National Aeronautics and
Space Administration

Langley Research Center
Hampton, VA 23681-2199

Educational Product	
Educators	Grades 3-5

EG-2004-03-06-LARC

The NASA SCI Files™
The Case of the Prize-Winning Plants

A Lesson Guide with Activities in Mathematics, Science, and Technology

Please Note: Our name has changed! The NASA "Why" Files™ is now the NASA SCIence Files™ and is also known as the NASA SCI Files™.

http://scifiles.larc.nasa.gov

The Case of the Prize-Winning Plants lesson guide is available in electronic format through NASA Spacelink - one of NASA's electronic resources specifically developed for the educational community. This publication and other educational products may be accessed at the following address: **http://spacelink.nasa.gov/products**

A PDF version of the lesson guide for NASA SCI Files™ can be found at the NASA SCI Files™ web site: **http://scifiles.larc.nasa.gov**

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The NASA SCI Files™ The Case of the Prize-Winning Plants

A Lesson Guide with Activities in Mathematics, Science, and Technology

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Production of the NASA SCI Files™ is made possible by the generous support provided by the Society of Women Engineers (SWE); Busch Gardens, Williamsburg; Hampton City Public Schools; and the NASA Langley Research Center's Aerospace Vehicle Systems Technology Program Office.

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Registered users of the NASA SCI Files™ may request a Society of Women Engineers (SWE) classroom mentor. For more information or to request a mentor, e-mail **kimlien.vu@swe.org**

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Program Overview

In *The Case of the Prize-Winning Plants*, Tony, the financial wizard of the tree house detectives is interested in investing in a fertilizer company. He agrees that he had better check out the fertilizer before investing and decides that the best way to do that is to grow a plant and actually use the fertilizer. To prove beyond a shadow of a doubt that his fertilizer is the best, Tony also decides to enter his plant in the Virginia State Fair's plant competition, sure that it will win.

Kali suggests that Tony grow a pineapple plant. Even though a pineapple plant is a bit unusual and not native to the Virginia area, Tony agrees. He soon realizes that they must learn a lot more about plants if they are going to successfully grow a pineapple plant in the Virginia climate. Kali promises to help but explains that she will be gone for a couple of weeks attending an ecology tour in Hawaii.

When Kali arrives in Hawaii, her first stop is the rain forest on the island of Hawaii to visit Ms. Rhonda Loh, a park ranger at Hawaii Volcanoes National Park. Ms. Loh explains how plants are classified and discusses the importance of rain forests throughout the world. Meanwhile, back in Virginia, the tree house detectives visit Dr. D to learn about plants' basic needs and the parts of plants.

The tree house detectives decide that they need to learn more about the basic needs of plants, and Bianca visits Ms. Lori Jones at NASA Kennedy Space Center. Ms. Jones explains how plants need and use carbon dioxide (CO_2) and shows Bianca the CO_2 lab. From there, Bianca visits Dr. Gregory Goins, who explains how plants use the energy from light for photosynthesis. Back in the tree house, Jacob is trying out his own CO_2 experiment. After realizing that he might need some "professional" help, the tree house detectives contact Ms. Leeper's class at Pearl Harbor Kai Elementary School in Honolulu, Hawaii. The class is conducting experiments with plants, light, and CO_2—just what the detectives need.

The detectives read that volcanic soil is best for growing pineapples, so they ask Kali to visit Dr. Don Swanson at the Hawaiian Volcano Observatory on the island of Hawaii. Kali not only learns about shield volcanoes and hot spots, but Dr. Swanson also explains that soil is formed from the weathering of rock and that basalt rock is rich in the minerals that plants need to grow well. Unable to locate volcanic soil, the detectives decide to dial up Dr. Susan Steinberg at NASA Johnson Space Center to learn about potting soil and how to grow a plant in a small pot. The next stop is Dr. D's for an explanation of how plants reproduce.

The tree house detectives finally think they have all the pieces put together when they discover that pineapples don't have seeds. They are confused and decide it is time for Kali to visit a pineapple expert. She heads for the Dole Pineapple Plantation on the island of Oahu to speak with Mr. Mark Takemoto. Now the tree house detectives are truly ready to grow a pineapple, and they head to Dr. D for a wrap-up.

