

Exercises in order to increase the number of practice questions for students and assignable homework questions for instructors.

THE LEARNING SYSTEM

To achieve the goals stated, this text includes a variety of features that should make student's study of *Integrated Science* more effective and enjoyable. These aids are included to help you clearly understand the concepts and principles that serve as the foundation of the integrated sciences.

OVERVIEW TO INTEGRATED SCIENCE

Chapter 1 provides an overview or orientation to integrated science in general and this text in particular. It also describes the fundamental methods and techniques used by scientists to study and understand the world around us.

MULTIDISCIPLINARY APPROACH

Chapter Opening Tools

Core Concept and Supporting Concepts

Core and Supporting Concepts integrate the chapter concepts and the chapter outline. The Core and Supporting Concepts outline and emphasize the concepts at a chapter level. The supporting concepts list is designed to help students focus their studies by identifying the most important topics in the chapter outline.

Connections

The relationship of other science disciplines throughout the text are related to the chapter's contents. The core concept map, integrated with the chapter outline and supporting concepts list, the connections list, and overview, help students see the big picture of the chapter content and the even bigger picture of how that content relates to other science discipline areas.

Chapter Overviews

Each chapter begins with an introductory overview. The overview previews the chapter's contents and what students can expect to learn from reading the chapter. It adds to the general outline of the chapter by introducing students to the concepts to be covered. It also expands upon the core concept map, facilitating in the integration of topics. Finally, the overview will help students to stay focused and organized while reading the chapter for the first time. After reading this introduction, students should browse through the chapter, paying particular attention to the topic headings and illustrations so that they get a feel for the kinds of ideas included within the chapter.

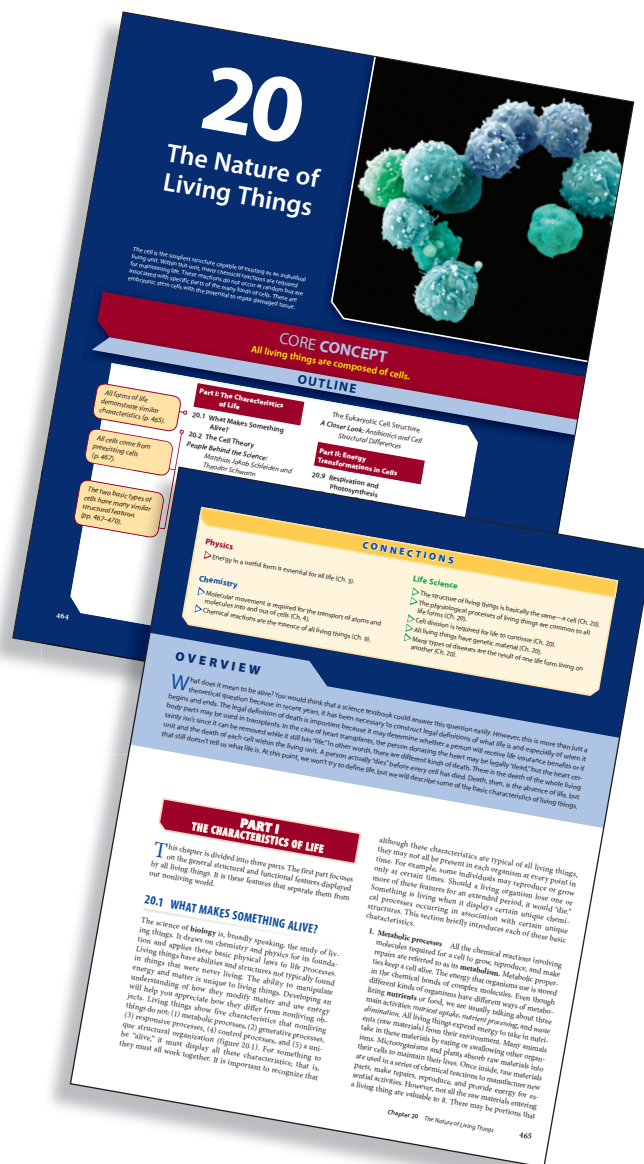
APPLYING SCIENCE TO THE REAL WORLD

Concepts Applied

As students look through each chapter, they will find one or more Concepts Applied boxes. These activities are simple exercises that students can perform at home or in the classroom to demonstrate important concepts and reinforce their understanding of them. This feature also describes the application of those concepts to their everyday lives.

