

Science

Grade 3

Unit 4

PLANT GROWTH and DEVELOPMENT (based on STC Kit)

INTRODUCTION

Plants are organisms that can reproduce and survive if they live in environments that meet their basic needs. Plants need to find ways to obtain water, air, nutrients and protection in the areas in which they live. Some plants live on land and others live in water. Sometimes, plants can adapt to their environments in order to find survival. Understanding how plants survive can help us gain a greater understanding of living things.

SCIENCE STANDARDS AND INDICATORS

Content Standard 2.2: Plants change their forms as part of their life cycles.

A19 Describe the life cycles of flowering plants as they grow from seeds, proceed through maturation and produce new seeds.

A20 Explore and describe the effects of light and water on seed germination and plant growth.

Content Standard 3.2: Organisms can survive and reproduce only in environments that meet their basic needs.

B3: Describe how different plants and animals are adapted to obtain air, water, food and protection in specific land habitats.

B4: Describe how different plants and animals are adapted to obtain water, food and protection in water habitats.

SCIENCE INQUIRY: Scientific inquiry is a thoughtful and coordinated attempt to search out describe, explain and predict natural phenomena.

SCIENCE LITERACY: Science literacy includes speaking listening, presenting, interpreting, reading and writing about science.

SCIENCE NUMERACY: Mathematics provides useful tool for the description, analysis and presentation of scientific data and ideas.

EXPECTED PERFORMANCES

BINQ.1 Make observations and ask questions about objects, organisms and the environment.

BINQ.4 Employ simple equipment and measuring tools to gather data and extend the senses.

BINQ.6 Analyze, critique and communicate investigations using words, graphs and drawings.

BINQ.9 Use mathematics to analyze, interpret and present data.

BIG IDEA Plants survive and thrive in environments in which their basic needs are met.

Key Vocabulary: environment, spines, thorns, toxins, needle, adaptations, stems, leaves, roots, pollination, fertilize, pollen

LINKS TO OTHER STANDARDS

MATH

4.1.a Design surveys for the collection of data and justify conclusions drawn from the data.

4.2.a Analyze data to identify a typical element or event.

4.3.a Use samples and simulations to determine probability, and to make and test predictions.

SCIENCE CONTENT STANDARD 2.2

<p>CONCEPTUAL THEME:</p> <p><i>Structure and Function - How are organisms structured to ensure efficiency and survival?</i></p> <p>CONTENT STANDARD:</p> <p>2.2 – Plants change their forms as part of their life cycles.</p>	<p>GRADE-LEVEL CONCEPT: ♦ The life cycles of flowering plants include seed germination, growth, flowering, pollination and seed dispersal.</p> <p>GRADE-LEVEL EXPECTATIONS:</p> <ol style="list-style-type: none"> 1. Flowering plants progress through a sequenced life cycle. First, seeds sprout (germinate), then seedlings grow into adult plants with leaves and flowers. If the flowers are pollinated, seeds develop that will grow into new plants to continue the life cycle. 2. Roots, stems, leaves, flowers and seeds are structures that develop during different stages of the plant’s life cycle. 3. Seeds contain the beginnings of a new plant (embryo) and the food (energy source) the new plant needs to grow until it is mature enough to produce its own food. Different plant varieties produce seeds of different size, color and shape. 4. Environmental conditions, such as temperature, amount of light, amount of water and type of soil, affect seed germination and plant development. 5. A plant’s seed will grow into a new plant that resembles but is not identical to the parent plant or to other new plants. For example, marigold plants produce marigold seeds that grow into new marigold plants. Individual marigolds, however, vary in height, number of leaves, etc. 6. Seedlings are young plants that produce the structures that will be needed by the plant to survive in its environment: Roots and leaves begin to grow and take in nutrients, water and air; and the stem starts to grow towards sunlight. 7. Adult plants form more leaves that help the plant collect sunlight and air to make its food. They produce flowers that are the structures responsible for reproduction. 8. Flowers have structures that produce pollen, attract pollinators and produce seeds that can grow into new plants. Some flowers have structures that develop into fruits, berries or nuts that contain the seeds that can grow into new plants. 9. Some seeds fall to the ground and germinate close to the parent plant; other seeds are carried (dispersed) by wind, animals, or water to places away. The structure of the seed is related to the way it is dispersed. <p>KEY SCIENCE VOCABULARY: life cycle, structures (body parts), seed, germinate, reproduce, flower, pollen, pollinator, seed dispersal</p>	<p>CMT EXPECTED PERFORMANCES</p> <p>A19 Describe the life cycles of flowering plants as they grow from seeds, proceed through maturation and produce new seeds.</p> <p>A20 Explore and describe the effects of light and water on seed germination and plant growth.</p>
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SCIENCE CONTENT STANDARD 3.2

CONCEPTUAL THEME:

*Heredity and Evolution -
What processes are
responsible for life's unity
and diversity?*

**CONTENT
STANDARD:**

**3.2 – Organisms can
survive and reproduce
only in environments
that meet their basic
needs.**

GRADE-LEVEL CONCEPT: ♦ Plants and animals have structures and behaviors that help them survive in different environments.

