

Plants in Our World

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About **Plants in Our World**

DeltaScienceModules, THIRD EDITION

Students explore the importance of plants and how they function. From corn to cotton to cork, plant products are varied and valuable. This module invites students to investigate *Plants in Our World* from the roots up. First, they focus on the tissue system that transports water and nutrients within the plant. Next, controlled experiments with seedlings confirm that plants need light and water. Students use three chemical indicators as they test plants for carbon dioxide, starch, and chlorophyll. Through these investigations, they determine how plants give off and take in gases, and produce and store food. Students express their findings in equations for respiration, transpiration, and photosynthesis. To close, students compile a comprehensive list of the ways people use plants and plant-based materials.

In the Delta Science Reader *Plants in Our World*, students find out about the wide variety of living things that make up the plant kingdom, beginning with the characteristics that define an organism as a plant. They read about how plants make food, get energy, respond to their environments, and reproduce. Then they compare and contrast the main categories of plants: nonvascular (such as mosses), seedless vascular (such as ferns), and seed plants (such as pine trees, peas, and roses). Next, students are introduced to ethnobotanists, scientists who study the amazing ways that people use local plants. Finally, they find out how seeds get from a parent plant to places with optimum conditions for the new plant to thrive.

Overview Chart for Hands-on Activities

Hands-on Activity	Student Objectives
1 Plant and Animal Cells <i>page 13</i>	<ul style="list-style-type: none"> • recognize the hierarchical structure of the classification of organisms • identify the major parts of plant and animal cells • distinguish between plant and animal cells • observe microslide images of real plant and animal cells • speculate as to the function of cell walls and chloroplasts in plant cells
2 Stems: Structure and Function <i>page 27</i>	<ul style="list-style-type: none"> • identify the functions of the xylem and phloem • observe the ability of xylem tissue to transport water and dissolved materials through a plant • observe microslide images of plant stems
3 What Do Plants Need? <i>page 35</i>	<ul style="list-style-type: none"> • compare the growth of seedlings in light and dark conditions • compare the growth of seedlings receiving various amounts of water • observe that plants require light and water to grow • observe the growth of stems toward light
4 Stomata and Transpiration <i>page 41</i>	<ul style="list-style-type: none"> • observe stomata on the underside of a leaf • observe transpiration through leaves • discover that blocking stomata inhibits transpiration • relate the transpiration of water from leaves to the uptake of water from the soil
5 Plants Take In Gas <i>page 49</i>	<ul style="list-style-type: none"> • explore the use of bromthymol blue as an indicator for carbon dioxide • set up an experiment to compare the intake of carbon dioxide by green plants in light and dark conditions • conclude that, in the presence of light, green plants take in carbon dioxide
6 Plants Give Off Gas <i>page 57</i>	<ul style="list-style-type: none"> • observe the production of gas by a green plant • compare the production of gas by plants in light and dark conditions • identify the gas produced by a green plant as oxygen • conclude that, in the presence of light, green plants give off oxygen
7 Paper Chromatography <i>page 63</i>	<ul style="list-style-type: none"> • separate the pigments in black ink using paper chromatography • separate the pigments in extracts of anacharis and onion using paper chromatography • compare anacharis leaf cells and onion skin cells • identify the greenish pigment in anacharis leaves as chlorophyll
8 Plants Make Food <i>page 73</i>	<ul style="list-style-type: none"> • use an indicator to test for starch • demonstrate that green plants produce glucose, which is stored as starch • demonstrate that without light, green plants do not produce glucose
9 Chlorophyll and Food Production <i>page 81</i>	<ul style="list-style-type: none"> • demonstrate that glucose is only produced when chlorophyll is present • infer from previous experiments which substances plants take in and give off during photosynthesis • write the chemical equation for photosynthesis
10 Respiration in Plants <i>page 87</i>	<ul style="list-style-type: none"> • observe that green plants turn bromthymol blue solution yellow in the dark • conclude that, in addition to oxygen, plants produce carbon dioxide • compare respiration to photosynthesis
11 Plants Store Food <i>page 95</i>	<ul style="list-style-type: none"> • identify plant foods that contain starch • identify plant foods that contain sugar • discuss the importance of plants as the source of all food on Earth
12 The Uses of Plants <i>page 103</i>	<ul style="list-style-type: none"> • list a variety of products made from plant materials and categorize them according to use • build a model structure out of plant materials • discuss the importance of plants to our lives
Assessment <i>page 109</i>	<ul style="list-style-type: none"> • See page 109.

