

## Lesson 1.2: Variables

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<b>2</b>	<b>4</b>	I can read and analyze an experimental procedure in order to describe variables.
<b>3</b>	<b>5-6</b>	I can analyze experimental questions and hypotheses in order to identify independent and dependent variables.

**Task 1 Learning Target:** I can describe the different types of variables in science experiments.

**Directions:** Take notes on the topic by completing the guided note sheet. See the next page for informational text and video link.

**Define each of the following vocabulary words and give an example of each based on the experiment below:**

**\*\*\*\*SKIP LINES/LEAVE SPACE FOR ADDITIONAL NOTES**

1. **Independent Variable** (manipulated variable):

Example:

2. **Dependent Variable** (responding variable):

Example:

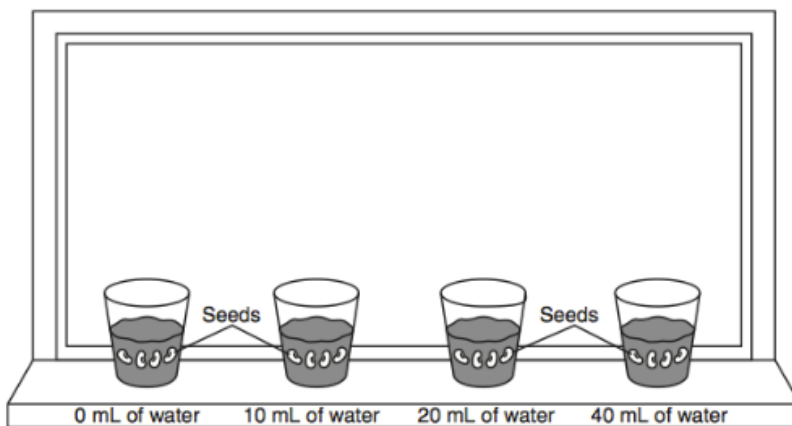
3. **Constants (controlled variables):**

Example:

4. **Control:**

Example:

The diagram shows a controlled experiment designed to test how much time it takes for seeds to germinate (begin growing) under four different conditions. Four bean seeds were placed in each of four pots. Each pot contained 100 cubic centimeters of soil. All four pots were placed on the same sunny windowsill. A different amount of water was placed in each pot.



5. Complete the following T Chart using the words/phrases.  
\*Some phrases should be placed in the "Control" section and others should be placed in the "Constant" section.

<u>Control</u>	<u>Constant</u>

- opposite of experimental group
- controlling variables
- controlled variables
- not in every experiment
- standard for comparison
- should be in every experiment
- ensures the experiment is fair
- compare to experimental group
- the more of this, the more reliable our experiment is
- receives no treatment of the independent variable

## **Task 1 Informational Text: Variables**

Chirp, chirp, chirp." It is one of the hottest nights of summer and your bedroom windows are wide open. The noise from the crickets is almost deafening! Why do all the crickets in your neighborhood seem determined to keep you awake tonight? Could the crickets be chirping more because of the heat? How could you find out?

As you lie awake, you are probably not thinking much about science. But, in fact, you are thinking just as a scientist would. You made observations- you heard the loud chirping of the crickets and felt the heat of the summer night. Your observations led you to infer that heat might cause increased chirping. You might even make a prediction: If it's cooler tomorrow night, the crickets will be quieter."

You might not know it, but your questioning can be the start of scientific inquiry. Scientific inquiry refers to the diverse ways in which scientists investigate the natural world and propose explanations based on the evidence they gather.

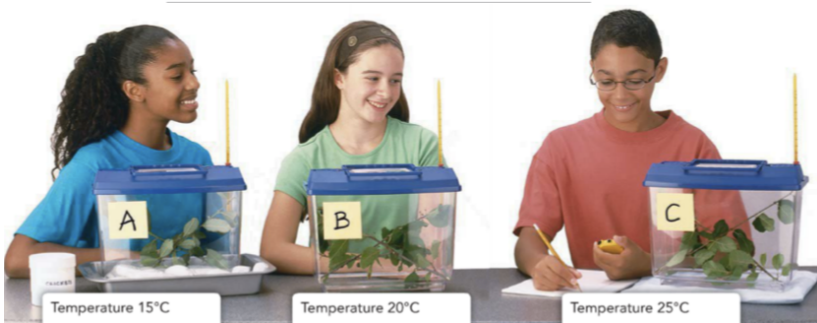
**Posing Questions-** Scientific inquiry often begins with a problem or question about an observation. In the case of the crickets, your question might be: Does the air temperature affect the chirping of crickets?

