

Experiment

Abstract: Students will be instructed to test the effect of varying salt concentrations on seed germination. They will prepare a standard stock solution of salt and then make serial dilutions of the stock to create other solutions of known concentrations. Radish seeds will be grown between paper towels dampened with the various solutions in plastic baggies taped to a window.

Background: In the winter, many people in Indiana use a type of salt to melt the ice on sidewalks near their homes and places of business. State and county highway departments spread salt and salt solutions on highways to make them safe for winter travel. As much as a convenience as this may be, it also has the unintended consequences of killing plants growing along the sidewalks and roads. The concentration of the salt left in the soil may kill the plants which will be growing in the spring.

The goal of “green chemistry” is the design of materials which are safer for human health and the environment. In this experiment, you will test the growth of radish seeds in several different salt solutions which may be used to melt ice on your home sidewalk. Although the commercial ice melting preparations are more complicated than table salt you will use, the results will be similar. And everyone can get sodium chloride in the grocery store. Not all stores will have the same types of ice-melting compounds.

Problem: What is the highest concentration of salt solution in which radish seeds will germinate? Which concentration of salt gives the highest percentage of germination of radish seeds?

Hypothesis: (students provide)

Supplies needed:

Salt (table salt, reagent grade sodium chloride, or Kosher salt)

Radish seeds (about 20-40 for each baggie for each salt solution, plus control)

Sealable plastic sandwich bags

Roll of paper towels Bounty, Brawny etc. (kitchen quality, not the brown ones from restrooms)

Measuring spoons or lab or kitchen balance

Graduated cylinder (borrow from science classroom)

Containers to hold at least 50 mL of water. (plastic or paper bathroom cups are fine)

Stirrers

Marking pen

Comment [p1]:

Water (tap water is okay)

Tape

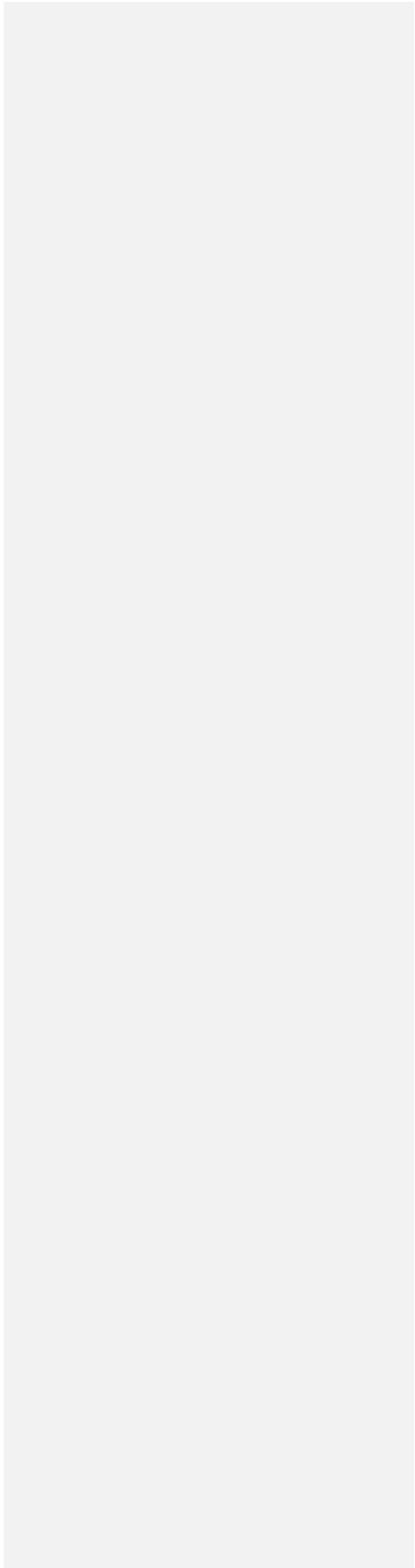
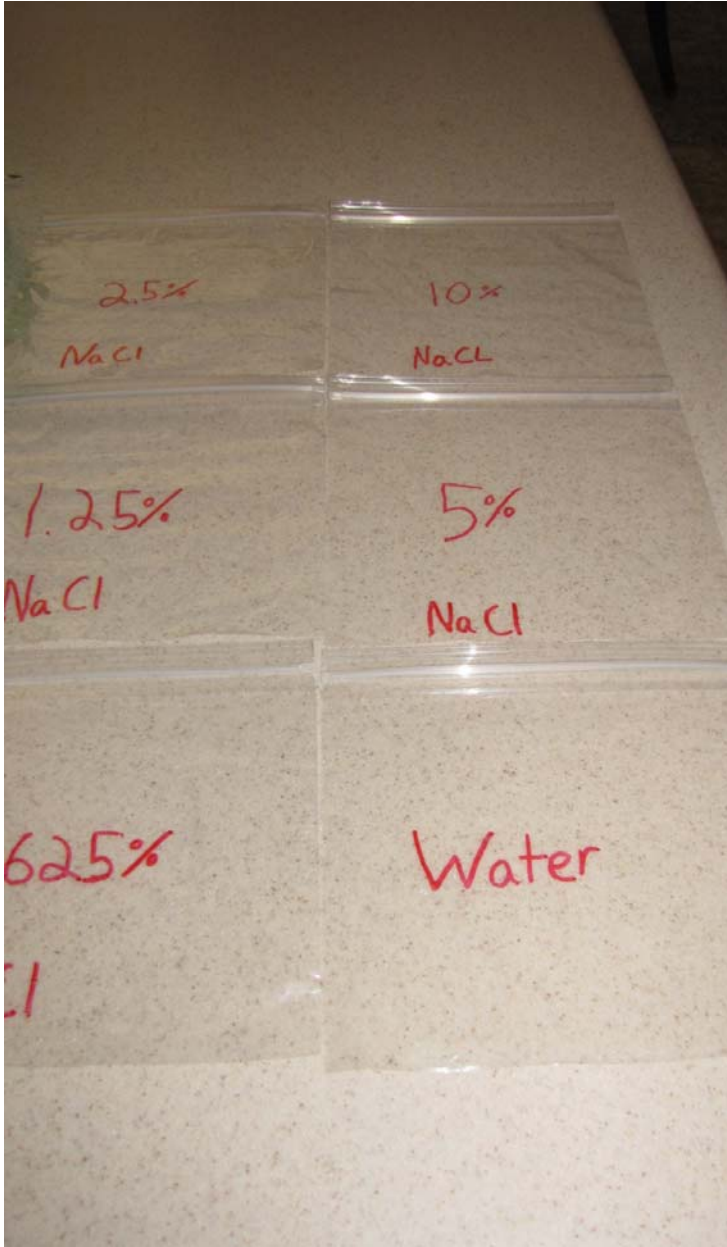
Directions:

