HOW DO PLANTS MEET THEIR NEEDS?

Overview

In this lesson students will germinate radish seeds and observe the root hairs on the root.

Objectives

On successful completion of this unit, students will be able to:

- germinate seeds;
- identify the root hairs on a plant root; and
- describe how root hairs help a plant survive.

Alaska Standards

Alaska Science Standards / Grade Level Expectations

[6] SA1.1 The students demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.

[6] SC3.1 The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by recognizing that organisms can cause physical and chemical changes (e.g., digestion, growth, respiration, photosynthesis) to matter and recognizing the importance of energy transfer in these changes.

Alaska Math Standards

6.G.4. Represent three-dimensional figures (e.g., prisms) using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Alaska Cultural Standards

[E] Culturally- knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. Students who meet this cultural standard are able to:

[E.2] understand the ecology and geography of the bioregion they inhabit.

Bering Strait School District Scope & Sequence

M.S. Sequence 6.8: Plant Structure, Function, and Life Cycles

D. Describe the functions of roots, stems and leaves.

HOW DO PLANTS MEET THEIR NEEDS?

Materials

- radish (or other plant) seeds
- snack or sandwich size plastic bags
- tissue paper, paper towels, or coffee filters
- hand lens, magnifying glass, or microscope
- water
- string
- ruler
- scissors
- markers
- STUDENT WORKSHEET: Germination Observations

Additional Resources

Glencoe Life Science Ch 9-10

Activity Preparation

1. Make copies of the Student Worksheet and gather supplies.
2. Clear a space in your classroom to store the germination baggies for 7-10 days.

Whole Picture

Overview

Plants need air, nutrients, water, light and space to grow. Roots absorb water and nutrients from the soil. Water is necessary for photosynthesis to take place. Carbon dioxide is also needed for photosynthesis. CO_2 enters through small openings in leaves. Water is transported in the xylem to the leaves. Leaves contain the pigment chlorophyll, which uses energy from sunlight to form glucose from water and carbon dioxide. Oxygen is also produced in the reaction. The glucose is transported to all cells in the plant through the phloem. The energy available in the glucose is used for life processes in the cells of the plant. Most plants make more glucose than is needed and it is stored as starch.

Root Hairs

This lesson focuses on the function of roots. Water and nutrients enter the root through long threadlike cells called root hairs. Root hairs are small enough to grow in the spaces between soil particles. They greatly increase the surface area of the root to provide a larger surface to absorb water and nutrients.

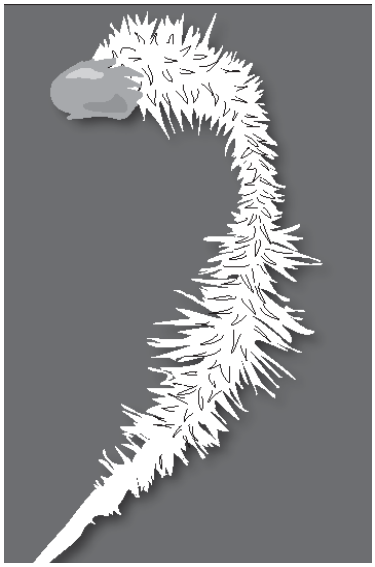
HOW DO PLANTS MEET THEIR NEEDS?

Vocabulary

root	part of a plant that attaches it to the ground; Water and nutrients move through it to the rest of the plant
root hair	small, threadlike extensions of cells that absorb water and nutrients from soil
germinate	beginning of growth from the seed of a plant after a period of dormancy
seed	plant embryo, its food supply, and a protective covering
stem	upright stalk of a plant
leaves	flattened structure of a plant that is attached to the stem; It is the primary location where photosynthesis takes place.
xylem	plant tissue that carries water and nutrients from a plant's roots to its leaves
phloem	plant tissue that carries food from the leaves to other cells

Activity Procedure

1. Ask students what plants need to in order to grow. Write their ideas on the board. Review the parts of a plant. Ask students to describe a root, what the function of the root is and how they absorb water.
2. Explain that they will germinate some seeds so they can observe the roots of the plants. Ask what seeds need in order to germinate? Go over the directions for starting the seeds and demonstrate how to set up the germination baggie. Radish seeds germinate fairly quickly, however it will take awhile before the root hairs are visible. They will need to check on the plants every day to monitor the progress.
3. Have students fill in the observation chart while waiting for the root hairs to develop.
4. Roots hairs will look like fuzzy material behind the tip of the root (see image). When they are visible have students use a magnify glass or microscope to look at them and draw one of their seeds on their worksheet. If the plastic bag is too wet the root hairs will be matted down. Open the bag to let it dry out. There are many images of radish root hairs available on the Internet. If necessary, show the students some examples so they know what to look for.
5. Have students complete the worksheet. Demonstrate how to use a string to measure around the diagrams of the roots. It may be helpful for students to work in pairs when measuring the diagrams.



6. Activity follow up: The students are measuring the length of the string around a cross section of a root. It would be very difficult to find the actual surface area of each root hair because of their small size and irregular shape. Discuss how the number of root hairs, and the increased length around the circumference of the root, would relate to an increase in the surface area of the root. In humans the villi of the intestine also serve to increase the surface area. There are many images available on the Internet. If possible, show students some images of villi and ask student to compare the villi to root hairs. An understanding of surface area is an important concept in biology.