GRADE-LEVEL EXPECTATIONS:

1. Plants and animals have physical and behavioral adaptations that allow them to survive in certain environments. Adaptations are passed from parents to offspring. Individuals that happen to be bigger, stronger or faster can have an advantage over others of the same kind for finding food and mates.
2. Plants have adaptations for getting the sunlight they need to survive. Examples include growing or facing toward sunlight and sending out chutes or tendrils to get taller than neighboring plants.
3. Plants have adaptations for protection from predators. Examples include spines, thorns and toxins (for example, poison ivy).
4. Plants have adaptations for surviving in different environmental conditions. Examples include dropping leaves in winter when sunlight and water are limited, having needle-shaped leaves that shed snow, or surviving drought by storing water in thick stems.

KEY SCIENCE VOCABULARY: adaptation, camouflage, hibernation, migration

**CMT EXPECTED
PERFORMANCES**

- B 1.** Describe how different plants and animals are adapted to obtain air, water, food and protection in specific land habitats.
- B 2.** Describe how different plants and animals are adapted to obtain air, water, food and protection in water habitats.

CONCEPTS

- Many plants follow a life cycle that begins with growth from a seed and proceeds through the production of seeds.
- Plants have distinct stages in their life cycle.
- To live and grow, plants need light, water and nutrients from the soil.
- Flowering plants must be pollinated in order to produce seeds.
- Many plants are pollinated by bees.
- A flower's pollen sticks to a bee, but some rubs off when the bee feeds at other flowers.
- One seed produces one plant; one plant can produce many seeds.

SKILLS:

- Planting and caring for *Brassica rapa*.
- Observing, describing and recording changes in plants.
- Comparing and discussing changes occurring in plants over time.
- Measuring and recording the growth of plants.
- Using graphs to display and compare growth patterns.
- Predicting future growth from observations and measurements.
- Reading to learn more about plants.
- Communicating results and reflecting on experiences through writing, drawing and discussion.

ESSENTIAL QUESTIONS TO GUIDE INSTRUCTION AND ASSESSMENT:

- What factors affect plant growth?
- What are the basic needs of plants?
- How do plants get their basic needs met?
- What makes plants grow and flourish?
- What predictions can be made about future plant growth from observing a plant?
- What is the relationship between plants and other living things (i.e. bees)?

MATERIALS AND SUPPLIES

- STC Plant Growth and Development Kit

OBJECTIVES AND GOALS (as summarized from STC Kit, "Plant Growth and Development")

LESSON ONE

What Do You Know About Plants?

- Students share what they know about plants and discuss what they would like to know.
- The teacher evaluates students' prior knowledge of plants.
- Students practice observation and prediction skills.

LESSON TWO

What is Inside a Seed?

- Students observe how the bean seed changed after being soaked in water overnight.
- Students record their observations.

- Students open the bean and observe inside.
- Students draw and label the parts of a bean seed.

LESSON THREE

Planting the Seeds

- Students collect and organize their own materials for planting.
- Students set up their planters with wicks, fertilizer, potting mix and seeds.

LESSON FOUR

Thinning and Transplanting

- Students discuss the purpose of thinning and transplanting.
- Students learn how to carry out these two tasks.

LESSON FIVE

How Does Your Plant Grow?

- Students learn how to measure their plants to the nearest centimeter.
- Students begin keeping records of their plant growth on a bar graph.

LESSON SIX

Observing: Leaves and Flower Buds

- Students observe two major developments: the true leaves and the flower buds.
- Students record their observations in their notebooks.
- Students review the life cycle of a plant through this stage of development.

LESSON SEVEN

Observing the growth spurt

- Students measure plant height in centimeters and record it on a graph every day for one week.
- Students predict how much their plants will grow each day.
- Students analyze their data on the growth spurt.

LESSON EIGHT

Why are bees important?

- Students share information about bees and raise questions about them.
- Students draw a picture of what they think a bee looks like.