National Science Standards (Grades K – 4)

Standard	Segment 1	Segment 2	Segment 3	Segment 4
Unifying Concepts and Processes				
Systems, orders, and organization	✖	✖		
Evidence, models, and explanations	✖	✖	✖	✖
Change, constancy, and measurement	✖	✖	✖	✖
Form and Function		✖		
Science as Inquiry (A)				
Abilities necessary to do scientific inquiry	✖	✖	✖	✖
Understanding scientific inquiry	✖	✖	✖	✖
Physical Science (B)				
Light, heat, electricity, and magnetism		✖		
Life Science (C)				
Characteristics of Organisms	✖	✖	✖	✖
Life cycles of organisms	✖	✖	✖	✖
Organisms and their environments	✖	✖	✖	✖
Earth and Space Science (D)				
Properties of Earth materials			✖	
Changes in Earth and sky			✖	
Science in Personal and Social Perspective (F)				
Abilities of technological design	✖	✖	✖	✖
Understanding science and technology	✖	✖	✖	✖
Abilities to distinguish between natural objects and objects made by humans	✖	✖	✖	✖
History and Nature of Science (G)				
Science as a human endeavor	✖	✖	✖	✖

National Science Standards (Grades 5 – 8)

Standard	Segment 1	Segment 2	Segment 3	Segment 4
Unifying Concepts and Processes				
Systems, order, and organization	✖	✖		
Evidence, models, and explanations	✖	✖	✖	✖
Change, constancy, and measurement	✖	✖	✖	✖
Form and function		✖		
Science as Inquiry (Content Standard A)				
Abilities necessary to do scientific inquiry	✖	✖	✖	✖
Understanding scientific inquiry	✖	✖	✖	✖
Physical Science (B)				
Transfer of energy	✖	✖	✖	✖
Life Science (C)				
Structure and function in living systems	✖			
Reproduction and heredity			✖	
Regulation and behavior	✖	✖	✖	✖
Populations and ecosystems	✖			✖
Diversity and adaptations of organisms	✖	✖	✖	✖
Earth and Space Science (D)				
Structure of the Earth system			✖	
Earth's history			✖	
Science and Technology (Content Standard E)				
Abilities of technological design	✖	✖	✖	✖
Understanding science and technology	✖	✖	✖	✖
Science in Personal and Social Perspectives (Content Standard F)				
Science and technology in society	✖	✖	✖	✖
History and Nature of Science (Content Standard G)				
Science as a human endeavor	✖	✖	✖	✖
Nature of science	✖	✖	✖	✖

National Mathematics Standards (Grades 3 – 5)

Standard	Segment 1	Segment 2	Segment 3	Segment 4
Number and Operations				
Understand numbers, ways of representing numbers, relationships among numbers, and number systems.	✖			✖
Geometry				
Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	✖			
Measurement				
Understand measurable attributes of objects and the units, systems, and processes of measurement.	✖	✖	✖	✖
Apply appropriate techniques, tools, and formulas to determine measurements.	✖	✖	✖	✖
Data Analysis and Probability				
Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.		✖		
Select and use appropriate statistical methods to analyze data.		✖		
Develop and evaluate inferences and predictions that are based on data.		✖		
Problem Solving				
Build new mathematical knowledge through problem solving.	✖	✖		✖
Solve problems that arise in mathematics and in other contexts.	✖	✖		
Apply and adapt a variety of appropriate strategies to solve problems.	✖	✖		
Monitor and reflect on the process of mathematical problem solving.		✖		
Communication				
Organize and consolidate students' mathematical thinking through communication.		✖		
Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.		✖		
Analyze and evaluate the mathematical thinking and strategies of others.		✖		
Connections				
Recognize and apply mathematics in contexts outside of mathematics.		✖		
Representation				
Create and use representations to organize, record, and communicate mathematical ideas.		✖		
Use representations to model and interpret physical, social, and mathematical phenomena.		✖		

International Technology Education Association Standards (ITEA Standards for Technology Literacy, Grades 3 – 5)

Standard	Segment 1	Segment 2	Segment 3	Segment 4
Nature of Technology				
Standard 1: Students will develop an understanding of the characteristics and scope of technology.	✖	✖	✖	✖
Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	✖	✖	✖	✖
The Designed World				
Standard 17: Students will develop an understanding of and be able to select and use information and communication technologies.	✖	✖	✖	✖

National Geography Standards, Grades 3 – 5

Standard	Segment 1	Segment 2	Segment 3	Segment 4
The World in Spatial Terms				
How to use maps and other graphic representations, tools, and technologies to acquire process and report information from a spatial perspective	✖		✖	
How to use mental maps to organize information about people, places, and environments in a spatial context	✖			
How to analyze the spatial organizations of people, places, and environments on Earth's surface	✖			
Physical Systems				
The physical process that shapes the patterns of Earth's surface	✖		✖	
The characteristics and spatial distribution of ecosystems on Earth's surface	✖			
Environment and Society				
How human actions modify the physical environment	✖	✖		
How physical systems affect human systems	✖	✖		