Process Skills	Vocabulary	Delta Science Reader
compare, classify, observe, define based on observations, infer, conclude	cell, cell membrane, cell wall, chloroplast, class, classification, cytoplasm, division, family, genus, kingdom, nucleus, order, phylum, species	pages 2–3, 23
communicate; predict; collect, record, and interpret data; conclude; infer; observe	phloem, stem, xylem	pages 5, 11, 14–15
communicate, predict, record data, observe, analyze data, conclude	phototropism	pages 2, 6
observe, communicate, compare, display data, predict, conclude	guard cells, leaf, stoma, stomata, transpiration	pages 5, 14
observe; communicate; investigate; collect, record, and interpret data; conclude	bromthymol blue (BTB), carbon dioxide, indicator	pages 2–3
communicate, investigate, conclude	oxygen	pages 2–4
communicate, observe, investigate, display data, compare, infer	chlorophyll, chromatogram, paper chromatography, pigment	pages 3–4
communicate; investigate; collect, record, and interpret data; define based on observations	glucose, starch	page 3
communicate, investigate, record data, compare	minerals, photosynthesis	pages 3–5
hypothesize; experiment; observe; collect, record, and interpret data; conclude; compare; infer	respiration	pages 3–4
communicate; investigate; collect, record, and analyze data	carbohydrates	pages 2–4, 21
compare, classify, make and use models, conclude		page 21

See the following page for the Delta Science Reader Overview Chart.

Overview Chart for Delta Science Reader

Plants in Our World

Selections	Vocabulary	Related Activity
Think About...		
What Is a Plant? <i>page 2</i>	cell wall, chloroplast, consumer, division, genus, kingdom, plant, producer, species	Activities 1, 11
How Do Plants Grow, Survive, and Reproduce? <i>pages 3–8</i> <ul style="list-style-type: none"> • Making Food and Getting Energy • Transporting Materials • Responding to Surroundings • Producing Offspring 	accessory pigment, asexual reproduction, chlorophyll, chromosome, diploid, dormancy, egg, embryo, fertilization, gamete, gametophyte, grafting, gravitropism, haploid, layering, nonvascular plant, offspring, photosynthesis, phototropism, pigment, regeneration, respiration, rhizome, runner, sexual reproduction, sperm, spore, sporophyte, thigmotropism, transpiration, tropism, vascular plant, zygote	Activities 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Nonvascular Plants <i>pages 9–10</i> <ul style="list-style-type: none"> • Characteristics • Types: Mosses, Liverworts, Hornworts • Reproduction 	rhizoid	
Vascular Plants <i>pages 11–20</i> <p>Seedless Vascular Plants <i>pages 11–12</i></p> <ul style="list-style-type: none"> • Characteristics • Types: Whisk Ferns, True Ferns, Club Mosses, Horsetails • Reproduction <p>Seed Plants <i>pages 13–20</i></p> <ul style="list-style-type: none"> • Characteristics • Gymnosperms Types: Cycads, Ginkgos, Gnetophytes, Conifers Reproduction • Angiosperms Types: Monocots and Dicots Reproduction 	frond, phloem, vascular bundle, xylem angiosperm, bark, cambium, cone, cork, cork cambium, cotyledon, dicot, flower, fruit, germination, gymnosperm, leaf, monocot, ovary, ovule, petal, pistil, pith, pollen, pollination, root, seed, seed coat, sepal, stamen	Activities 2, 4
People in Science		
<ul style="list-style-type: none"> • Ethnobotanists: People, Plants, and Medicine <i>page 21</i> 	ethnobotanist	Activities 11, 12
Did You Know?		
<ul style="list-style-type: none"> • About Seed Dispersal <i>page 22</i> 		

Teaching suggestions for the Delta Science Reader are in a 32-page booklet included with this guide.

