



BIG GREEN LESSONS

Germination: 3rd – 5th Grade

Lesson Outcomes

In this lesson, students will identify that seeds germinate into plants.

- A seed is made up of different parts (cotyledon, seed coat, embryo).
- Seeds sprout into baby plants.

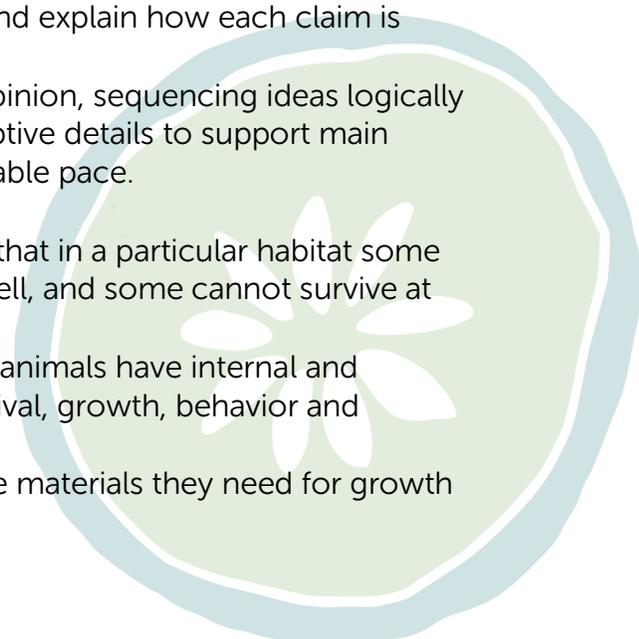
Standards Alignment

Common Core – English Language Arts

- SL.3.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.
- SL.3.3. Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.
- SL.3.4. Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.
- SL.3.6. Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification.
- SL.4.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
- SL.4.3. Identify the reasons and evidence a speaker provides to support particular points.
- SL.4.4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
- SL.5.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
- SL.5.3. Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.
- SL.5.4. Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

Next Generation Science Standards

- 3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction.
- 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.



Materials and Preparation

- **One week** before the Classroom Activity: students set up germination experiment
- **One day** before the Garden Activity: soak seeds (preferably lima beans) for seed dissection
- Familiarize yourself with your Learning Garden
Reminder: Big Green's Garden Educators are always available for additional support via email or by phone call

Germination Experiment Station:

- Seeds (any variety) - 3-5 per student or small group
- Paper towels - at least 1 per student or small group
- Zip lock plastic bags - 1 per student or small group
- Spray bottles - enough for easy sharing
- Labels or masking tape - 1 per student or small group
- Pencils
- Seed Germination Experiment worksheet (front and back) - 1 per student

Seed Dissection Work Station:

- Soaked seed - at least 1 per student (preferably lima beans from the grocery store)
- Magnifying glasses - enough for easy sharing at work station
- Paper towels - at least 1 per student
- Seed Dissection Work Station worksheet - 1 per group or work station

Teacher Background

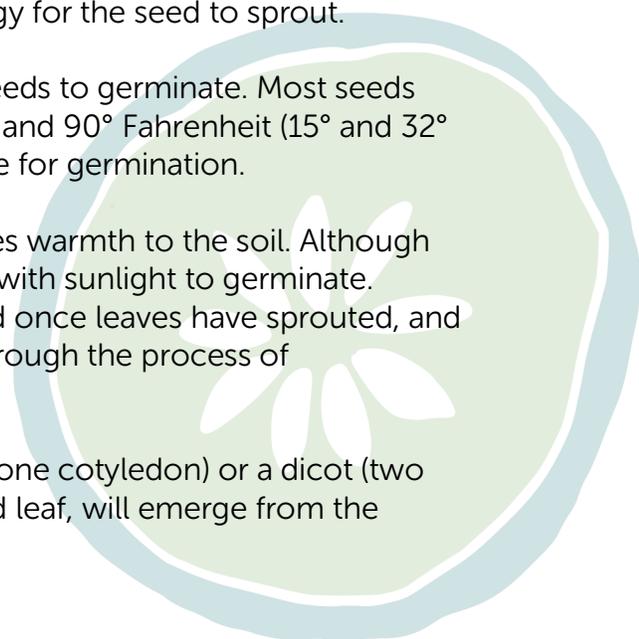
Germination is defined as the beginning of growth. The term is most commonly associated with plants, describing the process of a seed sprouting into a seedling. The term germination can also be applied to spores or buds.

When seeds are dry and hard they are dormant. For a seed to germinate the dormancy period will need to be broken with water and warmth. When a seed is moistened, it will absorb water, breaking the seed coat and initiating the food supply in the cotyledon through the activation of enzymes that produces energy for the seed to sprout.

Temperatures must fall between a specific range for seeds to germinate. Most seeds grown in the Learning Garden germinate between 60° and 90° Fahrenheit (15° and 32° Celsius), but each seed has a unique temperature range for germination.

Sunlight supports the germination process as it provides warmth to the soil. Although uncommon, some seeds do even need direct contact with sunlight to germinate. Sunlight warms the soil to help initiate germination and once leaves have sprouted, and it is also the primary energy source for plant growth through the process of photosynthesis.

