Chapter Highlights

SECTION 1

Vocabulary

life science *(p. 6)*

Section Notes

- Life science is the study of living things. Observations often lead to questions. Questions fuel the study of life science.
- Anyone can become a life scientist. Life scientists work in many different places and investigate a wide variety of questions and problems.
- Life scientists help prevent and treat diseases and help solve environmental problems.

SECTION 2

Vocabulary

scientific method *(p. 10)*
hypothesis *(p. 12)*
controlled experiment *(p. 14)*
variable *(p. 14)*
theory *(p. 18)*
technology *(p. 18)*

Section Notes

- The scientific method is a series of steps that scientists use to answer a question or solve a problem.
- The parts of the scientific method are not always completed in the same order. Steps are sometimes skipped or repeated.
- Scientists perform controlled experiments to test the effects of one factor at a time.
- Scientists must make careful observations, record data accurately, and be creative in finding answers and designing experiments.
- A hypothesis, which is a possible explanation for what has been observed, must be testable.

Skills Check

Math Concepts

UNIT CONVERSIONS Imagine that you are writing a paper on the Empire State Building, in New York City. One source in the library lists the height of the building as 381,000,000 µm. This is a very large number, so you'll probably want to convert it to a more manageable number by using meters instead of micrometers. As you can see in the table on page 22, 1 µm = 0.000 001 m. To convert micrometers to meters, you multiply by 0.000 001.

$$381{,}000{,}000 \times 0.000\ 001 = 381 \text{ m}$$

Visual Understanding

HOW BIG? To review what can be seen with different types of microscopes, turn to pages 19 and 20. The Scale of Sizes, on page 23, will also help you visualize sizes decribed using the metric system.

SAFETY FIRST! Make sure that you know and understand the different safety symbols shown on page 27.

SECTION 2

- A theory is a unifying explanation for a broad range of hypotheses and observations that have been supported by testing.
- Scientific knowledge is constantly changing and growing as scientists ask new questions, find different answers to the same questions, and use tools that allow them to gather information in new ways.

Labs

Does It All Add Up? *(p. 686)*

Graphing Data *(p. 688)*

SECTION 3

Vocabulary

compound light microscope *(p. 19)*

electron microscope *(p. 20)*

area *(p. 24)*

volume *(p. 24)*

mass *(p. 26)*

temperature *(p. 26)*

Section Notes

- Life scientists commonly use compound light microscopes and electron microscopes to make observations of organisms or parts of organisms that are too small to be seen with the naked eye.
- X rays, CT scans, and MRI are used to view internal structures of organisms.
- Life scientists use computers to collect, store, organize, analyze, and share data.
- The International System of Units (SI), which is a simple and reliable system of measurement, is used by most scientists.

Labs

A Window to a Hidden World *(p. 689)*

internetconnect

GO TO: go.hrw.com

Visit the **HRW** Web site for a variety of learning tools related to this chapter. Just type in the keyword:

KEYWORD: HSTLIV

GO TO: www.scilinks.org

Visit the **National Science Teachers Association** on-line Web site for Internet resources related to this chapter. Just type in the *sci*LINKS number for more information about the topic:

TOPIC: Scientific Method	***sci*LINKS NUMBER:** HSTL004
TOPIC: Deformed Frogs	***sci*LINKS NUMBER:** HSTL005
TOPIC: Careers in Life Science	***sci*LINKS NUMBER:** HSTL010
TOPIC: Tools of Life Science	***sci*LINKS NUMBER:** HSTL015
TOPIC: SI Units	***sci*LINKS NUMBER:** HSTL020

Chapter Review

USING VOCABULARY

To complete the following sentences, choose the correct term from each pair of terms listed below:

1. The set of skills or steps that scientists use to answer questions is the __?__. *(controlled experiment* or *scientific method)*
2. After recognizing a problem or asking a question, life scientists form one or more __?__, which are possible explanations for what has been observed. *(predictions* or *hypotheses)*
3. In a controlled experiment, the __?__ is the one factor that differs between the __?__ and the experimental group. *(prediction, variable group* or *variable, control group)*
4. __?__ is a measure of how much surface an object has. *(Area* or *Volume)*
5. Life scientists use __?__ to describe the measurement of an object's mass. *(meters* or *grams)*