Answers

1. Answer may vary. Usually the roots appear first.
2. Roots absorb water and nutrients from the soil
3. They look like small threadlike structures.
4. It would have less surface area.
5. It would probably not survive because there isn't enough surface area to absorb the amount of water and nutrients necessary to live.
6. Root hairs grow on almost all plants, so it is likely they would have them.

Student Worksheet: Germination Observations

Name: _____

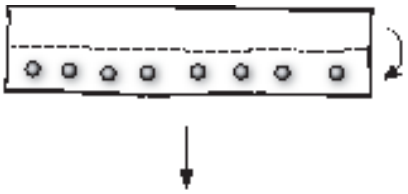
Seeds need water and air to germinate. In this lesson seeds will be started in a plastic bag. They will need to be checked on every couple of days. After 7 – 10 days the root will be examined with a magnifying glass or microscope.

Materials

- 5 – 10 radish (or other plant) seeds
- 1 snack or sandwich size plastic bag
- 1 piece of tissue paper, paper towel, or coffee filter
- water
- marker
- string
- scissors
- ruler

Procedure

1. Gather the seeds, plastic bag and paper. Put your name on the baggie with a marker.
2. Cut the paper to 3cm x 15cm.
3. Place the seeds along the top of the paper, approximately 1cm from the top.



4. Fold the paper over once and add a small amount of water. It should be moist, but not dripping wet.
5. Place the seeds in a plastic bag. If there is too much water in the bag carefully drain it.
6. Close the top about half way. Leave some room for air to enter.
7. Place the bag in the location your teacher tells you.
8. Check on the seeds every couple of days and write down your observations on the chart below.
9. When the roots have developed your teacher will have you take the seeds out of the bag and examine them with a magnifying glass, or microscope.
10. Complete the worksheet by 1) make a drawing of one of the seeds and label the root, root hairs, seed coat, stem and first leaves, 2) measuring the diagrams and 3) answering the questions.

Student Worksheet: Germination Observations

Name: _____

Observation Table

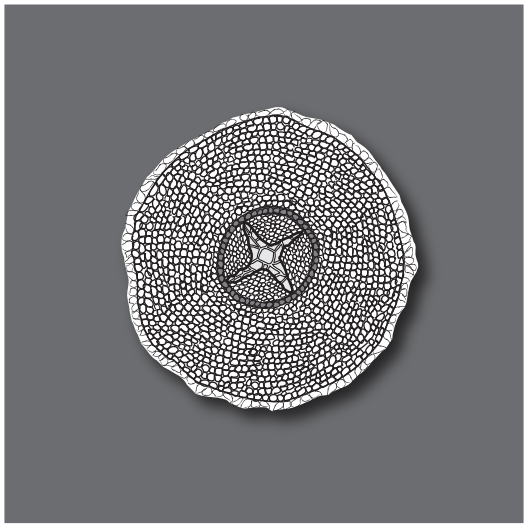
Date	Observations

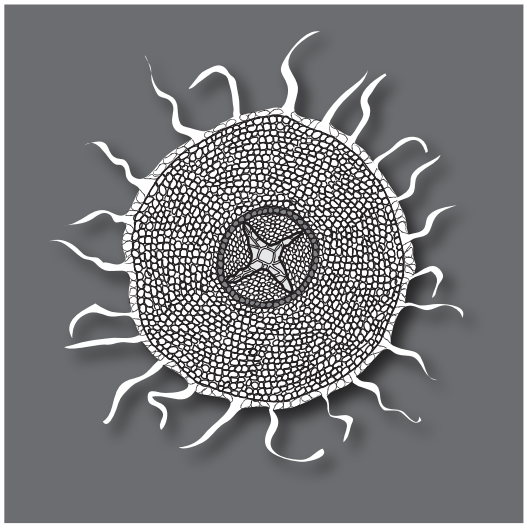
1. Draw a diagram of one of the plants. Label the roots, root hairs, seed, stem and first leaves.

Student Worksheet: Germination Observations

Name: _____

2. Below are two diagrams of a cross section of a root. The one on the left does not have root hairs and the one on right does.





3. Take a string and lay it around the outside of the root. Measure the length of the string and record it. Do the same for the diagram on the right and be sure to measure each root hair. Measure the length of the string with a ruler and record it.

   Length of string from root without root hairs _____

   Length of string from root with root hairs. _____

   This diagram only shows one small slice through a root. You should have found that the root hairs increase the length of string needed to go all the way around the root. If we could calculate the surface area of a root without root hairs and one with root hairs we would find that the root hairs dramatically increase the surface area. Some sources say that it increases the surface area of a root by 20 times. The large area helps to absorb water and nutrients.

Questions

1. With the seeds you germinated, what could you see first, the roots, stem or leaves?

Student Worksheet: Germination Observations

Name: _____

2. What is the function of the roots of a plant?

3. Describe what the root hairs of your plant looked like.

4. If a plant did not have root hairs, would the surface area of the root be greater, or less than, a root that did have them?

5. If a plant had a root without root hairs, do you think the plant could survive? Explain why or why not.

6. Explain why you would, or would not, find root hairs on the roots of plants that grow around your community.