 11.11 Review:

(1) Alkanes undergo rapid oxidation (combustion) reactions.

(2) Combustion reactions are exothermic.

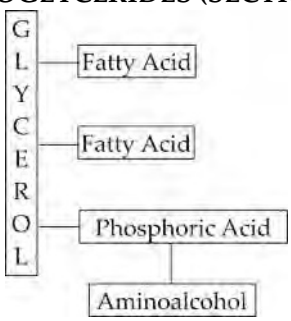
(3) Alkane combustion can be used as a source of heat, for cooking, or for running an engine.

(4) Oxygen is the limiting reactant when CO is produced. This is incomplete combustion.

18.26 Waxes are protective coatings on feathers, fur, skin, leaves, and fruits. They also occur in secretions of the sebaceous glands to keep skin soft and prevent dehydration.

PHOSPHOGLYCERIDES (SECTION 18.6)

☑18.28

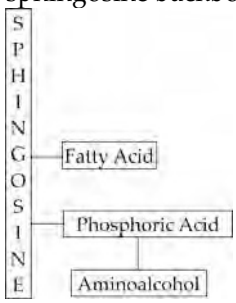


☑18.30 Lecithins are important structural components in cell membranes as well as emulsifying and micelle-forming agents.

18.32 Lecithins are phosphoglycerides that contain the aminoalcohol choline. Cephalins are phosphoglycerides that contain ethanolamine or serine.

SPHINGOLIPIDS (SECTION 18.7)

☑18.34 Sphingolipids include sphingomyelins and glycolipids. Both of these subclasses contain the sphingosine backbone and a fatty acid.



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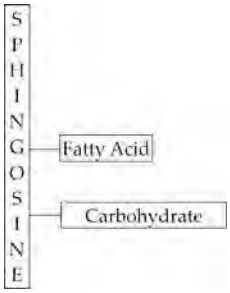

18.36 Three diseases caused by abnormal metabolism and accumulation of sphingolipids are Tay-Sachs, Gaucher's, and Niemann-Pick diseases.

18.38 Another name for glycolipids is cerebrosides. These compounds are abundant in brain tissue.

BIOLOGICAL MEMBRANES (SECTION 18.8)

18.40 The three classes of lipids found in membranes are phosphoglycerides, sphingomyelins, and steroids (cholesterol).

☑18.42 The fluid-mosaic model contains lipids organized in a bilayer in such a way that the hydrophilic heads are pointed toward the outside of the bilayer and the hydrophobic tails are pointed toward the inside of the bilayer. Some proteins float in the lipid bilayer and other proteins extend completely through the bilayer. The lipid molecules move freely laterally within the bilayer.

CHAPTER 17

1. B	7. B	13. B	19. C	25. T
2. A	8. C	14. D	20. A	26. T
3. B	9. C	15. C	21. D	27. T
4. C	10. A	16. B	22. T	28. T
5. C	11. B	17. C	23. F	29. F
6. D	12. D	18. A	24. F	30. T

CHAPTER 18

1. B	7. C	13. B	19. A	25. T
2. A	8. A	14. D	20. D	26. T
3. C	9. C	15. D	21. B	27. F
4. B	10. A	16. C	22. F	28. F
5. A	11. C	17. A	23. T	29. F
6. C	12. D	18. C	24. T	30. T

CHAPTER 19

1. C	8. A	15. D	22. D	29. C
2. B	9. D	16. A	23. A	30. F
3. B	10. D	17. C	24. C	31. T
4. A	11. D	18. A	25. C	32. T
5. B	12. B	19. B	26. D	33. T
6. C	13. B	20. D	27. A	34. F
7. D	14. C	21. B	28. C	35. F

CHAPTER 20

1. D	8. C	15. A	22. A	29. F
2. A	9. D	16. B	23. B	30. T
3. D	10. C	17. C	24. D	31. T
4. D	11. B	18. A	25. C	32. F
5. D	12. B	19. B	26. T	33. T
6. A	13. D	20. C	27. F	34. T
7. A	14. C	21. D	28. F	35. F

CHAPTER 21

1. B	8. D	15. B	22. T	29. F
2. B	9. A	16. C	23. F	30. F
3. D	10. C	17. A	24. F	31. T
4. B	11. A	18. C	25. F	32. F
5. C	12. A	19. C	26. F	33. T
6. A	13. D	20. D	27. T	34. T
7. D	14. A	21. B	28. T	35. T

CHAPTER 22

1. B	8. D	15. C	22. B	29. T
2. A	9. C	16. A	23. A	30. F
3. A	10. A	17. B	24. T	31. F
4. C	11. C	18. D	25. F	32. F
5. B	12. A	19. C	26. T	33. F
6. D	13. B	20. B	27. F	34. F
7. B	14. C	21. C	28. F	35. T