LESSON NINE

Getting a Handle on Your Bee

- Students use a hand lens to observe dried bee.
- Students make bee sticks to be used as a tool for pollination.

LESSON TEN

Looking at Flowers

- Students observe details about a flower's anatomy and identify the major parts.
- Students learn more about the crucifer family.

LESSON ELEVEN

Pollinating Flowers

- Students use the bee sticks to cross-pollinate their plants.
- Students read more about the interdependence of bees and flowers.

LESSON TWELVE

Observing Pods

- Students observe the development of the fertilized pods between Day 17 and Day 35.
- Students record their observations by drawing, writing and graphing.

LESSON THIRTEEN

Making a *Brassica* Model

- Students apply skills they have learned to construct an accurate model of the *Brassica*.
- Students work together on a group project.

LESSON FOURTEEN

Making a Bee Model

- Students construct an accurate model of a bee.
- Students work together on a group project.

LESSON FIFTEEN

Interpreting Graphs

- Students interpret information on two different graphs.
- Students apply math skills to reading graphs.

LESSON SIXTEEN

Harvesting and Threshing the Seeds

- Students harvest and thresh the seeds
- Students count the seeds and compare that number with the original number of seeds planted (8) to determine their profit or loss.
- Students think about additional questions they have about plants and experiments that might help answer them.

Significant Task

POST UNIT ASSESSMENT

Overview: Students revisit their lists from lesson one, and review their science notebooks. They make suggestions for revising the first list and offer evidence to support their suggestions. They answer many of the questions on the second list and add new questions to it. These activities and discussions help students realize how much they have learned about plant growth and development.

Materials: Each student must have his/her student notebook, and the two class lists from Lesson 1 should be available to all students.

Procedure:

1. Students are told that they will now discuss and reflect on some of the questions they discussed at the beginning of the unit.
2. Display the two class lists from Lesson 1. Ask students to first focus on the part of the list entitled: What We Know About Plants.
 - a. Ask students to identify statements on the list that they now know to be true without a doubt.
 - b. Ask students to identify statements on the list that need correcting or improvement. Again, have students give reasons for their suggestions.
3. Now direct student attention to the list entitled: What We Would Like to Know about Plants.”
 - a. Tell students to go through the list and pick the questions they can now answer. Have them support their ideas with evidence from the unit experiments.
 - b. Ask students how they might find answers to the questions that they are still unable to answer.
4. Ask students whether they have any new questions and encourage them to read and research to answer them.
5. Ask students to summarize in their notebooks some of the important things they have learned about plant growth and development. Encourage them to illustrate their comments with specific examples whenever possible.
6. Ask students to write a few sentences about good record keeping and observations. Urge them to use examples of how they used these strategies in their unit investigations.

Rubric: (use if desired)

Name: _____

Teacher: _____

Date : _____

Title of Work: _____

	Criteria				Points
	1	2	3	4	
Final Assessment: Plant Growth and Development	Student responses show little to no understanding of main concepts regarding plant survival and adaptation; responses are unclear and do not cite examples to support ideas.	Student responses show some understanding of main concepts regarding plant survival and adaptation; responses may be unclear and cite few examples to support ideas.	Student responses adequate understanding of main concepts regarding plant survival and adaptation; responses are clear and cite some examples to support ideas.	Student responses show mastery of concepts taught. Students use vocabulary properly, show understanding of plant adaptation as well as how plants meet their needs. Students also show ability to cite examples to support points of view and can verbalize understandings clearly.	_____
				Total---->	_____

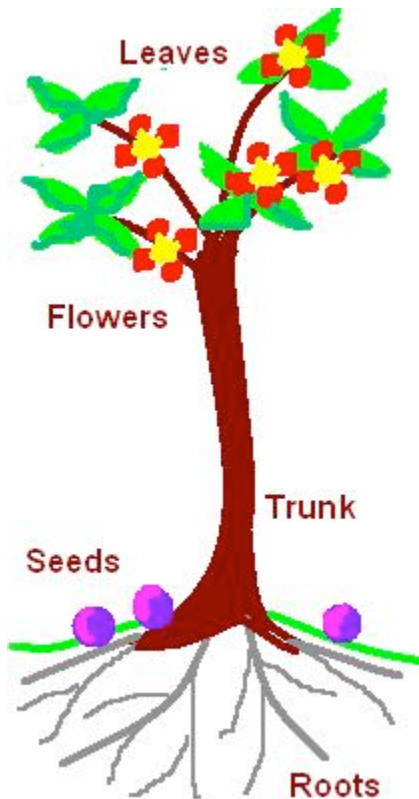
Teacher Comments:

Common Misconceptions:

- Plants, fungi, eggs and seeds are not living.
- Plants obtain their energy directly from the sun.
- Sunlight is composed of molecules.
- Plants produce oxygen for our benefit.
- Plants absorb water through their leaves.