UNDERSTANDING CONCEPTS

Multiple Choice

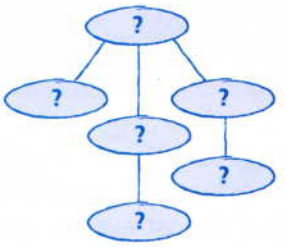
6. Which of the following would *not* be an area of study in life science?
   a. studying how lions and hyenas interact
   b. measuring the rate at which bacteria divide
   c. comparing the reproduction of arctic plants with that of desert plants
   d. studying how volcanoes are formed
7. The steps of the scientific method
   a. must all be used in every scientific investigation.
   b. must always be used in the same order.
   c. are not always used in order.
   d. start with the development of a theory.
8. In a controlled experiment,
   a. a control group is compared with one or more experimental groups.
   b. there are at least two variables.
   c. all factors should be different.
   d. a variable is not needed.
9. When a scientist finds that a hypothesis is wrong, the scientist usually
   a. tries to find another explanation for what has been observed.
   b. stops studying science.
   c. feels that nothing valuable was learned.
   d. adds an additional variable to his or her experiment.
10. What tool would a life scientist use to get a three-dimensional image of a microscopic organism?
    a. CT scan
    b. X ray
    c. scanning electron microscope
    d. magnifying lens
11. The International System of Units
    a. is based on standardized body measurements.
    b. contains units that are based on the number 10.
    c. is useful only for measuring lengths.
    d. is a device used to measure volume.

Short Answer

12. Why do hypotheses need to be testable?
13. What is a prediction?
14. Which SI units can be used to describe the measurement of volume? Which SI units can be used to describe the mass of an object?

Concept Mapping

15. Use the following terms to create a concept map: observations, predictions, questions, controlled experiments, variable, hypothesis.



CRITICAL THINKING AND PROBLEM SOLVING

Write one or two sentences to answer the following questions:

16. In a controlled experiment, why should there be several individuals in the control group and several in each of the experimental groups?

17. A scientist who studies mice observes that on the day he feeds the mice vitamins with their meals, they perform better in mazes. What hypothesis would you form to explain this phenomenon?

18. The volume of an egg and water in a graduated beaker is 200 mL. After the egg is removed, the volume of the water is found to be 125 mL. What is the volume of the egg in cm^3?

200 mL 125 mL

MATH IN SCIENCE

19. If you magnified a 5 µm long organism 1,000 ×, how long would that organism appear in millimeters (mm)?

INTERPRETING GRAPHICS

Examine the illustration below of an experiment set up to test the following prediction: ***If*** *bees are more attracted to yellow flowers than to red flowers,* ***then*** *bees will visit yellow flowers more often than they will visit red flowers.*

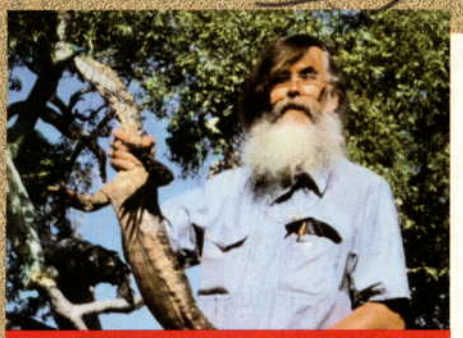
20. How many total visits did the yellow flowers receive? How many total visits did the red flowers receive?

21. What is the average number of visits for yellow flowers? What is the average number of visits for red flowers?

22. In what ways might the experimental setup be an unreliable test of the prediction?

Take a minute to review your answers to the Pre-Reading Questions found at the bottom of page 4. Have your answers changed? If necessary, revise your answers based on what you have learned since you began this chapter.

CAREERS



ZOOLOGIST

Eric Pianka became interested in lizards when he was 6 years old. "On a trip across the country with my family, I saw a big green lizard at a roadside park," Pianka explains. I tried to catch it, but all I got was the tail. At that moment, I knew I had to find out everything I could about the kind of life it led." Pianka is now a world-famous professor of zoology at the University of Texas, in Austin, Texas.

One of the things Eric Pianka likes best about his job is being in the wilderness and seeing things that few people have ever seen. "I've been almost everywhere! I've spent a lot of time studying deserts in the western United States. I've been to deserts in southern Africa, India, and Chile. My most current (and oldest) interest is in the deserts of Australia. I haven't had a chance to study the Brazilian Amazon yet, but that's a goal for the future!"

The Ecology of Desert Lizards

In his research as a zoologist, Pianka has focused on the ecology of desert lizards. He goes to a desert, collects lizards, and examines and classifies them. Then he compiles data and interprets them in books or papers. As Pianka puts it, "I try to answer questions like, Why are there more lizards in one place than in another? How do they react with each other and other species? How have they adapted to their environment?"

Recently, Pianka conducted a study to learn about the effects of wildfires on the ecology and diversity of lizard species. He hopes this work will show how lizard species adapted to the large-scale wildfires that at one time occurred regularly in desert areas but that today are usually controlled by humans.

▼ *The collared lizard lives in rocky regions of the southwestern United States.*

Learning from Wildlife

Pianka believes that doing research on lizards and other animals may help us protect our environment. "Everyone always asks, 'Why lizards?' I turn the question around and say, 'Why you?' The general attitude is that everything on Earth has to somehow serve humans. By looking at how other species have lived and died and changed over millions of years, we can gain a better understanding of the world we live in."

Be a Zoologist for a Day

▶ Select a common animal that lives in your area and that can be easily observed. Spend a few hours watching it carefully. Document everything you observe. Did you discover anything you did not already know? Present your findings to the class.