

Control and Experimental Variables

READ

Every experiment must follow the scientific method and contain variables. The variables found in every scientific experiment include an experimental variable and control variables. An experimental variable is the variable in the experiment that is changed on purpose. The experimental variable causes a change in another variable. In order to study the effect of the experimental variable, everything else in the experiment must remain the same. A variable that is kept the same in an experiment is called a control variable.

EXAMPLE

Alex is studying the effect of sunlight on plant growth. His hypothesis is that plants that are exposed to sunlight will grow better than plants that are not exposed to sunlight. In order to test his hypothesis, he follows the following procedures. He obtains two of the same type of plant, puts them in identical pots with potting soil from the same bag. Then, he puts one plant in the sunlight and the other in a dark room. He waters the plants with 200 mL of water every other day for one week.

The experimental variable in the experiment is the light exposure of the plant. One plant is put in sunlight and the other is put in darkness. The control variables are the type of plant, the pot, the soil, amount of water, and the time of the experiment.

PRACTICE

1. Julie sees commercials for antibacterial products that claim to kill almost all the bacteria in the area that has been treated with the product. Julie asks, “How effective is antibacterial cleaner in preventing the growth of bacteria?” She sets up an experiment in order to study the effectiveness of antibacterial products. Julie hypothesizes that the antibacterial soap will cause there to be no bacterial growth. In her experiment, she follows the following procedure.
 - a. Obtain two Petri dishes with nutrient agar.
 - b. Rub a cotton swab along the surface of a desk at school. Then, carefully rub the nutrient agar with the cotton swab without breaking the gel.
 - c. Repeat the same process with the other Petri dish.
 - d. Spray one of the Petri dishes with an antibacterial kitchen spray.
 - e. Carefully tape shut both of the Petri dishes and place them in an incubator.
 - f. Check the Petri dishes and record the results once a day for one week.

Identify the experimental variable and three control variables in the experiment.

2. John notices that his mom waters the plants in their house every other day. He asks, “Will plants grow if they are not watered regularly?” He hypothesizes that plants that are not watered regularly will not grow as large as plants that are watered regularly. In order to test his hypothesis, he conducts the following experiment.
 - a. Obtain two healthy plants of the same variety and size.
 - b. Plant each plant in the same type of pot and the same brand of potting mix.
 - c. Place both plants in the same window of the house.

- d. Water one of the plants every other day with 250 mL of water.
- e. Water the other plant once a week with 250 mL of water.
- f. Measure the height of the plants once a day for one month.

Identify the experimental variable and three control variables in the experiment.

3. Mike's dad always buys bread with preservatives because he says it lasts longer. Mike asks, "Will bread with preservatives stay fresh longer than bread without preservatives?" He hypothesizes that bread with preservatives will not grow mold as quickly as bread with preservatives. In order to test his hypothesis, he conducts the following experiment.
- a. Obtain one slice of bread containing preservatives and one slice of bread without any preservatives.
 - b. Dampen two paper towels. Fold the paper towels so that they will lay flat inside a zipper-top bag.
 - c. Lay each paper towel inside a separate zipper-top bag.
 - d. Place one slice of bread in each bag and seal the bags.
 - e. Place bags with bread and paper towels in a dark environment for one week.
 - f. Record mold growth once a day for one week.

Identify the experimental variable and three control variables in the experiment.

4. In science class, Kathy has been studying protists. They have been learning specifically about protists called algae that live in ponds. They know that algae thrive when there are plenty of nutrients available for them. Kathy asks, "Will water that has been treated with fertilizer have more algae than water that has not been treated with fertilizer?" In order to test her hypothesis, Kathy does the following experiment.
- a. Obtain a sample of algae from the teacher.
 - b. Obtain two beakers with 500 mL of water in each beaker.
 - c. Put one teaspoon of plant fertilizer in one of the beakers.
 - d. Put an equal amount of algae sample in each of the beakers.
 - e. Place the beakers in a sunny window for two weeks.
 - f. Using a microscope, examine algae growth in each of the beakers every other day for the two weeks and record your results.

Identify the experimental variable and three control variables in the experiment.