Germination and Moisture

Introduction

Seeds must have moisture if they are to sprout and grow. Is pure water required, or will any liquid do?

Concepts

- Germination
- Environmental pollution

Background

A seed is *viable* if its embryo is alive and, therefore, the seed is capable of germination. *Germination* (sprouting and growth) of a seed depends on the interplay of a number of environmental and internal seed factors. A seed that is viable will not necessarily germinate. Moisture is one variable that is critical for seed germination. How critical is it and what form must it take?

Materials

Liquid soap solution*
Rubbing (Isopropyl, 70%) alcohol solution*
Vinegar, white
Paper towels or filter paper
Petri dishes, 5
Radish seeds, 50
Water

**Use 10 mL of soap or alcohol, and add 90 mL of water to each for a 10% solution.*

Safety Precautions

Seeds are routinely treated with mold-inhibiting chemicals to help preserve them. Be sure to wash hands and work areas thoroughly upon completion of the laboratory work. Isopropyl alcohol solution is highly flammable. Keep away from heat, sparks, open flames and hot surfaces. Causes mild skin and serious eye irritation. Wear chemical splash goggles, chemical-resistant gloves and a chemical-resistant apron. Please consult current Safety Data Sheets for additional safety information.

Procedure

1. Cut layers of paper towels to fit into the bottom of Petri dishes. (Filter paper that fits in the bottom of a Petri dish can also be used.)
2. Set up five Petri dishes as outlined in the following table. Place two layers of towels or filter paper in the bottom of each dish. Pour specified liquids on the paper towels until the towels are completely moist (2–3 mL). Evenly space ten radish seeds on the soaked paper towels. Cover the seeds with another paper towel soaked in the same solution.

Petri Dish	Treatment
1	Dry paper towels
2	H_2O-soaked towels
3	Vinegar-soaked towels
4	Liquid soap-soaked towels
5	Alcohol-soaked towels

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3. Label the Petri dishes and set them aside for three days.
4. After three days open the dishes and examine the seeds in each of the dishes. Record the number of germinated (sprouted) seeds in each dish.
5. Answer the following questions:
   a. Which dish had the greatest rate of germination?
   b. Is there water in all the dishes? Is water needed for germination? Defend your answer from the data.
   c. Suggest an explanation for the lack of germination in some dishes.
   d. Do any of the dishes suggest possible analogies to the effects of acid rain? Other environmental pollutants?

Disposal

Materials may be disposed of according to the Flinn Suggested Method for Type VI Biological Waste as outlined in your current *Flinn Scientific Catalog/Reference Manual*.

NGSS Alignment

This laboratory activity relates to the following Next Generation Science Standards (2013):

Disciplinary Core Ideas: Middle School
MS-LS1 From Molecules to Organisms: Structures and Processes
LS1.B: Growth and Development of Organisms
MS-ESS3 Earth and Human Activity
ESS3.C: Human Impacts on Earth Systems

Disciplinary Core Ideas: High School
HS-LS1 From Molecules to Organisms: Structures and Processes
LS1.B: Growth and Development of Organisms
HS-ESS3 Earth and Human Activity
ESS3.C: Human Impacts on Earth Systems

Science and Engineering Practices
Asking question and defining problems
Developing and using models
Constructing explanations and designing solutions

Crosscutting Concepts
Cause and effect
Structure and function

Tips

- Germination results are very dramatic for this very simple experiment. Only seeds in the Petri dish with plain water are likely to germinate at all, thus indicating the sensitivity of seeds to their surroundings. The results dramatically illustrate how simple imbalances can kill seeds or prevent them from germinating.
- Please consult your current *Flinn Scientific Catalog/Reference Manual* for methods of preparing laboratory solutions. Almost any concentration of alcohol or soap solution will be effective for this exercise (5–10% solutions are recommended).
- A logical extension of this laboratory would be to determine the lower threshold of the sensitivity of radish seeds to alcohol, soap or vinegar.

Materials for *Germination and Moisture* are available from Flinn Scientific, Inc.

Catalog No.	Description
AB1439	Radish–Red
AP8170	Petri Dish, Disposable
AP3112	Filter Paper
I0021	Isopropyl Alcohol, 70%, 500 mL

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.