National Technology Standards (ISTE National Educational Technology Standards, Grades 3 – 5)

Standard	Segment 1	Segment 2	Segment 3	Segment 4
Basic Operations and Concepts				
Use keyboards and other common input and output devices efficiently and effectively.	✖	✖	✖	✖
Discuss common uses of technology in daily life and the advantages and disadvantages those uses provide.	✖	✖	✖	✖
Technology Productivity Tools				
Use general purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum.	✖	✖	✖	✖
Use technology tools for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom.	✖	✖	✖	✖
Technology Communication Tools				
Use technology tools for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom.	✖	✖	✖	✖
Use telecommunication efficiently and effectively to access remote information, communicate with others in support of direct and independent learning, and pursue personal interests.	✖	✖	✖	✖
Use telecommunication and online resources to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom.	✖	✖	✖	✖
Technology Research Tools				
Use telecommunication and online resources to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom.	✖	✖	✖	✖
Use technology resources for problem solving, self-directed learning, and extended learning activities.	✖	✖	✖	✖
Determine when technology is useful and select the appropriate tools and technology resources to address a variety of tasks and problems.	✖	✖	✖	✖
Technology Problem-Solving and Decision-Making Tools				
Use technology resources for problem solving, self-directed learning, and extended learning activities.	✖	✖	✖	✖
Determine when technology is useful and select the appropriate tools and technology resources to address a variety of tasks and problems.	✖	✖	✖	✖

The NASA SCI Files™
The Case of the
Prize-Winning Plants

Segment 1

Tony is eager to win the plant competition at the state fair to prove that his fertilizer is "top of the line." After some debate, the tree house detectives and Tony decide to grow a pineapple plant, hoping that such an unusual plant will guarantee a win. However, the pineapple is not indigenous to Virginia, and they soon learn that it isn't as easy as they thought. Kali has to leave to go on an eco tour in Hawaii but promises to help. Her first stop is Hawaii Volcanoes National Park to visit with Ms. Loh in the rain forest on the Big Island of Hawaii. Ms. Loh helps the tree house detectives learn how plants are classified and why rain forests are important to our global climate. Back home, the detectives visit Dr. D in his lab to learn more about the basic parts of a plant.

Objectives

The student will

- understand how plants are classified.
- compare vascular and nonvascular plants.
- recognize the importance of rain forests.
- identify the basic parts of a plant.
- identify the basic needs of plants.

Vocabulary

basic needs—the essential needs of a plant or animal, such as food, air, water, and shelter

binomial—a biological species name consisting of two terms according to the system of binomial nomenclature

bromeliad—a tropical American plant with fleshy, funnel shaped leaves that hold water

chloroplasts—a membranous sac (plastid) that contains chlorophyll and is the site of photosynthesis and starch formation in the cells of plants and algae

epidermis—a thin surface layer of protecting cells in seed plants and ferns

kingdom—one of the three primary divisions into which natural objects are classified – Animal Kingdom, Mineral Kingdom, and Plant Kingdom; a major category in the scientific classification of living things that ranks above the phylum and is the highest and broadest group

nonvascular—not having a tube or channel for carrying fluid (as the sap of a plant)

phloem—one of the two main types of tissues in the more highly developed plants. Phloem conducts dissolved food materials to all parts of the plant.

rain forest—an often tropical woodland with a high annual rainfall and very tall trees

temperate—having or associated with a climate that is usually mild

tropical—having a very hot climate that is often combined with a high degree of humidity

vascular—of or relating to a tube or channel for carrying fluid (as the sap of a plant) or to a system of such channels or tubes

xylem—plant tissue that carries water and dissolved minerals from the roots through the stem and leaves; functions also in support and storage, lies deeper inside the plant than the phloem, and usually makes up the woody parts (as of a plant stem)

Video Component

Implementation Strategy

The NASA SCI Files™ is designed to enhance and enrich existing curriculum. Two to three days of class time are suggested for each segment to fully use video, resources, activities, and web site.

Before Viewing

1. Before viewing Segment 1 of *The Case of the Prize-Winning Plants*, read the program overview to the students. List and discuss questions and preconceptions that students may have about plants and how they grow. Make a list of things that the tree house detectives might need to learn so they can grow a healthy plant.
2. Record a list of issues and questions that the students want answered in the program. Determine why it is important to define the problem before beginning. From this list, guide students to create a class or team list of three issues and four questions that will help them better understand the problem. To locate the following tools on the NASA SCI Files™ web site, select Educators from the menu bar, click on Tools, and then select Instructional Tools. You will find them listed under the Problem-Based Learning tab.

