

Native Seeds/SEARCH

Seed Germination – What Makes Seed Grow?

Appropriate Topics of Study: Science, Biology,

Learning Objectives:

Students will identify different parts of seeds.

Students will learn the connection between seeds and the factors that influence their germination.

Students will engage in a range of collaborative discussions with other students and the instructor. Students will complete seed diagrams.

Students will develop questions to test for a scientific experiment.

Student will follow scientific method by carrying out the experiment they develop.

Instructions:

Part 1: Parts of a Seed

Start by exploring the seed structures of a few pre-germinated seeds. Beans and corn work well. Germinate seeds 3-4 days prior to the lesson in wet paper towels. Place the paper towels in a plastic bag so they do not dry out and keep the bags in a sunny, warm spot. Fold over the opening of the plastic bag rather than seal it. Seeds need air to germinate and sealing the bag will more likely ferment the seeds than allow them to germinate. Provide students with knives and tweezers so that they can dissect the seeds to observe the interior structures.

Ask students to discuss what they are observing. What are these seeds? What has happened to them? What makes them sprout or germinate? What are the changes that have occurred to the seed? Are there different parts visible? It is okay if they do not know the names of the different seed parts are at this point, the point is to explore and make inferences of why they have different parts and what caused them to germinate.

After initial exploration of a few seeds, present a series of slides that discuss what the names are of different seed parts. As a group, have the students hypothesize what made the seeds sprout or germinate. What will happen next? Through guided group discussion generate a list of things that seeds need to germinate. What about growing, not just germinating? Are there things the seeds need that is not being provided by the wet paper towel? Through this discussion guide the students to generate questions, methods to test their question, and hypotheses.

Now that the students have some background, return to the seeds and discuss the function of each part visible in the germinated seed and the role they play in growing a plant. Have the students complete the Seed Identification Handout, drawing and labeling different parts of their seeds.

It is useful to have both a monocot and a dicot in this exercise and discuss the differences and similarities between different types of seeds.

Part 2: Germination Experiments and the Scientific Method

Review the scientific method and prepare students for designing and carrying out their own seed germination experiments. The experiments can be done in small groups or each individual can have their own research question.

Have the students or groups develop their own research question to test (for example: Will seeds germinate in Dr. Pepper? or Will seeds germinate in cold conditions?) Make sure the research question can have a hypothesis and is variables the students can adjust in a test. There are infinite possibilities to test with the seed germination experiments. Guide the students so they conduct a controlled experiment where only one variable is altered. Provide them with research question suggestions or different materials that could be used in the test. For the test, students can measure number of seeds germinated, as well as growth rates of plants after the seeds germinate. This can easily be calculated by dividing height of the plant by the time they have been growing.

After developing a research question, have the students develop a hypotheses and develop their research procedures. Have them write out their hypotheses, materials, procedures (including what they intend to measure), and how they will compare the data to their control. There is a sample seed germination experiment at the end of this document. Before starting the experiment, the instructor should review the procedures and provide adjustments.

Have the students follow their procedures to set up their experiments. They should keep their own notes and measurements. It may take two weeks for the experiments to be complete. The graded assessment for this lesson can be a written lab report. An example template is attached. Students can also create a poster or a powerpoint and present their experiments to the class.

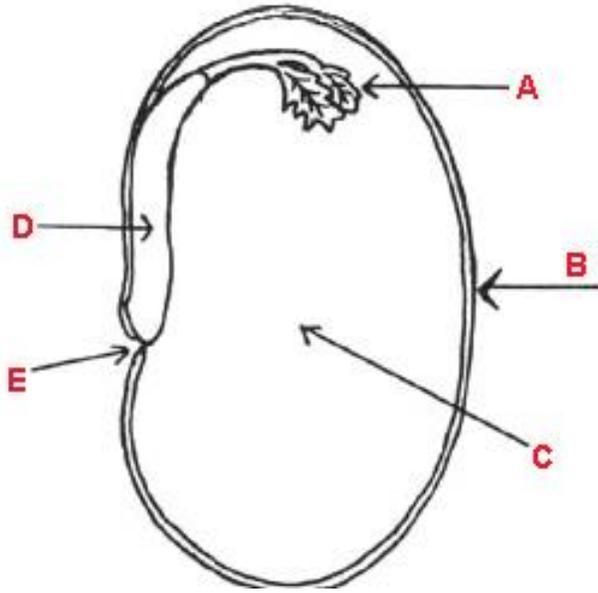
Materials:

Seeds- beans and corn work best
Cups & Potting soil or Paper towels & Plastic bags Water
Ruler
Experiments may need a diversity of materials
Handouts

SEED IDENTIFICATION HANDOUT

Option 1:

Instructions: Label the parts of a bean seed.



Option 2:

Instructions: In the space below, draw and label the parts of a seed. Is your seed a monocot or a dicot?

Endosperm

Cotyledon

Seed Coat

Plumule, hypocotyl, epicotyl

SAMPLE EXPERIMENT PROCEEDURE

Research Question: How do seeds germinate in soda?

Hypothesis: Seeds germinated and grown in soda will not grow as well as those grown in water.

Materials:

Bean Seeds
Paper Towels
Water
Dr. Pepper
Plastic bag
Ruler

Procedure:

1. 10 seeds will be tested as the variable and 10 seeds will be tested as the control.
2. The seeds will be placed on a paper towel and placed inside a plastic bag. A different plastic bag will be used for each treatment (control and variable).
3. Each paper towel will be dampened by the liquids (Dr. Pepper and water).
4. The paper towels will be checked daily (except weekends) and moistened as needed.
5. The length of time it takes for each seed to germinate, as determined by the emergence of the cotyledons from the seed coat, will be recorded (# of days) and a seed will be considered ungerminated after 1 week and no signs of germination are visible.
6. After the seeds germinate, growth will be determined by measuring the height of the plant with a ruler. This will be measured 2 weeks after the start of the experiment.
7. After the data is collected, the mean number of days it takes a seed to germinate will be recorded for both the variable and the control. This will be displayed in a bar graph, with the x-axis having two categories (water and Dr. Pepper) and the y-axis being the average number of days.
8. The median will also be determined and displayed in a table for the average days to germinate.
9. The average growth for each seedling will be determined and displayed on a similar bar graph. The median will also be determined for seedling growth.

Seed Germination Lab Report Outline

Introduction: Should contain background information justifying why you are testing your specific research question and hypothesis. The introduction should end with a clear statement of your research question, hypothesis and expectations.

Methods: Should be a detailed description of how your experiment was conducted. It should be detailed enough that someone else could read it and recreate your experiment.

Results and Data Analysis: This section should clearly describe what your results were and what you did to them to make sense of the data. This includes talking about how and why you made each graph or table.

Conclusions: This section should interpret your results and make some conclusions about your research. If no clear conclusions can be made, it should be used to talk about how you could improve the experiment. This section should also discuss future experiments that could be done based on the knowledge you have obtained through your experiment.