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[H1]

Carolina LabSheets™

Wisconsin Fast Plants® and Product Testing

In this activity, students conduct experiments to determine if a commercial product effects the germination of Wisconsin *Fast Plants*® seed. In doing so they practice basic science skills including collecting and graphing data, interpreting data, and doing serial dilutions.

Needed Materials

Wisconsin *Fast Plants*® Standard Seed (158805) 158805
petri dishes, 100 × 15 mm, 741250
filter paper (712801) 712801
consumer products for testing
plastic bags
permanent markers
test tubes and stoppers 731053 & 712403
test tube racks 731880
graduated cylinders or other devices for measuring 100-mL quantities 721613
graduated dropping pipets, (736988 or similar) 158981
beakers or cups, 200 mL 974213

Optional Materials

Hand lenses for examining the seeds for signs of germination. Small cups for distributing seeds 114637

Procedures

Students can work in groups of five, with each student in a group being responsible for testing a different concentration of a substance.

One 45-minute class period is needed for students to set up their experiments. Ten minutes is needed each day to count and record germinated seeds.

Purchase products for testing or have students bring them from home. Pre-approve any products for suitability and safety. Suitable products are liquids or soluble materials. Avoid testing pesticides and herbicides. Also avoid strong chemical cleaners such as those designed for cleaning ovens, removing grease from concrete, or unclogging drains. Some products may be flammable or poisonous if swallowed. Carefully read any warning labels. Vinegar is interesting to test, but leaves a persistent odor on any labware it contacts. Products that might be tested include sodas, shampoos, hand cleaners, bubble baths, dish and laundry detergents, and isopropanol (rubbing alcohol). Some interesting variations are to test regular vs. diet sodas and regular vs. antibacterial detergents.

Many consumer products are very viscous when undiluted. It may take 15 minutes or more for these products to be absorbed into filter paper. For these products, have the groups prepare the full strength plate, Plate 2, before preparing the dilutions.

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Preparing Test Dilutions

Set up a workstation for each group of 5 students with the following materials:

- test tube rack with 5 test tubes and 5 stoppers
- 5 dropping pipets (fewer pipets can be used if students carefully rinse them between uses)
- test substance
- beaker or cup with water
- empty beaker

Preparing Germination Plates

This can be done in conjunction with preparing the test dilutions or during a subsequent lab period.

Set up a workstation for each group of 5 students with the following materials:

- test tube rack with dilutions
- 5 dropping pipets
- 5 filter paper circles
- 5 petri dishes
- plastic bag
- beaker or cup with water
- empty beaker

Have the students place the plastic bags with completed plates under fluorescent lights. For best germination, the lights should be about 15 to 20 cm above the plates. If you will be examining phenotypes of these seedlings for genetics, lower the lights to 5 to 8 cm above the plates. *Fast Plants* seeds normally germinate in 2 days. Some products may inhibit but not totally prevent germination. To allow for this, students should collect germination data on 3 or more consecutive days.

Have students look at the ingredients lists on product labels. What chemicals are listed? Students can research these chemicals on the Internet to learn more about what they are and what they do. Often, it becomes apparent why a chemical is included in a product. Students can use this information in forming a hypothesis and interpreting their results.

Optional: After germination, seedlings can be planted and grown to maturity to observe the complete *Fast Plants* life cycle and to check for possible detrimental effects on growth and development. Other seeds can be tested to see if they react differently to the same test substances. Radish seeds (159000) work especially well. Students can graph their data as histograms.

159000

To incorporate more math and standardize data, students can convert their raw data into percent germination.

$$\% \text{ germination} = \frac{\text{number seeds germinated}}{\text{total number of seeds}} \times 100\%$$

Student Labsheets
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Answer Key to Questions Asked on the Student LabSheet

Link to PDF

*Answers should be in different color/font

Sample Data Table

Substance Tested: Dishwashing Detergent

	Number of Seeds Germinated				
Concentration	Day 1	Day 2	Day 3	Day 4	Total
0:1 (water)	4	25	1	0	30
1:0 (undiluted)	0	0	0	0	0
1:10	0	0	0	0	0
1:100	0	16	3	0	19
1:1000	0	20	2	0	22

1. What question are you investigating?

   Will dishwashing detergent keep *Fast Plants* seeds from germinating?

2. Write a null hypothesis for your experiment. A null hypothesis states that changing a given variable will not affect the outcome of the experiment.

   If *Fast Plants* seeds are placed on filter paper soaked with dishwashing detergent and on filter paper soaked with water only, there will be no difference in the germination.

   a. What is the expected outcome of your experiment if the null hypothesis is correct?

      The same number of seeds will germinate on filter paper soaked with dishwashing detergent as will germinate on filter paper soaked with water.

   b. What is the expected outcome of your experiment if the null hypothesis is incorrect?

      Fewer seeds will germinate on filter paper soaked with dishwashing detergent than on filter paper soaked with water. The greater the concentration of detergent, the fewer seeds will germinate.

3. What plate represents the control group of your experiment?

   The plate containing seed on filter paper soaked with water.

4. What represents the experimental group(s)?

   The plates containing seed on filter paper soaked with dishwashing detergent.

5. What is the independent variable (sometimes called the experimental variable or manipulated variable) of your experiment?

   The concentration of dishwashing detergent used to soak the filter paper.

6. What is the dependent variable of your experiment?

   The number of seeds that germinate.

