1ST GRADE
SEED GERMINATION EXPERIMENTS AND SOIL EXPLORATION

Summary: Students study what conditions affect the germination of seeds. They test: temperature, light, soil, water, and type of soil. After students set their seeds up to germinate they water them over the course of a month. Finally, students evaluate and analyze their experiments and then present their experiments and findings to the class.

Intended Learning Outcomes for 1st Grade:
Objective 1: Framing questions. Designing investigations. Conducting investigations. Collecting data. Drawing conclusions.
Objective 2: Developing social interaction skills with peers sharing ideas with peers. Connecting ideas with reasons. Using multiple methods of communicating reasons/evidence.
Objective 3: Ideas are supported by reasons. There are limits to ideas in science. Differences in conclusions are best settled through additional observations and investigations Communication of ideas in science is important for helping to check the reasons for ideas.

Utah State Core Curriculum Tie:
Standard 2 Objective 1: Earth and Space Science
Observe, compare, describe, and sort components of soil by size, texture and color.
Standard 4 Objective 2: Life Science
Identify how natural earth materials help to sustain plant life.
Make observations about living things and their environment using the five senses.
Describe and model life cycles of living things.

Preparation time: 40 min pre-lab time but does also have a post-lab time that involves watering the seeds until the germination project is complete.
Lesson time: 50 min
Small group size: works best with one adult for every 5 students

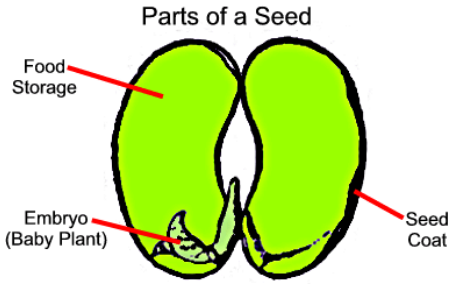
Materials:
Paper towels
Plastic cups – 8 oz
Seeds – carrot works well or any other seed that germinates relatively quickly
Heating pad
Desk lamp
Potting soil or humus
Sand

Clay – Carolina.com, 971610, Clay, Red, 8-lb Bucket, $9.95, this is not modeling clay but clay found in soil
magnifying lenses
3 small containers for each group to hold the soil component
white paper, one piece per student
water in squirt bottles or small beakers of water with eyedroppers or pipettes
3 plastic spoons for each group

Background information:

When a seed is provided with enough air, warmth, and water - germination begins. As the seed uptakes water it expands and the enzymes and food supplies become hydrated. These hydrated enzymes become active and the seed increases its energy production for growth.

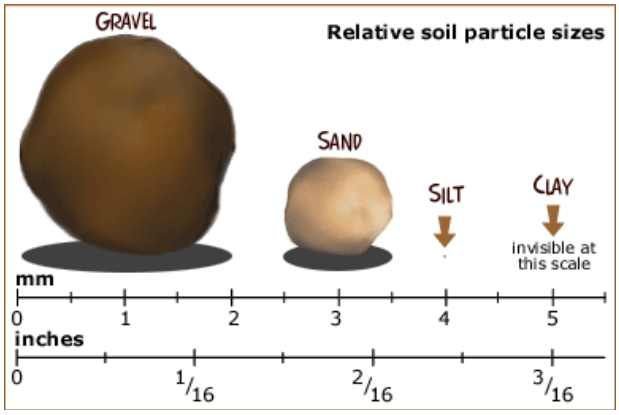
During germination, the first event to occur is the swelling of the seed and the splitting of the seed coat. The food storage area of the seed provides nourishment to the growing plant embryo. As the hydrated enzymes break down the food storage, the seedling begins to grow. The second event involves the elongation of the root from the seed. It does not matter how the seed is placed in the soil or cup, the root will turn around if need be and grow down with gravity. The final event involves the formation of the shoot. The shoot grows up from the plant embryo, away from gravity, and generally carries the seed with it. From the seed, the seed leaves will emerge and the seed coat will fall off.