Examples

Many of the more computational topics discussed within the chapters contain one or more concrete, worked Examples of a problem and its solution as it applies to the topic at hand. Through careful study of these Examples, students can better appreciate the many uses of problem solving in the sciences.



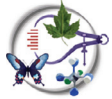
discussed to real-world issues, underscoring the relevance of integrated science in confronting the many issues we face in our day-to-day lives. They are identified with the following icons:

“A Closer Look: The Compact Disc was, again, an excellent application of optics to everyday life and to something modern students thrive on—CDs and DVDs.”

—Treasure Brasher, West Texas A&M University

“Connections—wonderful!!!!. . . . A Closer Look . . . excellent. Clear, interesting, good figures. You have presented crucial information in a straightforward and uncompromising way.”

—Megan M. Hoffman, Berea College



General: This icon identifies interdisciplinary topics that cross over several categories; for example, life sciences and technology.



Life: This icon identifies interdisciplinary life science topics, meaning connections concerning all living organisms collectively: plant life, animal life, marine life, and any other classification of life.



Technology: This icon identifies interdisciplinary technology topics, that is, connections concerned with the application of science for the comfort and well being of people, especially through industrial and commercial means.



Measurement, Thinking, Scientific Methods: This icon identifies interdisciplinary concepts and understandings concerned with people trying to make sense out of their surroundings by making observations, measuring, thinking, developing explanations for what is observed, and experimenting to test those explanations.



Environmental Science: This icon identifies interdisciplinary concepts and understandings about the problems caused by human use of the natural world and remedies for those problems.

END-OF-CHAPTER FEATURES

At the end of each chapter are the following materials:

- **Summary:** highlights the key elements of the chapter
- **Summary of Equations** (chapters 1–9, 11): highlights the key equations to reinforce retention of them
- **Key Terms:** page-referenced where students will find the terms defined in context
- **Applying the Concepts:** a multiple choice quiz to test students’ comprehension of the material covered (Answers are included in appendix F.)
- **Questions for Thought:** designed to challenge students to demonstrate their understandings of the topic
- **For Further Analysis:** exercises include analysis or discussion questions, independent investigations, and activities intended to emphasize critical thinking skills and societal issues, and develop a deeper understanding of the chapter content

- **Invitation to Inquiry:** exercises that consist of short, open-ended activities that allow students to apply investigative skills to the material in the chapter
- **Parallel Exercises** (chapters 1–9, 11): There are two groups of parallel exercises, Group A and Group B. The Group A parallel exercises have complete solutions worked out, along with useful comments in appendix G. The Group B parallel exercises are similar to those in Group A but do not contain answers in the text. By working through the Group A parallel exercises and checking the solution in appendix G, students will gain confidence in tackling the parallel exercises in Group B and thus reinforce their problem-solving skills.

“I like the key terms with the page numbers with each one. I always like to see more conceptual- and synthesis-type questions, which is why I like the ‘Questions for Thought’ and ‘For Further Analysis’ parts. . . . Exercises such as ‘Questions for Thought’ number 7, having students think about why oxygen is in Earth’s atmosphere but not in Venus or Mars’ atmosphere, is a valuable sort of question, because it requires students to know something and apply it.”

—Jim Hamm, Big Bend Community College

TABLE 13.6 Distances from the Sun to Planets Known in the 1990s

Planet	a	Diameter Predicted by Kepler's Law (in Earth radii)	Actual Diameter (in Earth radii)
Mercury	0.39	0.4	0.39
Venus	0.72	1.0	0.92
Earth	1.0	1.0	1.0
Mars	1.52	1.3	1.2
Jupiter	5.2	11.2	11.2
Saturn	9.5	9.5	9.5
Uranus	19.2	19.2	19.2

SUMMARY

The planets can be classified into two major groups: (1) the terrestrial planets of Mercury, Venus, Mars, and Earth and (2) the giant planets of Jupiter, Saturn, Uranus, and Neptune.