7. Did the outcome of the experiment support the null hypothesis?

   The results do not support the null hypothesis. More seeds germinated on filter paper soaked in water than on filter paper soaked in dishwashing detergent, and the more concentrated the detergent, the fewer seeds germinated.

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NAME _____

DATE _____

Wisconsin Fast Plants® and Product Testing

Consumer products undergo numerous tests before they can be sold. In this activity, you will test a commercial product for possible effects on the germination of Wisconsin *Fast Plants* seeds. You will do this by placing a filter paper in a petri dish and saturating the paper with a test solution. You will then sow the filter paper with *Fast Plants* seeds and count the number of germinated seeds on successive days. You will test different concentrations of the substance to determine if there are dosage effects.

Absorption of water initiates seed germination. The plant embryo inside the seed begins to grow, and it breaks through the seed coat, giving the first visual indication of germination. Under good conditions, it takes *Fast Plants* 2 days to germinate.

Record here the name of the product your group will test. Also record the ingredients list, if any, from the product label.

Product Name _____

Ingredients:

_____

_____

_____

_____

_____

_____

Preparing Test Dilutions

Work in groups of five. Each of you will need a test tube and dropping pipet. Number the test tubes 1 through 5 and use the following instructions to make the serial dilutions needed for your tests.

Test tube 1 Add 10 mL of water and place test tube 1 in the test tube rack. The concentration of solution in test tube is 0:1 or 0%. This is the equivalent of 0 mL of test substance in 10 mL of solution.

Test tube 2 Add 10 mL of the substance to be tested and place test tube 2 in the test tube rack. The concentration of solution in test tube 2 is 1:0 or 100% (undiluted).

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Test tubes 3–5 Add 9 mL of water to each one, then proceed as follows, completing tube 3, then using it to complete tube 4, and using tube 4 to complete tube 5.

Test tube 3 Draw up 1 mL of the test substance from test tube 2. Slowly add this to the 9 mL of water in your test tube (test tube 3). Stopper the test tube and slowly invert it several times to mix the contents. Place test tube 3 in the rack. The concentration of solution in test tube 3 is 1:10; that is, one mL of test substance in 10 mL of solution.

Test tube 4 Draw up 1 mL of the test solution from test tube 3. Slowly add this to the 9 mL of water in your test tube (test tube 4). Stopper the test tube and slowly invert it several times to mix the contents. Place test tube 4 in the rack. The concentration of solution in test tube 4 is 1:100. This is the equivalent of one mL of test substance in 100 mL of solution.

Test tube 5 Draw up 1 mL of the test solution from test tube 4. Slowly add this to the 9 mL of water in your test tube (test tube 5). Stopper the test tube and slowly invert it several times to mix the contents. Place test tube 5 in the rack. The concentration of solution in test tube 5 is 1:1000. This is the equivalent of 1 mL of test substance in 1000 mL of solution.

Rinse your pipet by drawing water into it and expelling the water into the empty beaker or cup. Repeat as necessary.

If you are stopping here, stopper each tube and leave the test tube racks with tubes in the place indicated by your instructor. Otherwise, proceed to Preparing Germination Plates.

Preparing Germination Plates

Number your petri dishes 1 through 5. Place a circle of filter paper into the bottom of each dish. Use the tip of a dropping pipet to smooth out the paper so that it lies flat.

Plate 1, 0:1 Concentration (water) Use your dropping pipet to add 2 mL of water from test tube 1 to the filter paper in petri dish 1. Replace the lid. Mark the lid 0%.

Plate 2, 1:0 Concentration (undiluted) Use your dropping pipet to add 2 mL of the substance you are testing from test tube 2 to the filter paper in petri dish 2. Replace the lid. Mark the lid 100%.

Plate 3, 1:10 Concentration Use your dropping pipet to remove 2 mL of liquid from test tube 3 and add it to the filter paper in petri dish 3. Replace the lid. Mark the lid 1:10.

Plate 4, 1:100 Concentration Use your dropping pipet to remove 2 mL of liquid from test tube 4 and add to the filter paper in petri dish 4. Replace the lid. Mark the lid 1:100.

Plate 5, 1:1000 Concentration Use your dropping pipet to remove 2 mL of liquid from test tube 5 and add to the filter paper in petri dish 5. Replace the lid. Mark the lid 1:1000.

Rinse all pipets.

Sow 30 *Fast Plants* seeds on the filter paper in each petri dish. Label the plastic bag with your group's identification, slip all petri dishes into the bag, and seal it. This is to prevent evaporation. Leave the bag at the incubation area indicated by your teacher.

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Data Collection

Daily, count and record in the Data Table the number of seeds germinated. Remove germinated seeds as you count them.

Data Table

Substance Tested: _____

	Number of Seeds Germinated				
Concentration	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Total**
0:1 (water)					
1:0 (undiluted)					
1:10					
1:100					
1:1000					

1. What question are you investigating?

2. Write a null hypothesis for your experiment. A null hypothesis states that changing a given variable will not affect the outcome of the experiment.

   a. What is the expected outcome of your experiment if the null hypothesis is correct?

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b. What is the expected outcome of your experiment if the null hypothesis is incorrect?

3. What plate represents the control group of your experiment?

4. What represents the experimental group(s)?

5. What is the independent variable (sometimes called the experimental or manipulated variable) of your experiment?

6. What is the dependent variable of your experiment?

7. Did the outcome of the experiment support the null hypothesis?