Problem Board—Printable form to create student or class K-W-L chart

Guiding Questions for Problem Solving—Questions for students to use while conducting research

Problem Log and Rubric—Students' printable log with the stages of the problem-solving process

Brainstorming Map—Graphic representation of key concepts and their relationships

The Scientific Method and Flowchart—Chart that describes the scientific method process

3. **Focus Questions**—These questions at the beginning of each segment help students focus on a reason for viewing. They can be printed ahead of time from the Educators area of the web site in the Activities/Worksheet section under Worksheets for the current episode. Students should copy these questions into their science journals prior to viewing the program. Encourage students to take notes while viewing the program to help them answer the questions. An icon will appear when the answer is near.
4. **"What's Up?" Questions**—These questions at the end of the segment help students predict what actions the tree house detectives should take next in the investigative process and how the information learned will affect the case. They can be printed by selecting Educators on the web site in the Activities/Worksheet section under Worksheets for the current episode.

View Segment 1 of the Video

For optimal educational benefit, view *The Case of the Prize-Winning Plants* in 15-minute segments and not in its entirety. If you are watching a taped copy of the program, you may want to stop the video when the Focus Question icon appears to allow students time to answer the question.

After Viewing

1. Have students reflect on the "What's Up?" Questions asked at the end of the segment.
2. Discuss the Focus Questions.
3. Students should work in groups or as a class to discuss and list what they know about plants, how plants are classified, and the basic parts of a plant. Have the students conduct research on the basic needs of plants. Brainstorm for ideas of what plants need to grow and be healthy. As a class, reach a consensus on what additional information is needed. Have the students conduct independent research or provide them with the information needed.
4. Have the students complete Action Plans, which can be printed from the Educators area or the tree house Problem Board area in the Problem-Solving Tools section of the web site for the current online investigation. Students should then conduct independent or group research by using books and Internet sites noted in the Research Rack section of the Problem Board in the Tree House. Educators can also search for resources by topic, episode, and media type under the Educators main menu option Resources.
5. Choose activities from this Educator Guide and the web site to reinforce concepts discussed in the segment. The variety of activities is designed to enrich and enhance your curriculum. Activities may also be used to help students "solve" the problem along with the tree house detectives.
6. Have the students work individually, in pairs, or in small groups on the problem-based learning (PBL) activity on the NASA SCI Files™ web site. To locate the PBL activity, click on Tree House and then the Problem Board. Choose the 2003–2004 Season and click on "Runaway Runoff."
   - To begin the PBL activity, read the scenario (Here's the Situation) to the students.
   - Read and discuss the various roles involved in the investigation.
   - Print the criteria for the investigation and distribute.
   - Have students begin their investigation by using the Research Rack and the Problem-Solving Tools located on the bottom menu bar for the PBL activity. The Research Rack is also located in the Tree House.
7. Having students reflect in their journals what they have learned from this segment and from their own experimentation and research is one way to assess student progress. In the beginning, students may have difficulty reflecting. To help them, ask specific questions that are related to the concepts.

Careers

botanist
conservationist
ecologist
forester
park ranger
plant taxonomist

8. Have students complete a Reflection Journal, which can be found in the Problem-Solving Tools section of the online PBL investigation or in the Instructional Tools section under Educators.
9. The NASA SCI Files™ web site provides educators with general and specific evaluation tools for cooperative learning, scientific investigation, and the problem-solving process.

Resources (additional resources located on web site)

Books

Berger, Melvin: *Does It Always Rain in the Rain Forest?* Scholastic, Inc., 2002, ISBN: 0439193834.

Blevins, Wiley: *Parts of a Plant*. Compass Point Books, 2003, ISBN: 0756505186.

Cherry, Lynn: *The Great Kapok Tree*. Bt Bound, 2001, ISBN: 0613285077.

Cole, Joanna: *The Magic School Bus Plants Seeds: A Book About How Living Things Grow*. Scholastic, 1995, ISBN: 0590222961.

Dunphy, Madeline: *Here is the Tropical Rainforest*. Hyperion Press, 1997, ISBN: 0786812125.

Olien, Rebecca: *Exploring Plants*. Scholastic, 1997, ASIN: 0590963724.

Osborne, Will and Ma: R*ain Forest (Magic Tree House Research Guide)*. Random House Books for Young Readers, 2001, ISBN: 0375813551.