**Developing a Hypothesis-** How could you explain your observation of noisy crickets on that summer night? "Perhaps crickets chirp more when the temperature is higher," you think. In trying to answer the question, you are in fact developing a hypothesis. A hypothesis (plural: *hypotheses*) is a possible explanation for a set of observations or answer to a scientific question. In science, a hypothesis must be testable. This means that researchers must be able to carry out investigations and gather evidence that will either support or disprove the hypothesis. Many trials will be needed before a hypothesis can be accepted as true. In this case, your hypothesis would be "*If the temperature increases, then crickets will chirp more frequently.*"

**Designing an Experiment-** Hypotheses lead to scientific tests. To test your hypothesis, you will need to observe crickets at different air temperatures. All other variables, or factors that can change in an experiment, must be exactly the same, known as controlled variables or constants. Controlled variables or constants would include the kind/species of crickets, the type of container you test them in, and the type of thermometer you use. By keeping all of these variables the same, you will know that any difference in cricket chirping must be due to temperature alone.

The one variable that is purposely changed in an experiment is called the independent variable (also called the manipulated variable). In your cricket experiment, the independent variable is the air temperature. The factor that may change in response to the independent variable is called the dependent variable (also called the responding variable). The dependent variable here is the number of cricket chirps.

In science, a controlled experiment often has a control (group). A control (group) is a part of the experiment to which you can compare the results of the other tests. The control group would receive no treatment of the independent variable. For the cricket experiment, your control crickets would receive no change in temperature. That way, you can better recognize the effects of increased temperature on chirping.



**Watch the following video for more information:** <https://www.youtube.com/watch?v=791Ac4RJ4S4>

**Task 2 Learning Target:** I can read and analyze an experimental procedure in order to describe variables.

Directions: Read and analyze the experiment procedure described below and complete A - E:

**Materials:**

- 27 bush bean seeds
- potting soil
- measuring cup
- water
- Country music CD or cassette
- Classical music CD or cassette
- 9 small plastic yogurt containers

**Procedure:**

1. Plant 3 seeds into each yogurt container after filling them almost up to the top with potting soil. Place the seeds just a little bit below the surface. Water the plants with  $\frac{1}{4}$  cup of water.
2. Put all 9 containers into a spot by a window.
3. Take the plants away from the window at 4:00 P.M. every day.
4. Place 3 containers in a room with country music being played.  
Place another 3 containers in a room with classical music being played.  
Place the last 3 containers into a room where the music that the other 6 plants are listening to cannot be heard.  
This takes place for an hour each day.
5. At about 5:00 P.M., place each plant back on the original window spot.
6. Let each plant grow for 2 whole weeks. Then find out the total growth of the plants.

A. In 1 or 2 sentences summarize the experiment.

B. Identify the independent variable (IV). HDYK?

C. Identify the dependent variable (DV). HDYK?

D. Describe the constants. HDYK?

E. Identify the control group. HDYK?

**Task 3 Learning Target:** I can analyze experimental questions and hypotheses in order to identify independent and dependent variables.

## **Identifying Variables:**

**Identify the independent and dependent variable for each.**

1. How does high temperatures affect radish growth?

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_

2. How does studying with music affect student test scores?

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_

3. How does food color affect the amount of food fish eat?

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_

4. How does light affect plant growth?

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_

5. How does smiling affect a teacher giving no homework?

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_

6. If plants are watered, then growth height will increase.

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_

7. If chocolate is given to teachers, then the amount of homework will decrease.

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_

8. If trees have leaves, then bird nests will increase.

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_

9. If acid rain is in water, then fish population will increase.

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_

10. If calcium is given, then bone strength will increase.

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_