

**observation:** the act of gathering facts or making notes about events

**experimentation:** the act of conducting experiments

**scientific method:** a technique used for scientific investigation

**hypothesis:** a simple statement that can be tested to see if it's true or not

**variables:** parts of an experiment that can change and cause a change in the results

Here's a quick review of the steps in the scientific method:

- Ask a question about the world.
- Form a hypothesis that answers the question.
- Design an experiment or make observations to prove or disprove the hypothesis.
- If the hypothesis is wrong, form a new hypothesis and design new tests.
- If the hypothesis is correct, test it again to be sure you get the same results.
- Share the results with other scientists so they can test the hypothesis as well.

### *Why are experiments such an important scientific tool?*

Scientists are like detectives trying to solve the mysteries of the universe. They use their skills to investigate what, when, where, why, and how things happen. Probably the two most important tools a scientist has at his or her disposal are **observation** and **experimentation**. They're both parts of the **scientific method**, but they definitely aren't the same thing.

Science always begins with observation. Good scientists are curious, so their observations lead to questions. The scientific method begins when a question has been asked. Then, a hypothesis can be formed. A **hypothesis** is only useful—and scientific—if it can be tested.

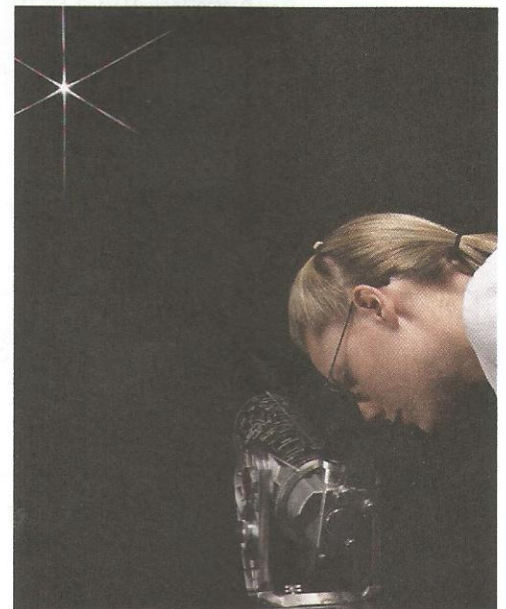
The best way to test a hypothesis is to design an experiment. Experiments are one of science's greatest inventions because they allow the scientist to be in control. Each experiment is carefully designed to answer just one question—is the hypothesis true or false? In nature, there are often too many **variables** to know for sure why something happened. In an experiment, the scientist can limit the number of variables. An experiment allows a scientist to see why he or she got one result instead of another.

As important as experiments are to science, they aren't always practical. For example, how does an astronomer test a star that's thousands of light-years from Earth? Observation, however, is almost always possible. Observational science uses scientific facts that are already known to answer questions about what the scientist sees.

An astronomer can't travel across space, but with observation, he or she can still discover a lot about the stars. For example, experiments on Earth have shown that when elements are burned, each one emits a very specific wavelength of color. By observing the colors of stars, astronomers can tell which chemical elements the star contains—without ever leaving our planet.

Certain types of science use observation much more than experimentation. Archeology, paleontology, and astronomy rely heavily on observing the world, and then drawing conclusions based on the evidence.

Observation is always a part of experimenting. How else would you know what happened in an experiment if you didn't observe the results? But observational science is the method you use when experimenting can't be done.





Circle the letter of the best answer to each question below.

1. Observing and experimenting are both
  - a. parts of the scientific method.
  - b. ways of investigating the world.
  - c. examples of hypotheses.
  - d. Both a and b
  
2. A hypothesis is
  - a. a scientific question that can be answered easily.
  - b. a statement that can be proven true or false.
  - c. a type of experiment used in the scientific process.
  - d. the end result of an experiment.

Write your answers on the lines below.

Maddie is testing different kinds of soil to see which one is the best for growing plants. She fills one cup with a mixture of soil and sand, a second cup with soil and gravel, and a third cup with soil and shredded bark. Then, she plants radish seeds in all three cups.

3. Write a possible hypothesis for Maddie's experiment.

\_\_\_\_\_

4. What is the variable in this experiment?

\_\_\_\_\_

5. How will observation be a part of Maddie's experiment?

\_\_\_\_\_

Read the examples of scientific activities listed below. Write **O** on the line if the scientist is using observation. Write **E** on the line if the scientist is conducting an experiment.

6. \_\_\_\_\_ A paleontologist decides that a dinosaur is a meat-eater because it has sharp teeth.
7. \_\_\_\_\_ A physicist tests three types of gases to see which one is densest.
8. \_\_\_\_\_ A chemist mixes water and sodium to prove that an explosion will occur.
9. \_\_\_\_\_ An archaeologist digs up an arrowhead and concludes that the ancient people who used it were hunters.