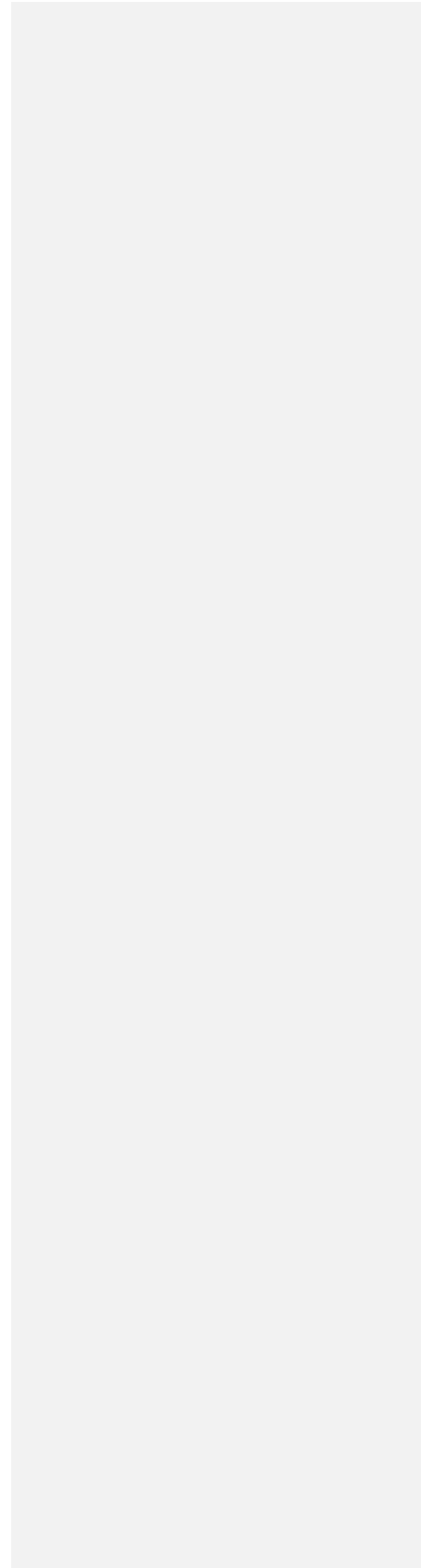
1. Prepare a standard stock solution of 10% salt as described by one of the methods in the instructions.
2. Prepare a serial dilution of the stock solution for each concentration.
 - a. Beginning with your 10% solution, using a graduated cylinder measure, 50 mL of it and place it in a plastic cup. Add exactly 50 mL of water to that cup and stir. The new solution concentration will be exactly half the concentration of the stock solution, or 5.0% salt. Label the cup 5%
 - b. Using a clean, dry graduated cylinder, measure 50 mL of the 5% solution and place it in a clean, dry plastic cup labeled 2.5% salt. Add exactly 50 mL of water to the cup and stir. This solution is exactly half the concentration of the second solution because you have diluted 50 mL of it with 50 mL of water.
 - c. Continue to prepare other solutions in the same manner until you have a 1.25% and a 0.625% salt solutions.
3. Label 6 plastic bags with each salt concentration, plus one labeled 0.0% which is for pure water.
4. Tear off a segment of paper towel and using scissors cut it in half.
5. On the paper towel you have prepared, place a known number of radish seeds. Twenty is a good number although you may use any number. Just make sure you put exactly the same number of seeds in each of the test baggies.
6. Fold the paper towel in half over the seeds and place carefully into the baggie so it is flat.
7. Measure out 20 mL of 10% salt solution and add it to the baggie carefully wetting the paper towel and the seeds.
8. Seal the baggy and keep it flat.
9. Do the same procedure for each of the other concentrations plus one for water.
10. Tape all of the baggies to a window in the classroom that gets the most light.
11. Check the baggies for evidence of germination. You can see root growth through the plastic bag; you do not need to open the baggies.
12. Keep sealed for 4-7 days, depending on the amount of sunlight and growth seen.
13. Open the bags carefully and peel back the paper towel.
14. Count the number of seeds which have germinated in each solution.
15. Record the number in a table.
16. Construct a graph showing the percentage germination versus the salt concentration.



Kosher salt and measuring spoons (top photo)

Plastic cups, labeled with salt solutions. Marked 100 mL on the outside to show 1:1 dilutions (bottom photo)







Labeled baggies (photo #3)

Seeds counted out and placed on paper towels before folding and inserting into baggies. (photo #4)

Baggie with paper towel folded over the seeds and 20mL of salt solution added. (Photo this page)



Baggies taped to window in my kitchen. You can see the water's shadow at the bottom of each baggie. The paper towel acts as a wick and keeps the seeds dampened with the salt solution.