All flowering plants are classified as either a monocot (one cotyledon) or a dicot (two cotyledons). In a monocot, one cotyledon, or one seed leaf, will emerge from the

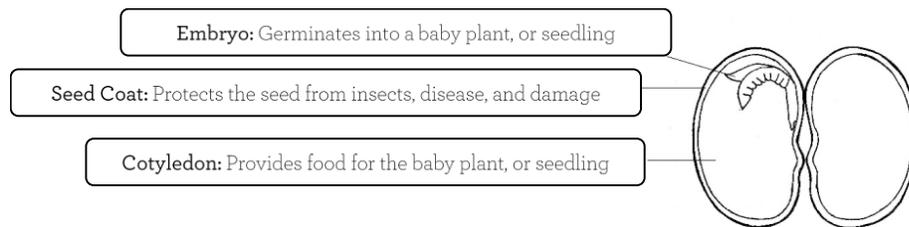


germinating seed. In a dicot, two cotyledons, or two seed leaves, will emerge from the germinating seed. There are other differences between a monocot and a dicot, most notably the leaf structure. In a monocot, the leaf veins are paralleled, like a blade of grass. In a dicot, the leaf veins are netted like an oak leaf.

Use the chart below to help familiarize yourself with monocot and dicot examples.

Monocot Examples:		Dicot Examples:	
Garlic	Onion	Tomato	Beans
Corn	Wheat	Pepper	Peas
Rice	Grasses	Carrot	Cauliflower

When seeds sprout in the soil, the radicle, or embryonic root, will be the first to emerge from the seed coat. The developing stem, described as the epicotyl, will emerge next and will grow towards the surface of the soil, eventually pushing its way through. The developing stem will bring the cotyledon along, which appears as the first two sprouting leaves, which looks different than the true leaves of the plant that grow once the stem and roots are established.



Introduction

Spend time discussing the following introductory question:

- What does a seed need to sprout?
- Review the definition of a hypothesis.

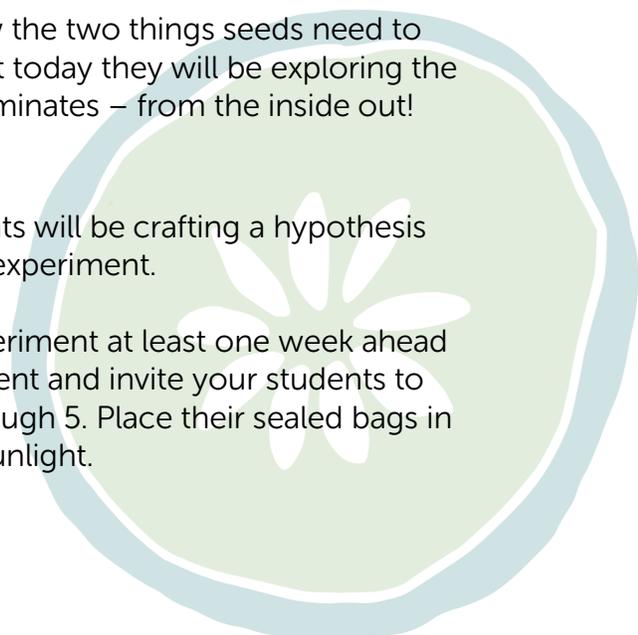
Make a list of student responses on the board and group or categorize responses together, discuss and strike any responses that are not needed to germinate a seed.

Introduce and define the word germination and review the two things seeds need to germinate – warmth and water. Let students know that today they will be exploring the inside of the seed, so they understand how a seed germinates – from the inside out!

Classroom Activity

During the classroom portion of today's lesson, students will be crafting a hypothesis and making observations about the seed germination experiment.

NOTE: Have your students set up the germination experiment at least one week ahead of time. Use the worksheet Seed Germination Experiment and invite your students to collect the experiment supplies and follow steps 1 through 5. Place their sealed bags in a warm spot. Remember, it doesn't have to be in the sunlight.



1. Use complete sentences and give clear directions about how the teacher will engage with the students.
2. Invite your students to collect their seed germination experiment. Pass back their worksheet, Seed Germination Experiment, and have your students quietly review the rest of the worksheet.
3. Review the remainder of the Seed Germination Experiment worksheet with your students. Ask for students to raise their hand and volunteer to read each section.
4. Give students 10 minutes to complete the Seed Germination Experiment worksheet individually.
5. Have students pair and share the results of their experiment and review the two things seeds need to germinate – warmth and water.

Break here if this lesson will be taught in two sections

Garden Activity

Welcome your students to the Learning Garden and line students up along one side. Stand on the opposite side of the Learning Garden so you can address the entire group.

Ask students if they know what they will be doing in the Learning Garden for the day's lesson. Let them know they will be dissecting a seed and learning about the parts of a seed.

1. Use complete sentences and give clear directions about how the teacher will engage with the students.
2. Let your students know that today they will be working in workstation groups to dissect and explore the inside of a seed. Ask for a student volunteer to review the definition of germination.
3. Introduce the supplies at each workstation.
4. Break students up into workstation groups. Be sure to bring enough supplies for each workstation.
5. Give your students 10 minutes to complete the seed dissection activity and as groups finish, have them complete the seed dissection diagram.
6. Gather your students back together and review the parts of a seed and the function of each plant part.

NOTE: As the teacher, be aware of poisonous plants and other hazards in and around your Learning Garden and review those concerns with your students. Review any additional rules of the Learning Garden. Ask students about known bee/wasp sting allergies before going into the Learning Garden.

Conclusion

Have students share out key parts of the day's activities and review the Key Understandings for this lesson.

- Ask students why seeds are so important. What part do they play in plant survival?
- Ask students to think about the location of seeds for different plants in the Learning Garden.

Students should clean-up the Learning Garden as needed.