MATERIALS LIST

Plants in Our World

Quantity	Description	Quantity	Description
5	alcohol, ethyl, 1 pt*	1	Teacher's Guide
1	aluminum foil*	8	Delta Science Readers
16	bags, reclosable, plastic, 15 × 15 cm*	1	Living Material Card* Shipment includes: 36 anacharis/ <i>Elodea</i> sprigs
1	baking soda, 1 lb*	TEACHER-PROVIDED ITEMS	
1	beaker, 800-mL	8	celery, stalks*
2	Benedict's solution, 100 mL*	1	clock, with second hand
3	BTB solution, 100 mL*	1	clothing, cotton
8	clamps, test tube	32	colored pencils, green
8	containers, plastic, 32-oz	8	containers, 1-L
1	cornstarch, 4 oz*	1	electric hot plate
16	cups, plastic, 1-oz	4-5	geranium plants*
16	cups, plastic, 9-oz	8	glue, bottles*
1	Delta Science Dictionary	1	knife, sharp
1	Delta Science Dictionary Copymaster Booklet	1	light source, artificial
32	flower pots	1	mitt, oven, cloth
1	food coloring, red, 1 oz*	2	onions*
8	funnels	1	overhead projector
8	knives, plastic	-	paper, scrap
6	Lugol's solution, 100 mL*	-	paper towels*
4	microslide strips	-	paper, white
4	microslide viewers	8	pens, black, felt-tip, nonpermanent
1	mortar and pestle	-	pictures, assorted plant and animal cells
1	paper, blotter*	-	pictures, assorted plants
2	paper clips, p/100*	-	plant-based building materials*
8	petri dishes	-	plant foods containing starch and sugar*
2	petroleum jelly, 1 oz*	-	plant reference materials
16	pipettes	1	ruler, metric
3	posters, resource	32	safety goggles
1	sand, 1 oz*	1	saucepan, medium
1	seeds, mung bean, 10 oz*	8	scissors
2	soil, potting, 4 qt*	1	variegated plant*
8	spoons, plastic	1	water, bottled, spring, 1 gal*
50	straws, drinking*	-	water, tap*
1	string, 75 m, roll*	1	wood, piece
3	tape, masking, rolls*	* = consumable item † = in separate box	
1	tea bag		
8	test tubes		
1	transparency, Animal Cell		
1	transparency, Plant Cell		
4	trays, plastic		
8	tweezers		
33	vials, plastic, with caps		

ACTIVITY SUMMARY

This Delta Science Module introduces students to the world of plants. Through a series of 12 activities, students discover what plants need, what they produce, and why they are important to life on Earth.

ACTIVITY 1 Students are introduced to the scientific classification system and use the system to classify a plant of their choosing, identifying it by scientific name. They also observe pictures, transparencies, and microslide images of plant and animal cells and identify their major parts. They note similarities and differences and speculate as to the function of cell walls and chloroplasts.

ACTIVITY 2 Students are introduced to two types of vascular tissue in plants: xylem and phloem. They learn the functions of these tissues and then observe the transport of water and dissolved materials in the xylem of celery. They conclude the activity by locating the phloem and xylem in microslide images of plant stems.

ACTIVITY 3 Students demonstrate that plants require light and water by comparing the growth of seedlings in light and dark, and wet and dry conditions. They also observe and discuss phototropism.

ACTIVITY 4 Students experiment with transpiration. They conclude that water exits a land plant through tiny holes in the leaves, called stomata, and they link transpiration to the uptake of water from the soil.

ACTIVITY 5 Students demonstrate that in the presence of light, green plants take in carbon dioxide. Using bromthymol blue (BTB) as an indicator for the presence of carbon dioxide, they compare the intake of carbon dioxide by anacharis/*Elodea* plants, or sprigs, in light and dark conditions.

ACTIVITY 6 Students demonstrate that in the presence of light, green plants produce oxygen.

They also compare the production of oxygen gas by plants in light and dark conditions.

ACTIVITY 7 Students use the technique of paper chromatography to separate pigments contained in extracts of anacharis leaves and onion bulbs and identify the greenish pigment in anacharis as chlorophyll. Then they compare microslide images of the cells of anacharis leaves and onion bulbs and conclude that chlorophyll is located in the chloroplasts.

ACTIVITY 8 Students use Lugol's solution, an indicator for the presence of starch, to demonstrate that plants produce food. They compare the production of starch by green plants in light and dark conditions and conclude that light is necessary for starch to be produced.

ACTIVITY 9 Students demonstrate that in addition to light, chlorophyll is also necessary for starch production. They are introduced to the concept of photosynthesis and apply what they now know about the substances plants take in and give off to write an equation that represents this process.

ACTIVITY 10 Students use BTB to show that green plants give off as well as take in carbon dioxide. They learn that in addition to photosynthesis, plants undergo respiration to release the energy stored in the food they produce. Students then compare the two processes and note that their chemical equations are the reverse of each other.

ACTIVITY 11 Students investigate the variety of plants that contain carbohydrates by performing starch and sugar tests on plant foods. They discuss the importance of plants as the source of all food on Earth.

ACTIVITY 12 Students explore the variety of ways in which people use plants and plant-based materials.