Worth, Bonnie: *If I Ran the Rain Forest: All About Tropical Rain Forests*. Random House Books for Young Readers, 2003, ISBN: 0375810978.

Video

Jacobs, Larry and Bastien, Charles: *The Magic School Bus—In the Rainforest*. A Vision, 2003, ASIN: 1568328613.

Web Sites

The Great Plant Escape
Help Detective Leplant and his partners, Bud and Spout, unlock the amazing mysteries of plant life. This site offers six different "cases" students can solve as they learn all about plants in the process. The site is also offered in Spanish.
http://www.urbanext.uiuc.edu/gpe/index.html

Texas A&M University: "Kinder Garden"
An introduction to the many ways children can interact with plants and the outdoors.
http://aggie-horticulture.tamu.edu/kindergarden/kinder.htm

Fullerton Arboretum
Visit this site to learn more about the parts of a plant. There are games for students as well as word searches and crossword puzzles.
http://www.arboretum.fullerton.edu/educ/chld.asp

4-H Children's Garden at Michigan State
Magnificent site with views of 56 theme gardens for children. Theme gardens include the Crayon Color Garden, Perfume Garden, Pizza Garden, African American garden, Dinosaur Garden, Pond & Water Garden, and the Cereal Bowl Garden.
http://4hgarden.msu.edu/main.html

Missouri Botanical Garden: Tropical Rain Forests
Explore this site to learn about all the unusual plants of the various rain forests around the world and plan your own tropical feast!
http://mbgnet.mobot.org/sets/rforest/index.htm

Hawaii Volcanoes National Park
Visit this site to learn more about the park and the volcanoes that created the islands.
http://www.nps.gov/havo

Activities and Worksheets

In the Guide

Classic Classifying
Sort various objects and learn all about classification. 16

EXTRA! EXTRA! READ ALL ABOUT IT!
Write a story about the day you discovered a new species of plant. 17

Classy Plants
Cut out pictures from magazines and books to learn how plants are classified. 18

Tubes for the Move
Observe the movement of water through the vascular tubes of a celery stalk. 20

The Leafy Debate
Conduct a demonstration to observe how the loss of forests may change the climate. 21

Danger! Deforestation
Simulate the results of deforestation. 22

It's Raining in My Classroom
Create a facsimile of a tropical rain forest. 23

Plant Nomenclature
Make your own flashcards to learn the nomenclature and parts of a plant. 24

It's Basically Basic
Try this experiment to understand the basic needs of plants. 26

Answer Key
....27

On the Web

The Layers of the Rain Forest
Search the Internet and/or use reference materials to learn more about the layers of the rain forest.

Around the Word
Research the location of rain forests around the world.

Classic Classifying

Purpose

To understand how things are classified

Materials

index cards
sand samples *(may be obtained from sandboxes, rivers, beaches, hardware stores)*
wide, clear packing tape
hand lens or microscope
wire tea strainers or pieces of screen wire
empty plastic soda or water bottles
science journal

Background

You classify things every day. When you sort objects and put them in a specific place, that's classification. Think about your bedroom. Do you have a sock drawer, a drawer for pants and shirts, or a drawer for toys? What about the kitchen? Are the glasses all together or are they mixed in with the pots and pans? We classify things to organize them and better understand them.

Procedure

1. Place the box of assorted buttons on the table. Carefully examine the buttons and begin to group the buttons according to any characteristics you choose; for example, size, color, number of holes, or texture.
2. In your science journal, illustrate your groupings and explain why you grouped items in such a way.
3. Now look at the peanuts and group them according to external structure and characteristics.
4. Illustrate your groupings and explain.
5. Break open the shells and observe the internal characteristics of the peanut and regroup them.
6. Illustrate and explain the groupings.
7. Observe the plant leaves and group them according to structure and characteristics.
8. Try regrouping them according to alternate characteristics.
9. Illustrate and explain the groupings

.

Conclusion

1. Which group was the easiest to arrange? Why?
2. What are the common characteristics of peanuts? Do these characteristics make it easier or more difficult to classify them?

Extension

1. Brainstorm for ideas to classify other groups of living things such as pets, animals in the zoo, animals in the jungle, and so on.
2. Use a copy-paper box lid and cardboard strips to make a classification box with individual compartments of various sizes. Collect items from nature such as leaves, seeds, flowers, and so on and group them together in the individual compartments.

