



1.1 What Is Science?

Lesson Objectives

-  State the goals of science.
-  Describe the steps used in scientific methodology.

BUILD Vocabulary

A. The chart below shows key terms from the lesson with their definitions. Complete the chart by writing a strategy to help you remember the meaning of each term. One has been done for you.

| Term | Definition | How I'm Going to Remember the Meaning |
|-----------------------|--|--|
| Control group | Part of an experiment that is not changed so that it can be compared to the experimental group | <i>A <u>c</u>ontrol group is used for <u>c</u>omparison.</i> |
| Controlled experiment | | |
| Data | | |
| Dependent variable | | |
| Hypothesis | | |
| Independent variable | | |
| Inference | | |

B. As you work through this lesson, you may find these terms in the activities. When you need to write a key term or a definition, **highlight** the term or the definition.

Scientific Methodology: The Heart of Science

Collecting and Analyzing Data A scientist's work isn't finished until all the data are collected and analyzed. Quantitative data include numbers. Qualitative data are descriptive.

Complete the table using the phrases below. Write phrases that are qualitative on the left side of the table. Write phrases that are quantitative on the right side. One has been done for you.

The grass is t this week.
Plants grown in the sun are 12 cm taller than those grown in shade.
Salamanders in the wild are disappearing.
Days are shorter in the winter than in the summer.
Frogs that were fed crickets weighed 32 g more than those fed mealworms.
In the experiment, 21 mL of liquid fertilizer were added to the bean plants.

| Qualitative | Quantitative |
|---|--|
| <p><i>Days are shorter in the winter than in the summer.</i></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> | <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> |

Questions 3–10 refer to spontaneous generation, the idea that life can arise from nonliving matter. Spontaneous generation was accepted by many in the scientific community up until the mid-nineteenth century. A series of simple experiments tested the validity of this idea.

3. Evidence used to support spontaneous generation was the observation that foods over time become covered in maggots or fungal and bacterial growth. The inference behind spontaneous generation is that there is no “parent” organism. Write this inference as a hypothesis using an if–then sentence that suggests a way of testing it.

4. In 1668, Francesco Redi proposed a different hypothesis to explain the specific example of maggots that appear on spoiled food. He had observed that maggots appear on meat a few days after flies have been seen on the food. He inferred that the flies had left behind eggs too small to see. Redi’s experiment is shown below. What conclusion can you draw from Redi’s experiment?

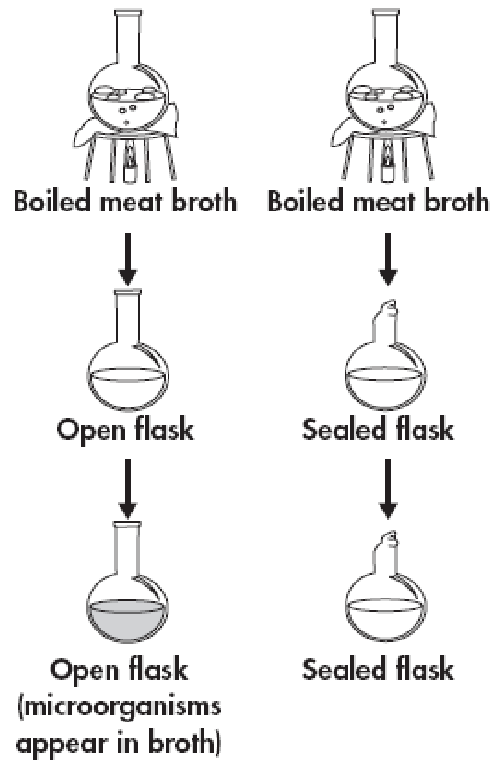


5. In the late 1700s, Lazzaro Spallanzani designed a different experiment to show that life did not arise spontaneously from food. He inferred that some foods spoil because of growing populations of microorganisms. Fill in the information requested below.

Independent variable:

Dependent variable:

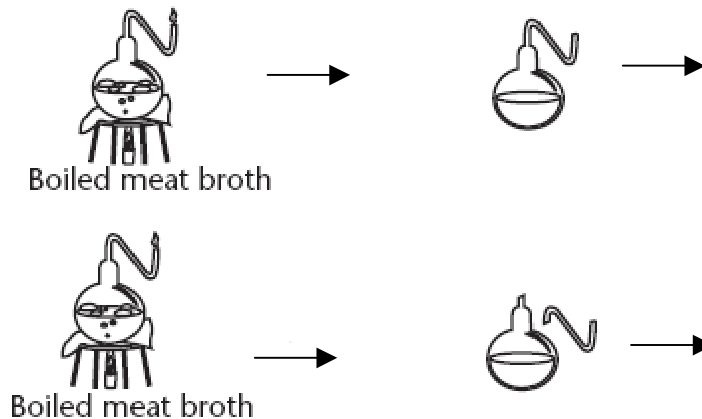
Controlled variables (identify three):



THINK VISUALLY

6. Critics of Spallanzani said that he showed only that organisms cannot live without air. In 1859 Louis Pasteur designed an experiment to address that criticism, an experiment that reproduced Spallanzani's results.

Draw in the third and final steps in the experiment. Use an arrow to show the path of travel of the microorganisms. Shade the broth in the flask(s) in which microorganisms grew.



7. How did Pasteur solve Spallanzani's problem of limiting exposure to air?

8. What purpose did boiling the meat broth serve in both the Spallanzani and Pasteur experiments?

9. How do the Redi, Spallanzani, and Pasteur experiments disprove the hypothesis you wrote in Question 3?

10. Today, we use a process of heating liquids to prevent spoiling by bacteria and other microorganisms, pioneered by one of the three scientists mentioned above. What is that process called and for what food it is used?

Apply the Big idea

11. What facts did Redi's, Spallanzani's, and Pasteur's experiments establish? What broader scientific understanding about life did the experiments explore? How does the example of these experiments demonstrate science as a way of knowing?
