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INTRODUCTION TO CHEMISTRY**SECTION 1.1 CHEMISTRY (pages 7–11)**

This section defines chemistry and differentiates among its traditional divisions. It also distinguishes pure from applied chemistry and provides several reasons to study chemistry.

► What Is Chemistry? (page 7)

1. What is matter?

Matter is anything that has mass and takes up space.

2. What is chemistry?

Chemistry is the study of the composition of matter and the changes that matter undergoes.

► Areas of Study (page 8)

3. What are the five major areas of chemistry?

- a. organic chemistry
- b. inorganic chemistry
- c. analytical chemistry
- d. physical chemistry
- e. biochemistry

4. Is the following sentence true or false? The boundaries between the five areas of chemistry are not firm.
- true

5. Complete the table by filling in the appropriate subdivision of chemistry.

physical chemistry	Investigating ways to slow down the rusting of steel
biochemistry	Developing a better insulin-delivery system for diabetics
analytical chemistry	Determining the amount of mercury present in a soil sample
inorganic chemistry	Comparing the hardness of copper and silver
organic chemistry	Developing a new carbon-based fiber for clothing

CHAPTER 1, Introduction to Chemistry *(continued)***► Pure and Applied Chemistry (page 9)**

6. Applied chemistry is research that is directed toward a practical goal or application; pure chemistry is the pursuit of chemical knowledge for its own sake.

► Why Study Chemistry? (pages 10–11)

7. Why is the study of chemistry important?
- explaining the natural world
 - preparing for a career
 - being an informed citizen
8. List three careers that require some knowledge of chemistry.
firefighter, turf manager, and photographer

**Reading Skill Practice**

Outlining can help you understand and remember what you have read. Write an outline for Section 1.1, Chemistry. Begin your outline by copying the headings in the textbook. Under each heading, write the main idea. Then list the details that support the main idea. Do your work on a separate sheet of paper.

Students' outlines should have four major topics, matching the four headings of the section. Details should include all the highlighted key terms, as well as the important concepts discussed under each heading.

SECTION 1.2 CHEMISTRY FAR AND WIDE (pages 12–17)

This section summarizes ways in which chemistry affects many aspects of life.

► Materials (page 12)

1. Is the following statement true or false? Chemists design materials to fit general needs. false
2. In George de Mestral's hook-and-loop tapes, were the hooks macroscopic or microscopic? microscopic

► Energy (page 13)

3. List two ways to meet the demand for energy.
- conserving energy
 - producing more energy

4. How does insulation help conserve energy?

Insulation acts as a barrier to heat flow.

5. How are soybeans used as a source of energy?

Soybean plants can be used to make biodiesel, a fuel that burns more cleanly than regular diesel.

6. Circle the letter of the statement that is always true about a battery.

a. All batteries are able to be recharged.

b. Batteries use chemicals to store energy.

c. Batteries are devices that conserve energy.

d. NASA developed batteries that are thrown away after use.

► **Medicine and Biotechnology (page 14)**

7. What is the role of chemistry in the development of medicines?

Chemists use knowledge of the structure and function of chemicals in cells to design safe and effective drugs.

8. List three new materials chemists have developed that have medical applications.

a. plastic tubes to replace diseased arteries

b. artificial hips and knees

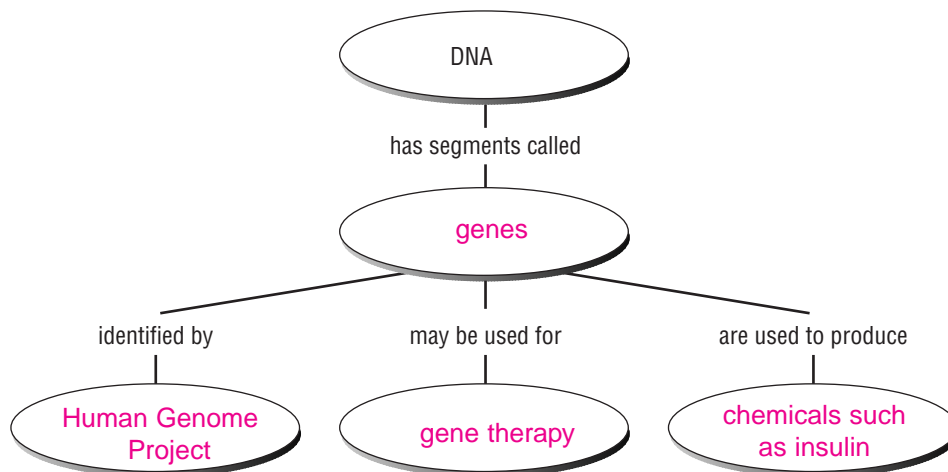
c. plastic "skin" that can heal itself when it cracks

9. The field that applies science to the production of biological products is

biotechnology .