Comets are porous aggregations of water ice, frozen methane, dust, and other volatile materials. The solar system is surrounded by one or two belts and a few clouds of these objects. Something called the Kuiper Belt and the Oort Cloud are thought to be reservoirs of comets. The Kuiper Belt is a ring of icy bodies that lies between the orbits of Neptune and Pluto. The Oort Cloud is a vast, roughly spherical cloud of icy bodies that surrounds the Sun. Increased volcanic activity, ice sublimation, and other processes have caused the inner planets to lose their atmospheres. A scattered trail of light and matter is called a meteor. A meteoroid that survives the trip through the atmosphere to reach the surface of Earth is called a meteorite. Most meteorites are fragments of rocks that condensed from the solar nebula. Some meteorites are fragments of a small body from space that falls on the surface of Earth as a meteorite.

KEY TERMS

asteroid (p. 301)
atmosphere (p. 307)
comet (p. 300)
dwarf planet (p. 306)
great planet (p. 307)
Kuiper Belt (p. 300)
meteor (p. 302)
meteorite (p. 303)

APPLYING THE CONCEPTS

Answers are located in Appendix F.

- Earth, other planets, and all the members of the solar system have atmospheres.
 - have atmospheres.
 - form billions of years ago, when the elements and molecules were previously existing.
 - are made of a planet that captured the atmosphere.
 - are made of a planet that condensed from the accretion disk.
 - are made of a planet that collapsed with an internal or external heat source.
- The hot of asteroids between Mars and Jupiter is probably the remains of a planet that exploded.
 - is a planet that exploded.
 - is a planet that condensed from the accretion disk.
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QUESTIONS FOR THOUGHT

- Describe the protoplanet nebula model of the origin of the solar system. Which part or parts of the model seem least credible to you? Explain. What information could you look for to test the model?
- What are the basic differences between the terrestrial planets and the giant planets? Describe how the protoplanet nebula model accounts for these differences.
- What evidence exists that Mars was once habitable? How do you know? How do you think Mars did have liquid water at one time, but it is now dry? How do you think Mars did have liquid water at one time, but it is now dry? How do you think Mars did have liquid water at one time, but it is now dry?
- What are the rings of Saturn?
- Describe some of the unusual features found on the moons of Jupiter and Saturn.
- What are the similarities and the differences between the moons of Jupiter and Saturn?
- Give one idea about why the Great Red Spot exists on Jupiter. Support this idea! Explain.
- What is so unusual about the moons and rings of Venus and Uranus?

FOR FURTHER ANALYSIS

- What are the significant similarities and differences between the terrestrial and giant planets? Describe why these similarities and differences exist.
- Draw a sketch showing the positions of the Earth, Sun, and Mars showing the positions when Venus appears in the evening star.
- Evaluate the statement that Venus is Earth's twin planet.

INVITATION TO INQUIRY

What's Your Signal?

Form a team to investigate how the Great Red Spot exists on Jupiter. Each team member should select one hemisphere and track what it does to happen and what actually happens each day.

QUESTIONS FOR THOUGHT

- Which of the following planets would be mostly composed of gas?
 - Mercury
 - Uranus
 - Venus
 - Mars
 - Jupiter
- Which of the following planets probably has an internal atmosphere?
 - Mercury
 - Venus
 - Mars
 - Jupiter
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Appendix A

Mathematical Review

A.1 WORKING WITH EQUATIONS

Many of the problems of science involve an equation, a shorthand way of describing patterns and relationships that are observed in nature. Equations are also used to identify properties and to define certain concepts, but all uses have well-established meanings. Symbols that are used by convention, and allowed mathematical operations. This appendix will assist you in better understanding equations and the reasoning that goes with the manipulations.