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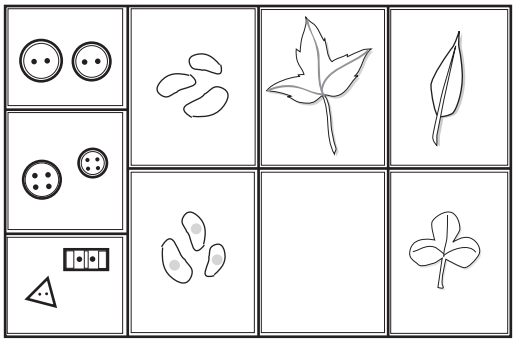


EXTRA! EXTRA! READ ALL ABOUT IT!

Using a newspaper writing style, write a story about the day you discovered a new species of plant.

Background

Newspaper stories are usually written in an inverted pyramid style. This style arranges the lead, the basic facts, and the conclusion first. As you move through the story, more and more detail and background are provided. This type of writing is best in newspapers for many reasons. First, in the days of the telegraph, it took a long time to transmit the entire news story, and starting with the main information ("The battle was lost; 940 killed") was more important than the details ("Our soldiers crossed the bridge at dawn with fresh supplies . . ."). Secondly, giving the important facts first made it easier for the layout people to fit the story into the available space because they could just cut off the end if necessary. Finally, the pyramid style also presented the important information first for readers who had less time to read. Newspaper readers should know at first glance what the story is about and what its emphasis is. When writing newspaper articles, be sure to answer the five Ws and an H: Who, What, Where, When, Why, and How.

EXTRA! EXTRA!
READ ALL ABOUT IT!

Classy Plants

Purpose

To become familiar with how plants are classified

Background

The plant kingdom is classified into major groups called divisions. A division is the same as a phylum in other kingdoms. Another way to group plants is as vascular or nonvascular plants. Vascular plants have tube-like structures that carry water, nutrients, and other substances throughout the plant. Nonvascular plants do not have these tube-like structures and use other ways to move water and substances.