CHAPTER 1, Introduction to Chemistry (continued)

10. Complete the concept map about genes.



► Agriculture (page 15)

11. How do chemists contribute to agriculture?

Chemists help to develop more productive crops and safer, more effective ways to protect crops.

12. How can a potato plant modified with a jellyfish gene help a farmer to conserve water?

The modified potato plant glows when it needs water.

13. What type of pesticides do chemists design to protect crops?

Chemists design pesticides that only kill specific insects because some insects are helpful and shouldn't be destroyed.

14. In Figure 1.11, how does the plastic tube around the tomato stem protect the plant?

The plastic tube emits a chemical that attracts male pinworm moths, which reduces the number of harmful pinworms produced.

► **The Environment (page 16)**

15. What are two ways that chemists work to protect the environment?

a. identify pollutants

b. prevent pollution

16. Define a pollutant.

A pollutant is a material found in air, water, and soil that is harmful to humans or other organisms.

17. How is lead harmful to humans?

Low levels of lead in the blood can permanently damage the nervous system, especially of growing children.

18. What strategies have been used to prevent lead poisoning in children?

blood testing; regulating sales of older homes to families with younger children; public awareness campaigns

► **The Universe (page 17)**

19. Scientists can learn about the chemical composition of stars by analyzing the _____ light _____ they transmit.

20. Why won't the method used to discover the chemical composition of stars work for the moon and planets?

The moon and planets do not emit light.

21. What did chemists learn about the moon's surface by analyzing moon rocks?

They learned that oceans of lava once covered the moon's surface.

22. Look at Figure 1.14 on page 17. What is the key difference in the methods scientists used to analyze rocks from Earth's moon and Mars?

Astronauts collected rock samples from Earth's moon.

Rocks on Mars were analyzed by a robotic vehicle.

CHAPTER 1, Introduction to Chemistry (continued)

SECTION 1.3 THINKING LIKE A SCIENTIST (pages 20–25)

This section describes the development of an experimental approach to chemistry and steps involved in the scientific method. It also discusses the role of collaboration and communication in science.

► Alchemy (page 20)

1. Practical alchemy focused on

developing techniques for working with metals, glass, and dyes.

2. Alchemists developed processes for separating _____ mixtures _____ and purifying _____ chemicals _____.

► An Experimental Approach to Science (page 21)

3. How did Lavoisier help to transform chemistry?

He demonstrated the importance of measurement.