- Sunlight is a food.
- Sunlight is “consumed” in photosynthesis.

Sample Literacy Component



<http://www.world-builders.org>

All About Plants!

1 - Plants can be divided into two types: flowering plants and non-flowering plants. There are many flowering plants such as the rose, daisy, tulip and others. Non-flowering plants include coniferous trees such as the pine and spruce.

2 - Both types of plants follow a similar process of growth. Plants have both male pollen and female parts of the flower. Pollen from a plant is carried by the wind, or by insects, to fertilize the female parts of

the plant. Once fertilized, a cone or seed is produced that is capable of creating a new plant.

3 - Many plants, such as grass, weeds and even large pine trees, rely on the wind for pollination. The pollen is small and light, allowing it to be blown by the wind. The pollen lands on other plants and fertilizes them.

4 - Worker bees collect pollen and nectar from flowers in order to create the wax they need to build their hive. The queen bee creates the wax in her abdomen, or lower half, which she uses to build chambers or cells where she lays her eggs.

5 - In the process of building their hive, bees play a very important role pollinating flowers and plants. As a bee gathers nectar from a flower, tiny grains of pollen will stick to its hairy legs and body. When the bee flies to another flower for nectar, the pollen on its legs and body brushes off to help fertilize the flower.

6 - Since most plants cannot travel from place to place, they rely on animals and the wind to scatter their seeds. Seeds come in a wide variety of sizes, from small flower seeds to large acorn seeds and pine cones.

7 - Many plants and flowers reproduce from bulbs. The parent plant produces buds or bulbs that split off and start to grow a new plant.

8 - Plants are very important to our world. Without them, we would not have food, shelter, furniture, clothing and many other things, including the paper you are reading from right now! Plants are like the glue that holds the world together!

From

<http://www.kidport.com/RefLib/Science/HowPlantsGrow/HowPlantsGrow.htm#PlantsFlowers>

Sample Literacy Component continues on next page

Strand Questions for “All About Plants”

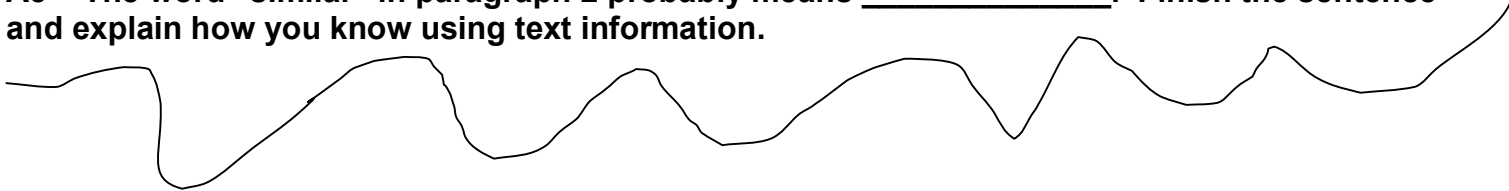
A1 – What is this article mainly about?

A2 – The third paragraph is mostly a description of _____? Finish the sentence and explain how you know using details from the text.

A3 – Explain how plants become pollinated by bees. Use details from the article to support your answer.

A4 – If the author added another paragraph to the end of this article, what might it be about? Use details from the text to support your answer.

A5 – The word “similar” in paragraph 2 probably means _____. Finish the sentence and explain how you know using text information.



B1 – Paragraph 1 contains:

- a) an opinion b) a definition c) a comparison d) a description

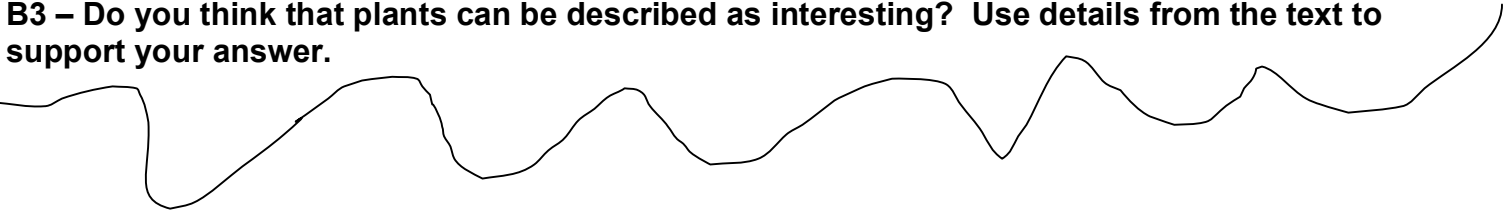
B1 –

The chart below shows facts about wind and bee pollination. What is one more difference between wind and bee pollination? Complete the chart.

