Scientific Inquiry

Key Concepts

- How do scientists investigate the natural world?
- What role do models, laws, and theories play in science?

Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on evidence they gather. **The processes that scientists use in inquiry include posing questions, developing hypotheses, designing experiments, collecting and interpreting data, drawing conclusions, and communicating ideas and results.**

Scientific inquiry often begins with a problem or questions about an observation. A scientific question is one that can be answered by making observations and gathering evidence. A **hypothesis** is a possible explanation for a set of observations or answer to a scientific question. In science, a hypothesis must be testable.

Any factor that can be measured in an experiment is called a **parameter.** The variable that is purposely changed to test a hypothesis is called the **manipulated variable.** The factor that is expected to change in response to the manipulated variable is called the **responding variable.** All other variables should be held constant. An experiment in which only one variable is manipulated at a time is called a **controlled experiment.**

A controlled experiment produces data. **Data** are facts, figures, and other evidence gathered through observations. A data table provides an organized way to collect and record observations. One useful tool in interpreting data is a graph. Graphs can reveal trends or patterns in the data. After gathering and interpreting data, a scientist draws conclusions about the hypothesis.

An important part of the scientific inquiry process is communicating the results. **Communicating** is the sharing of ideas and experimental findings with others through writing and speaking.

Scientists use models and develop laws and theories to increase people's understanding of the natural world. A **model** is a picture, diagram, computer image, or other representation of an object or process. A **scientific theory** is a well-tested explanation for a wide range of observations or experimental results. A **scientific law** is a statement that describes what scientists expect to happen every time under a particular set of conditions. A scientific law describes an observed pattern in nature without attempting to explain it. Sometimes, a large set of related observations can be connected by a single explanation.

Scientific Inquiry (pp. 10–15)

This section explains the process of scientific inquiry and describes what makes an explanation called a hypothesis testable. It also explains the difference between a scientific theory and a scientific law.

Use Target Reading Skills

After you read this section, reread the paragraphs that contain the definitions of the Key Terms. Use all the information you have learned to write a definition of each Key Term in your own words on the lines below.

scientific inquiry

_____

_____

_____

hypothesis

_____

_____

parameter

_____

_____

manipulated variable

_____

_____

responding variable

_____

_____

controlled experiment

_____

_____

data

_____

_____

communicating

_____

_____

model

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_____

Scientific Inquiry *(continued)*

scientific theory

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_____

scientific law

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_____

Introduction (p. 10)

1. What does scientific inquiry refer to?

_____

_____

_____

_____

The Process of Inquiry (pp. 10–14)

2. Is the following sentence true or false? Scientific inquiry often begins with posing questions. _____

3. Circle the letter of each sentence that is a scientific question.

a. At what temperature does water boil?
b. When does the sun rise on April 3?
c. How can my team work better together?
d. Why does she like science more than he does?

4. A(n) _____ is a possible explanation for a set of observations or answer to a scientific question.

5. Is the following sentence true or false? Scientists consider a hypothesis to be a fact. _____

6. What is a testable hypothesis?

_____

_____

_____

_____

7. To test a hypothesis, a scientist designs a(n) _____.

Match the term with its definition.

____	**8.** responding variable	**a.** the one variable that is purposely changed to test a hypothesis
____	**9.** manipulated variable	**b.** a factor that can be measured in an experiment
____	**10.** controlled experiment	**c.** the factor that may be measured in response to the manipulated variable
____	**11.** parameter	**d.** an experiment in which only one variable is manipulated at a time

12. Is the following sentence true or false? If you do not control variables in an experiment, there will be no way to know which variable explains your results. _____

13. The facts, figures, and other evidence gathered through observations are called _____.

14. In carrying out a controlled experiment, what does a data table help you do?

_____

_____

_____

15. Scientists generally use a system of measument called _____ to share quantitative data.

16. Circle the letter of each sentence that is true about graphs.

a. A graph can reveal a trend in data.
b. Graphs help scientists interpret data.
c. Graphs are the only way to organize data.
d. A graph can reveal a pattern in data.

17. A(n) _____ is a summary of what you have learned from an experiment.

18. What should you ask yourself in drawing a conclusion about an experiment?

_____

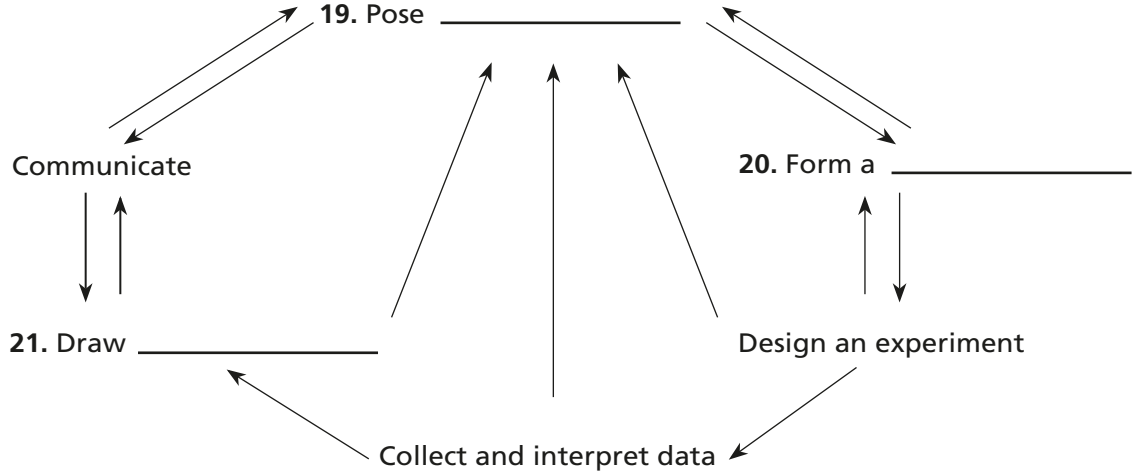
_____

_____

Scientific Inquiry *(continued)*

Complete the diagram below by filling in the blanks.

The Nature of Inquiry



22. Is the following sentence true or false? Scientific inquiry is a process with many paths, not a rigid sequence of steps. _____

23. In scientific inquiry, what is communicating?

_____

_____

How Science Develops (pp. 14–15)

24. What is a scientific model?

_____

_____

25. What is a scientific law?

_____

_____

26. You can think of a(n) _____ as a rule of nature.

27. What is a scientific theory?

_____

_____

_____

28. Is the following sentence true or false? Future evidence can prove a scientific theory to be incorrect. _____

29. How is a scientific law unlike a scientific theory?

_____

_____