Name _____ Class _____ Date _____

1.1 What Is Science?

Lesson Objectives

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

What Science Is and Is Not

1. What is science?

_____

2. What are the goals of science?

_____

_____

Scientific Methodology: The Heart of Science

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:

_____

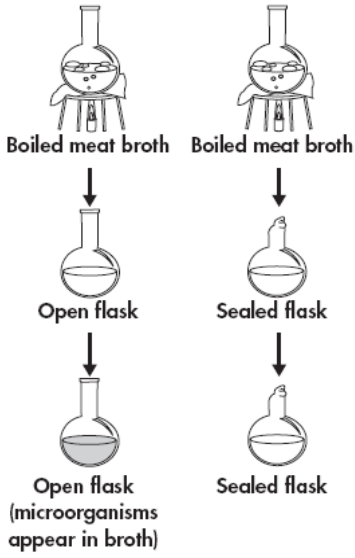
Dependent variable:

_____

Controlled variables (identify three):

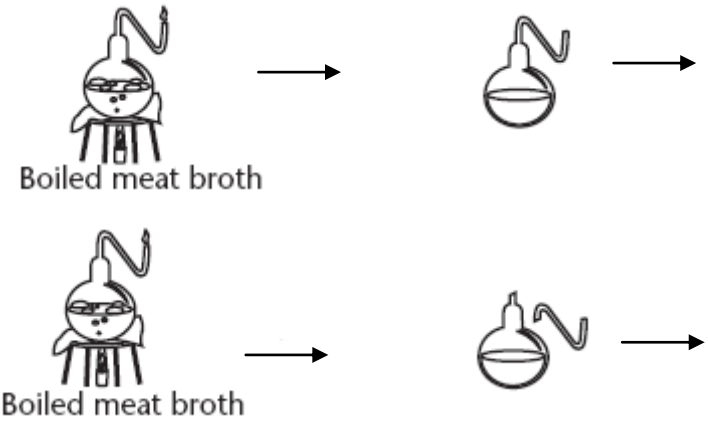
_____

_____



6. **THINK VISUALLY** Critics of Spallanzini 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?

_____

Name _____ Class _____ Date _____

1.2 Science in Context

Lesson Objectives

- Explain how scientific attitudes generate new ideas.
- Describe the importance of peer review.
- Explain what a scientific theory is.
- Explain the relationship between science and society.

Exploration and Discovery: Where Ideas Come From

1. Describe how new ideas are generated.

_____

2. How are science and technology related?

_____

_____

3. It took hundreds of years of discussion and the experiments of Louis Pasteur in the nineteenth century for the larger scientific community to accept that spontaneous generation of life was not a valid scientific concept. Referring to the diagram, describe how modern methods of communication have changed the scientific process.

_____

_____

_____

_____

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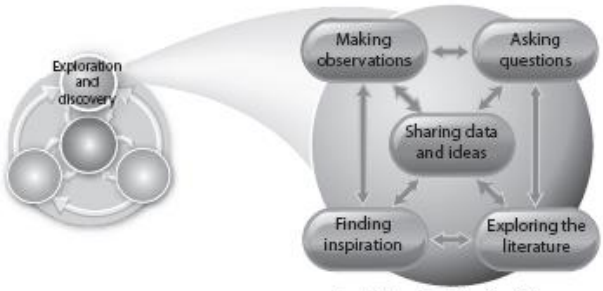

Adapted from *Understanding Science*, UC Berkeley, Museum of Paleontology

Communicating Results: Reviewing and Sharing Ideas

4. **THINK VISUALLY** Use lesson concepts to complete the diagram to show the outcome of communication among scientists. Why are "New Ideas" placed at the center of the diagram?

_____

_____

Adapted from *Understanding Science*, UC Berkeley, Museum of Paleontology

5. Of the four types of communication you added, identify the one that is critical to ensuring communication among the scientific community.

_____

Scientific Theories

6. A typical dictionary will have different definitions for the word *theory*. It will include a definition that describes how scientists use the term, but it will also define *theory* as speculation, or an assumption, or a belief. Are these common definitions of *theory* synonyms (words similar in meaning) or antonyms (words opposite in meaning) to the definition of a scientific theory? Explain your thinking.

For Questions 7–11, identify whether each statement is a hypothesis or a theory. For a hypothesis, write an "H" on the line. For a theory, write a "T."

_____ **7.** The rate that grass grows is related to the amount of light it receives.

_____ **8.** All life is related and descended from a common ancestor.

_____ **9.** The universe began about 15 billion years ago.

_____ **10.** New tennis balls bounce higher than old tennis balls.

_____ **11.** Caffeine raises blood pressure.

Science and Society

12. How can bias affect the application of science in society? What role does a good understanding of science play in this phenomenon?

Apply the Big idea

13. What is it about science, as a way of knowing, that makes it self-correcting?