Background

In addition to call operations and concepts. Among these are: The term **thing**. For example, subtraction, a reciprocal is defined between two numbers. $1/a$ is the reciprocal of a . 5 to give $1/5$ of the other. The fraction $1/2$ key will depress the $1/x$ key again. The reciprocal of $1/2$ is 2 . A ratio is a comparison of the numerator and denominator. $1/2$ is the ratio of the numerator to the denominator. Working-solving exercises needed to carry

these operations to remember that a number (or a unit) divided by itself is equal to 1; for example,

$$\frac{5}{5} = 1 \quad \frac{1 \text{ inch}}{1 \text{ inch}} = 1 \quad \frac{5 \text{ inches}}{5 \text{ inches}} = 1$$

When one fraction is divided by another fraction, the operation commonly applied is to "invert the denominator and multiply." For example, $2/5$ divided by $1/2$ is

Glossary

A **abiotic factors** involving parts of an organism's environment

absolute humidity a measure of the actual amount of water vapor in the air at a given time—for example, in grams per cubic meter

absolute magnitude a classification scheme to compare for the brightness that stars would appear to have if they were all at a defined, apparent distance

absolute scale temperature scale set so that zero is absolute distance

absolute zero the theoretical lowest temperature of motion that can occur

absolute zero the theoretical lowest temperature of motion that can occur

absorbance the practically level plane in a reaction

acceleration a change in velocity per change in time; by definition, this change in velocity can result from a change in speed, direction, or a combination of changes in speed and direction

accretion disk the rotating disk of gas and dust from the protostar

acetylcholine a neurotransmitter secreted into the synapse by many axons and received by dendrites

acetylcholinesterase an enzyme present in the synapse that destroys acetylcholine

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acid a substance that is a proton donor when dissolved in water; generally considered a substance which ionizes generally considered a substance which ionizes in water that can neutralize a base, forming a salt and water

acid-base indicator a vegetable dye used to detect acids and base solutions by a color change

adjusted characteristics characteristics an organism gains during its lifetime that are not genetically determined and therefore cannot be passed on to future generations

active transport one of a carrier molecule to move molecules through a cell membrane in direction opposite that of the concentration gradient; the carrier requires an input of energy other than the kinetic energy of the molecule

adaptor a double-stranded oligonucleotide base of DNA or RNA, the complementary base of thymine or uracil

adaptor protein a protein that binds to the primary and secondary structures of a protein and helps in its folding

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aerobic cellular respiration the biochemical pathway that requires oxygen and consumes food, such as carbohydrates, to produce dioxide and water; during this conversion, it releases the energy stored in the bonds of the food

air mass a large, more or less uniform body of air that has a fairly uniform temperature and moisture content throughout

air mass weather the weather experienced within a given area, characterized by slow gradual changes (over days to weeks)

alcohol an organic compound with a general formula of $R-OH$, where R is one of the hydrocarbon groups, for example, methyl or ethyl

aldehyde an organic molecule with the general formula $R-CHO$, where R is one of the hydrocarbon groups, for example, methyl or ethyl

allele one of the alternative forms of a gene for a particular characteristic (e.g., attached-earlobe and free-earlobe are alternative alleles for the ear shape)

alpha particle the nucleus of a helium atom (two protons and two neutrons) emitted in radioactive decay

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angle of incidence angle of an incident (arriving) ray or particle to a surface; measured from a line perpendicular to the surface (the normal)

angle of reflection angle of a reflected ray or particle from a surface; measured from the normal

angular momentum quantum number the quantum mechanical number in the atom, one of four quantum numbers describing electrons within the atom

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END-OF-TEXT MATERIAL

At the back of the text are appendices that give additional background details, charts, and answers to chapter exercises. Appendix E provides solutions for each chapter's follow-up Example exercises. There are also a glossary of all key terms, an index organized alphabetically by subject matter, and special tables printed on the inside covers for reference use.

“... many books addressing similar disciplines have a tendency to talk over a student's head, making a student frustrated further in a class they do not want to be attending. . . . Personally, I would admit that Integrated Science has a slight edge. The glossary seems up-to-date and centers in on words many non-science majors may not understand.”

—David J. DiMattio, St. Bonaventure University