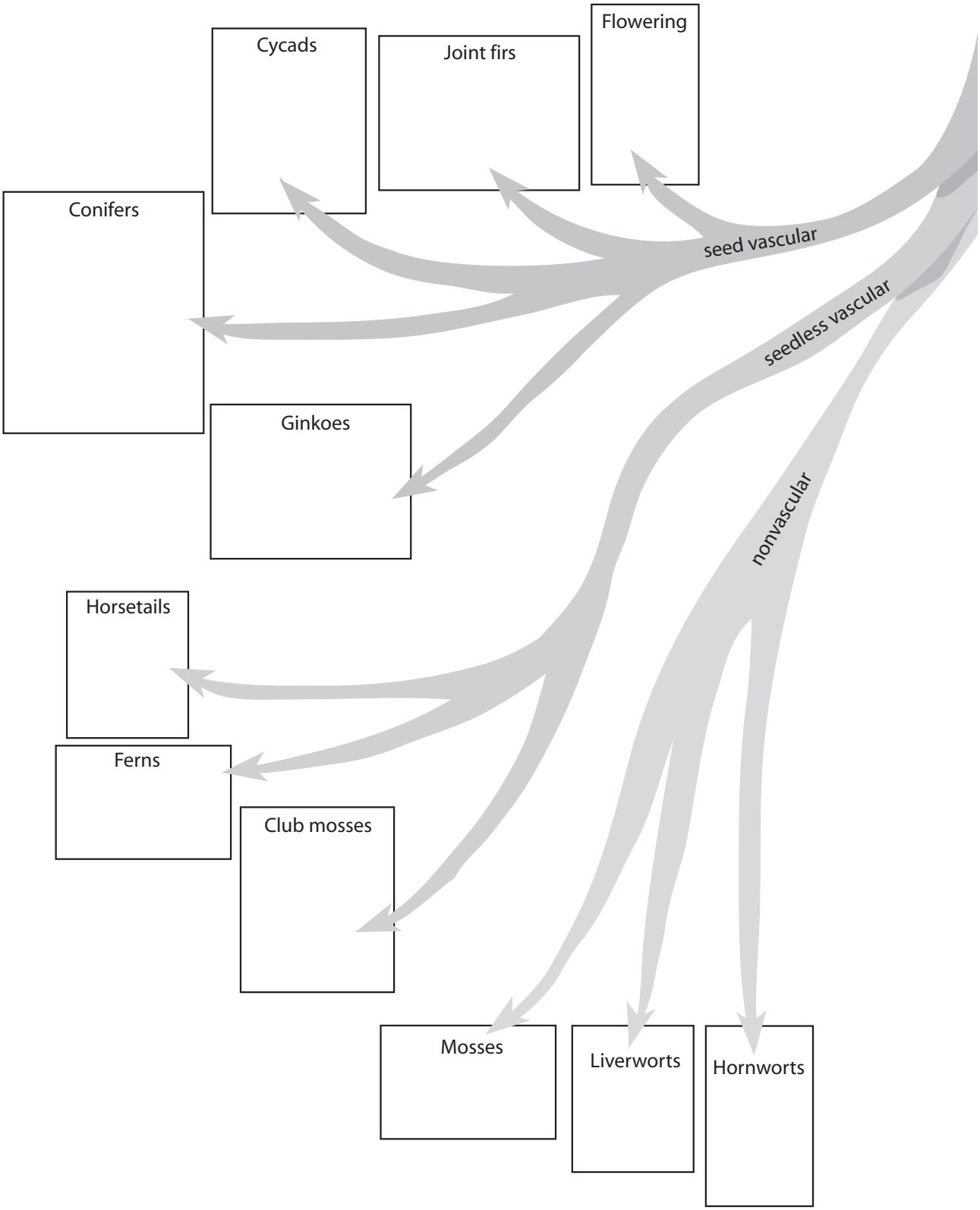
Materials

glue
Internet (optional)
magazines to cut apart
plant books
scissors

Procedure

1. Use reference books to find examples of each plant in the diagram below.
2. Use garden magazines or the Internet to find pictures of each plant.
3. Cut out or print a picture of each plant.
4. Glue the pictures in the boxes.

Classy Plants



Tubes for the Move

Purpose

To observe the movement of water through the vascular tubes of a plant

Materials

glue
Internet (optional)
magazines to cut apart
plant books
scissors

Background

The plant kingdom is classified into major groups called divisions. A division is the same as a phylum in other kingdoms. Another way to group plants is as vascular or nonvascular plants. Vascular plants have tube-like structures that carry water, nutrients, and other substances throughout the plant. Nonvascular plants do not have these tube-like structures and use other ways to move water and substances.

Procedure

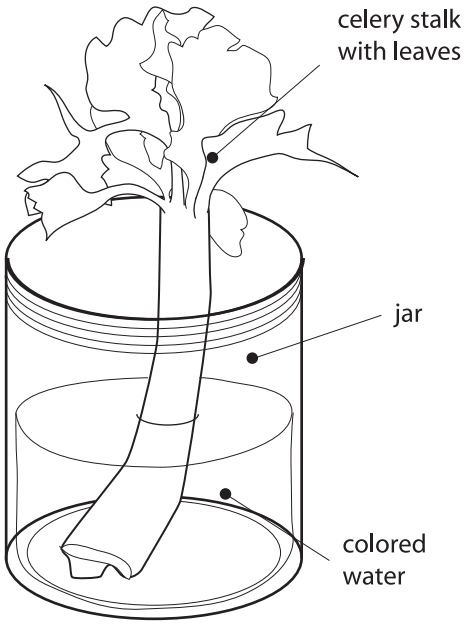
1. Fill the jar almost to the top with water.
2. Add 5–10 drops of food coloring to the water and gently stir.
3. Cut the stem of the celery stalk diagonally so that it measures 20 cm.
4. Place the celery stalk into the jar with the stem inside the water.
5. Observe and record your observations in your science journal.
6. Each hour observe and record your observations until you notice a change in the leaves of the celery stalk.
7. Carefully take the celery stalk out of the water and dry the stalk so as to not drip colored water. Observe the stalk, paying close attention to the end where the stem was cut. Record your observations.

Conclusion

1. What happened to the leaves of the celery stalk? Why?
2. What can you conclude by observing the cut part of the stem?

Extension

1. Use flowers such as carnations and see if the results are the same as with the celery.
2. Conduct the experiment again, but with three stalks. Place one in a dark room, one in the sunlight, and one in fluorescent light. Observe and record your observations each hour. Do they all react the same?
3. Observe a cross section of a tree and compare it to the cross section of the celery stalk or flower stem. Count the number of light and dark rings. Hypothesize why the rings are different colors and sizes.



The Leafy Debate

Purpose

To demonstrate how the loss of forests may change the climate

Materials

medium-sized plant with several branches
2 plastic bags
science journal
scissors
sunny area
2 twist ties

Background

Tropical rain forests are in great danger because they are being cut or burned down at an alarmingly fast rate. This deforestation causes many animals and plants to disappear because their habitats are destroyed. In addition, the loss of the rain forests may change the climate of the tropics, which may affect other areas on Earth.