<u>WIND POLLINATION</u>	<u>BEE POLLINATION</u>
Depends on weather conditions	Involves another living creature
	Pollen is carried by the bee on his legs

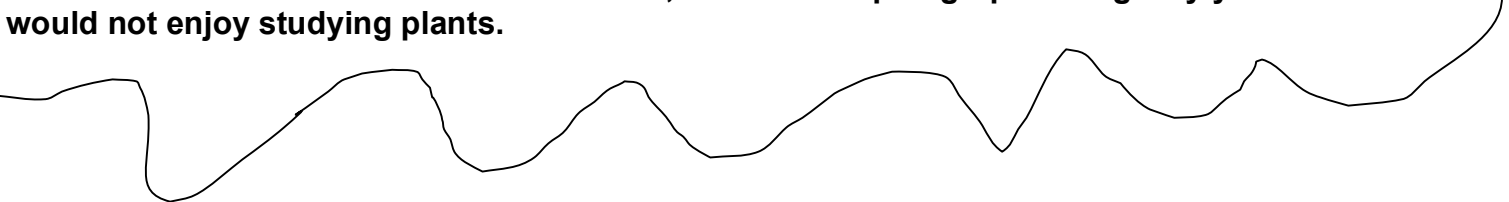
B2 – Why did the author include paragraph 8?

B3 – Do you think that plants can be described as interesting? Use details from the text to support your answer.



C1 – Think about a job that someone has. Tell how that job is like the job of the bee in this article.

C2 – Based on the information in the article, write a brief paragraph telling why you would or would not enjoy studying plants.



D1 – A simile is a comparison between two unlike things using like or as. Choose a simile from this article and explain why the author used this simile.

D2 – Using information from the article, write a journal entry that might appear in the diary of a plant scientist after a typical day working with plants.

D3 – Using information from the text, explain how the author shows that plants are important to us.

RESOURCES

Web Sites

http://www.ubcbotanicalgarden.org/potd/flowering_plants/
<http://plants.usda.gov/>
<http://www.geocities.com/EnchantedForest/Glade/3313/>
<http://library.thinkquest.org/3608/plantsgrow.html>
<http://school.discovery.com/lessonplans/programs/allaboutplants/>
<http://www.mbgnet.net/bioplants/>
<http://www.picadome.fcps.net/lab/currl/plants/default.htm>

Literacy Books

The Most Beautiful Roof in the World by K. Lasky
Gardening with Kids by Sharon MacLatchie
Susannah's Garden by Debbie Macomber
Strawberry Girl by Lois Lenski
Garden by Robert Maass
One Bean by Anne Rockwell
A Log's Life by Wendy Pfeffer
Over Under in the Garden: An Alphabet Book by Pat Schories
Have You Seen Trees? by Joanne Oppenheim
Watch them Grow by Linda Martin

Extension Activities

- Developing a class garden
- Creating a school compost bin

Field trips

- Edgerton Park Greenhouse
- Local Nursery
- Outside the school area to plant seeds

Links to United Streaming

[How Plants Grow](#) (19:00)
[Importance of Plants, The](#) (13:00)
[Peep and the Big Wide World: Peep Plants a Seed/ The Root Problem](#) (22:02)

[Debbie Greenthumb: How Plants Grow](#) (12:59)
[Debbie Greenthumb: Plants Can Be Found Everywhere](#) (13:50)
[Debbie Greenthumb: The Importance of Plants To Our World](#) (13:46)
[Debbie Greenthumb: Where Plants Come From](#) (12:54)
[Plant Parts and Their Uses](#) (12:00)
[Plants: A First Look](#) (17:00)
[How Plants Grow](#) (19:00)
[Plant Habitats Around the World](#) (22:00)
[Plant Lifecycles](#) (20:00)
[I SPY the Clouds Roll By](#) (12:33)
[Let's Explore: In The Woods](#) (19:00)

[Desert Habitats](#) (21:00)

[Peep and the Big Wide World: Spring Thing/Springy Thingy](#) (22:01)

[Blue Dragon, The: Roots and Fruits](#) (13:10)

[Play and Discover with Digger and Splat: Green and Growing](#) (17:37)

[Play and Discover with Digger and Splat: Growing Up](#) (16:10)