4. Circle the letter of the word that identifies what Lavoisier demonstrated was necessary for materials to burn.

a. phlogiston

b. nitrogen

c. oxygen

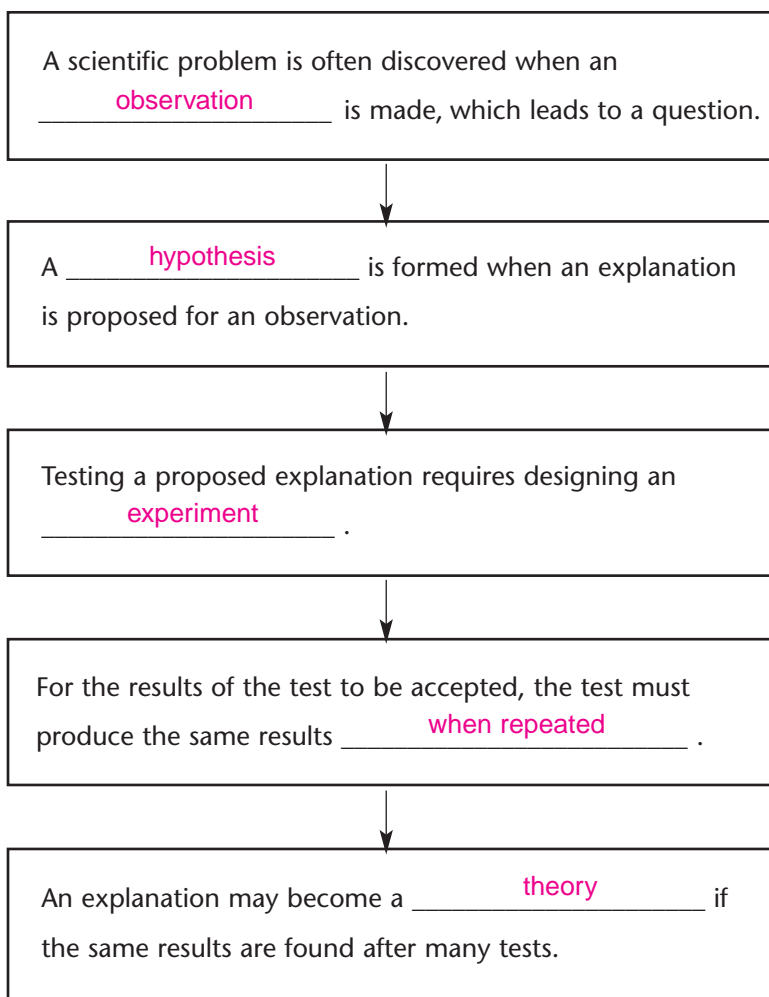
d. metals

► The Scientific Method (pages 22–23)

5. What is the scientific method?

It is a logical systematic, approach to the solution of a scientific problem.

6. Complete the flowchart about the scientific method.



7. Circle the letter of the activity that involves using the senses to gather information directly.

- a. forming a hypothesis
- b.** making an observation
- c. planning an experiment
- d. analyzing data

8. What do scientists do if the results of an experiment do not support the hypothesis?

They develop a new hypothesis and perform experiments to test the new hypothesis.

9. The variable that you change during an experiment is the manipulated variable .
 The variable that is observed during an experiment is the responding variable .

CHAPTER 1, Introduction to Chemistry (continued)

10. Is the following sentence true or false? Once a theory has been proven, no experiment will ever disprove it. false

11. What is a scientific law?

A scientific law is a concise statement that summarizes the results of many observations and experiments.

12. Circle the letter of each statement that expresses a scientific law.

a. As the temperature of a balloon increases, the balloon expands.

b. Increasing the temperature of a balloon might cause it to burst.

c. If all other variables are kept constant, the volume of a gas increases as the temperature increases.

d. Sometimes increasing the temperature of a gas causes the gas to expand.

► Collaboration and Communication (pages 24–25)

13. Several scientists working together to solve a problem is collaboration .

14. Is the following statement true or false? Scientists from different disciplines may need to work together on a problem because the problem is too complex for one person to solve. true

15. Exchanging ideas about science is called communication .

16. How are journals helpful to scientists?

Scientists use journals to keep up with new discoveries.

17. Is the following statement true or false? Experts in an author's field review articles after they are published in a journal. false .

SECTION 1.4 PROBLEM SOLVING IN CHEMISTRY (pages 28–32)

This section describes effective approaches for solving numeric problems and conceptual problems.

► Skills Used in Solving Problems (page 28)

1. Name an everyday situation that requires problem-solving skills.

Students' answers will vary, but should include aspects of problem solving.

2. What is involved in effective problem solving?

developing a plan and implementing that plan

► Solving Numeric Problems (pages 29–30)

3. What are the three steps for solving numeric problems?

a. *analyze*

b. *calculate*

c. *evaluate*

4. What must you determine first when solving a word problem?

where you are starting from (what is known) and where you are going (the unknown)

5. What are two skills that you may need to use as you calculate an answer to a problem?

converting a measurement from one unit to another and rearranging an equation

to solve for an unknown

6. If your answer to a problem does not seem reasonable, list two things you can do.

Possible answers: Reread the problem. Make an estimate of the answer.

CHAPTER 1, Introduction to Chemistry *(continued)*

7. For the following word problem, fill in the table, listing the known and unknown information: A person can walk a mile in 20 minutes. The person is going for a 10-mile walk. How many hours will it take for the person to complete the walk?

Known	Unknown
total distance = 10 miles	total time = ? h
rate of walking = 1 mile in 20 minutes	
number of minutes in an hour = 60	

► **Solving Conceptual Problems** (pages 31–32)

8. After you identify the known and unknown in a conceptual problem, what should you do next?

Make a plan for getting from the unknown to the known.

9. What are the steps for solving conceptual problems?

analyze and solve