

Name \_\_\_\_\_

Date \_\_\_\_\_

Class \_\_\_\_\_

## Designing a root growth experiment

### Learning Objectives

Students will set up an experiment to determine what factors affect root growth.

### Materials (for when you do the experiment)

Seeds (10)	Colored markers for tracing roots
Clear plastic cups (10)	String/wire for measuring roots
Soil, sand, or other growth medium	Metric rulers
Chemicals or equipment used to change the plant environment (vinegar, heating pad, etc)	

### Summary

Using the **scientific method**, your group will design an experiment to test the effect of one environmental condition on the growth of plant seedling roots.

You will be given ten (10) seeds and ten (10) clear plastic cups for your experiment. Five cups will be used for your **control group** and five cups for your **experimental group**. Using multiple test subjects provides **replication** that increases the reliability of your results.

Potting soil will be provided for planting your seedlings, or you may request sand or another growth medium if you are using that as your experimental treatment.

Simple household chemicals or equipment should be chosen to manipulate the environment. Be creative! Good scientific research requires creativity to come up with new ideas. Your teacher will approve your experimental design and provide materials as possible. You are encouraged to bring materials from home if possible. Make sure to let your teacher know what you will need provided in advance.

Roots will be measured by tracing with colored markers on a clear plastic cup. Different colors will be used for different days to determine change over time. String can be used to measure roots by covering your marked tracings, marking the string, and then straightening out the string to measure it with a ruler. You will also want to measure growth of the stem and leaves to compare with root growth.

\*Decide how much and how often you will add your experimental chemical. Most chemicals only need to be added once. If it is not a liquid, or is very concentrated, you will want to dissolve it into water before adding it to the cup.

## Procedure

1. Research how and why roots grow using books, the internet, and any other available resources. Record your references and summarize them on a separate sheet of paper.
2. Choose one **independent variable** that you will manipulate in your experiment. You may want to add a simple chemical to the soil to change pH (garden lime, vinegar), nutrients (fertilizer, vitamins, sugar) change the soil type (sand vs. potting soil), or adjust light or temperature (using a dark cabinet or heating pad). Other ideas may be acceptable- your teacher will approve your idea to ensure it will be appropriate.
3. As a group, develop a **hypothesis** that states what you will test in your experiment.
4. What variables will you need to control for in your experiment?  
List **controlled variables**:
5. What **dependent variable** will you be measuring?
6. How many **treatment groups** do you have? What are they?
7. On a separate sheet of paper, write out your **methods** in detail. Make sure to include a list of **materials** (supplies) that you are requesting your teacher to provide.

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## Conducting a root growth experiment

Students will measure and compare root growth under different environmental conditions.

1. Check that you have your starting materials:  
10 seeds  
10 clear plastic cups  
Any chemicals or equipment (vinegar, sugar, heating pad, etc.)
2. Put your group number near the rim of each cup: Group 1, etc
3. Use a marker to label your cups near the top rim.  
Control 1 through 5: C1, C2, C3, C4, C5  
Experimental 1 through 5: E1, E2, E3, E4, E5
4. Put soil in the bottom half of each cup. If you are adding a solid substance (rocks, trash, coffee grounds, leaves) to the soil, go ahead and mix it in now. If you add a solid to the soil, make sure each experimental cup gets the same amount.  
  
Solid added \_\_\_\_\_ amount (g) \_\_\_\_\_
5. In each cup, place a seed to one side. Don't put the seed in the center- we are interested in seeing roots grow; you want the plant to grow along the side of the cup so you can see its roots.
6. Place your cups one of the tubs provided. The tubs will hold the cups upright, protect them from tipping, and catch any water that flows out the drain hole.
7. Moisten the soil with water or your experimental solution\* if you are using one. Measure the amount of the chemical you add to each experimental cup.  
  
Chemical added \_\_\_\_\_ amount (mL, g) \_\_\_\_\_
8. Place your cups in light near a window or lamp, unless you are using darkness as your independent variable. If you are using any special equipment (heating pad, black light), make sure that is in place. Special equipment \_\_\_\_\_
9. Monitor your plant regularly to track its progress. If the soil is dry, water it to keep the soil moist.
10. Measure your plant each week and record the measurements on the back of this page. You will record height, count the leaves, and trace the roots that grow in each cup. You can measure the length of the roots using a piece of wire or string. Cover the root with the wire or string, mark the wire or string, and then measure the length of the wire or string to determine the length of a root.

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