

SECTION

1.3

SCIENTIFIC THINKING AND PROCESSES

Reinforcement

KEY CONCEPT Science is a way of thinking, questioning, and gathering evidence.

Scientists do not use one scientific method, but all science is based on the same principles: curiosity, critical and logical evaluation of evidence, and the open and honest exchange of data. In any scientific inquiry, scientists

- **Make observations:** Scientists use their senses and various measurement tools to collect information, or make **observations**, about the world.
- **Form hypotheses:** Scientists propose answers to scientific questions, or form **hypotheses**, based on observations they, or other scientists, made.
- **Test hypotheses:** Scientists devise methods of observing and experimenting to test their predictions.
- **Analyze data:** Scientists use statistics to analyze data. This analysis tells a scientist whether a hypothesis is supported or not supported by the data.
- **Evaluate results:** Scientists evaluate both their own results and the results from other scientists.

Scientists use experiments to test hypotheses. A scientific **experiment** uses tightly controlled conditions to test a possible cause-and-effect relationship between variables. In an experiment, there are constants and two types of variables: the independent variable and dependent variables.

- **Independent variables:** An **independent variable** is a condition that is manipulated by a scientist to determine its effect on a dependent variable. An independent variable is the “cause.”
- **Dependent variables:** A **dependent variable** is measured by a scientist to study the effect of the independent variable. It is the “effect” and depends on the independent variable.
- **Constants:** Factors that are controlled so that they do not change are **constants**.

A hypothesis is a proposed explanation for a single observation. A scientific **theory**, however, is a proposed explanation for a wide range of observations and experimental results, and is supported by a wide range of evidence.

1. How do scientists use hypotheses? _____

2. What is the difference between independent variables and dependent variables? _____

3. What is a theory? _____

SECTION

1.3

SCIENTIFIC THINKING AND PROCESSES

Section Quiz

Choose the letter of the best answer.

- _____ 1. Which word best describes a scientific hypothesis?
- a. provable
 - b. theoretical
 - c. testable
 - d. quantifiable
- _____ 2. At which stage of scientific inquiry would scientists find out if their hypotheses were supported by their data?
- a. observing
 - b. testing hypotheses
 - c. analyzing data
 - d. evaluating results
- _____ 3. In an experiment, the condition that is manipulated by a scientist is the
- a. independent variable.
 - b. dependent variable.
 - c. constant.
 - d. control condition.
- _____ 4. Which of the following is an important characteristic of a scientific theory?
- a. proven by more than one scientist
 - b. unchanged by new evidence
 - c. accepted by the public
 - d. supported by much evidence
- _____ 5. One way in which experimental research differs from observational research is that only experimental research can
- a. test a hypothesis.
 - b. produce scientific results.
 - c. support a theory.
 - d. show cause and effect.