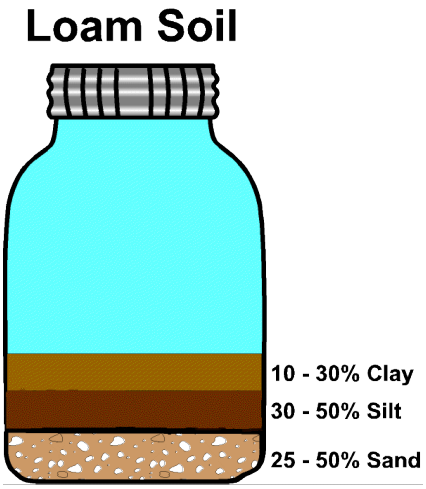


Carrot seeds must have water for germination and carrot seeds can germinate if flooded with water. The difference between enough water and flooding occurs in the root and shoot elongation. Seeds that were flooded will germinate but have short roots and shoots. Carrot seeds will not germinate in freezing or cold conditions. Depending on the heat of the heating pad or the coolness of the room, seed germination will either produce longer shoots and roots at room temperature or heating pad conditions. Carrot seeds do not need light to germinate but once shoots form light is necessary for healthy plant growth. Carrot seeds germinated in the dark will put all their energy into elongating the shoot in its search for light. The leaves will be yellow and roots

very short. As for soil, seeds germinate and shoots grow regardless of whether soil is present. Seeds grow best in humus or topsoil because pure clay and pure sand do not regulate water appropriately for strong growth of the plant.

The largest particles in soil are gravel (larger than 2 mm). The other particles in soil are sand (less than 2 mm), silt (less than 1/16 mm), and clay (less than 1/256 mm). The smaller the particle size the more easily water is held in the soil. The larger the particle size the easier it is for water to seep through it and this soil type contains lots of air. Roots need water, and air for oxygen. The best texture for plant growth is called loam, which has all three of the different particle sizes (sand, silt, and clay). The loam allows plants to get a sufficient amount of both water and air.





Pre-lab discussion: Ask students what they think a seed needs to germinate. Be sure and discuss specifically what conditions of light, water, temperature, and soil a seed may need. List these conditions on the board and describe to students the experiments they are going to set up in the classroom. Explain that they are going to watch their seeds germinate and grow for several weeks and then measure the sprouts that grow. They are going to determine the best conditions for seed germination. Explain to the students that they will also study three different components that make up soil: clay, sand, and humus. Explain that these components differ in their particle size and how well they hold onto water.

Instructional procedure:

I. Seed Germination experiments: Divide the class into 5 groups. If you have one parent volunteer working with each group they can read the directions and help students set up the experiments.

1. Each group will set up a different experiment. Hand out to each group the seed germination directions for the conditions they are going to study. These directions are found in an easy to use separate document on the website.

2. Each group will follow the directions to complete this part of the lab.

A few things to note:

a. For paper towels, different brands come in different sizes. Before the lesson, look at the pictures on the direction page and decide how to fold your paper towels in order to fit them into the cup. It takes a few tries to figure out which system works best.
b. Make sure your heating pad is set on a setting that warms up the cup without cooking it. If you want to just run it through the day when you are at school but not overnight and on the weekends that is reasonable.
c. For the 24 hours a day of light, put a note on the lamp so that the custodians don't turn it off in the evening.
d. For the flooded cup, make sure to check its water more often so as to keep it flooded.

3. Seeds will germinate and seedlings grow for approximately 4 weeks. You can stop the experiment whenever the longest sprouts are about 6 cm long. It may be shorter or longer than four weeks depending on which seeds you buy and how soon they germinate.

4. When it is determined to stop the growth of the sprouts, a second germination evaluation lesson will gather data and students will analyze their results and present them to the class.

II. Studying soil components

a. For each group, fill three small containers containing each of the three types of soil components: sand, humus, and clay. Have each student place a small amount of each on a piece of white paper.

b. With the magnifying lenses, have students study the particle size, texture, and color of each sample. How are they similar and how are they different? Discuss how clay has the smallest particle size and sand the largest.

d. Add a small amount of water to each sample and observe how the different soil types react to water. The clay absorbs the water and the sand does not.

e. Explain that good soil for healthy plant growth contains some amount of all three of these components mixed together.