Procedure

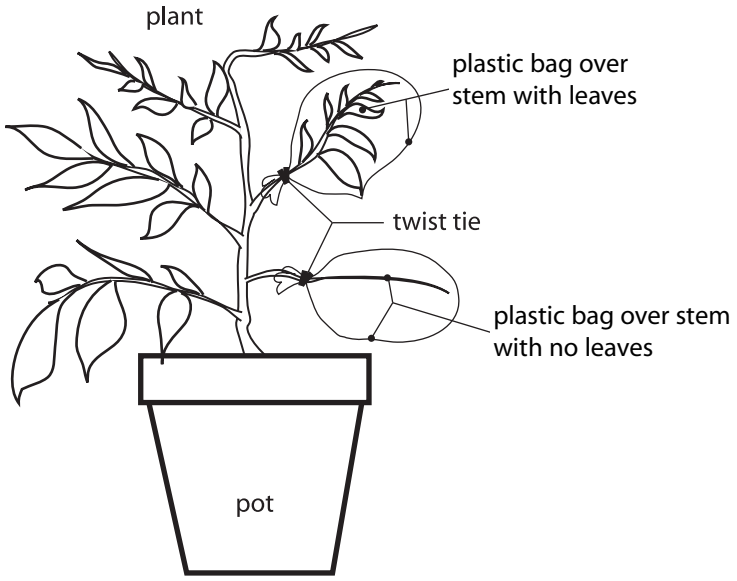
1. Select two branches that are similar in size and number of leaves.
2. Carefully cover one of the branches with a plastic bag, being sure not to break off any of the leaves.
3. Using a twist tie, carefully secure the bag to the branch. This branch represents an intact tropical rain forest.
4. Using scissors, cut the leaves off the other branch.
5. Repeat steps 2 and 3. This branch represents an area of the tropical rain forest that has been cut down.
6. Put the plant in a sunny spot and let it stand for about 24 hours.
7. Observe the plant the next day and record your observations in your science journal.
8. Illustrate your observations.

Conclusion

1. Where did the water come from?
2. What can you infer about the amounts of water created by forests? By deforested areas?
3. What role do plants play in the water cycle?
4. Why should people be concerned about the destruction of tropical rain forests?

Extension

1. Keep observing the plant daily for two weeks and record your observations.
2. Try this experiment with other plants.



Danger! Deforestation

Purpose

To understand the results of deforestation

Materials

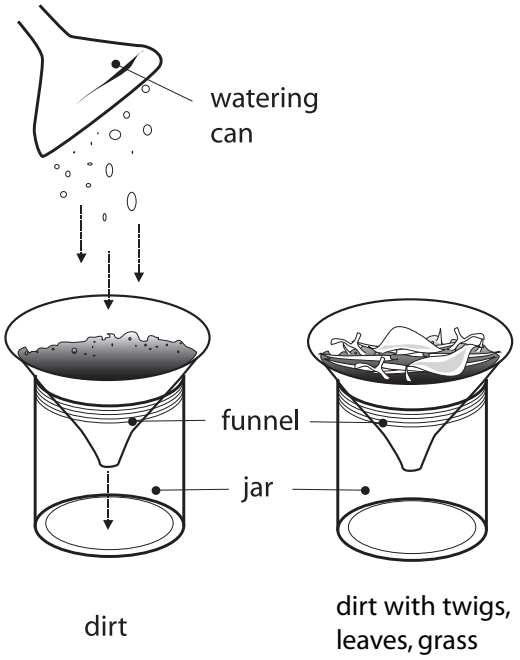
2 funnels
2 large jars
mixture of leaves, moss, grass, etc.
science journal
soil
stopwatch (optional)
water
watering can

Procedure

1. Fill one funnel with soil and place the funnel inside the mouth of the jar.
2. Fill the other funnel with a mixture of soil, leaves, grass, pine needles, and so on. Place the funnel inside the mouth of the second jar. See diagram 1.
3. Use the watering can to simulate "rain." Be sure to hold the watering can over each funnel for the same amount of time.
4. Observe each jar and record your observations in your science journal.

Conclusion

1. Which jar contained the most sediment? Why?
2. In which jar did the water filter through the quickest? Why?
3. Explain how this experiment simulates what happens when the rain forests are deforested.
4. Predict what effect the destruction of the rain forest might have on global climate, new medicines, and the people who live in rain forests.



Extension

1. Write a story about a young child who lives in the rain forest and encounters his/her home being burned and destroyed to make room for cropland.

It's Raining in My Classroom

Purpose

To create a facsimile of a tropical rain forest to become more familiar with a rain forest environment

Materials

butcher paper
construction paper
glue
miscellaneous items
scissors

Teacher Note

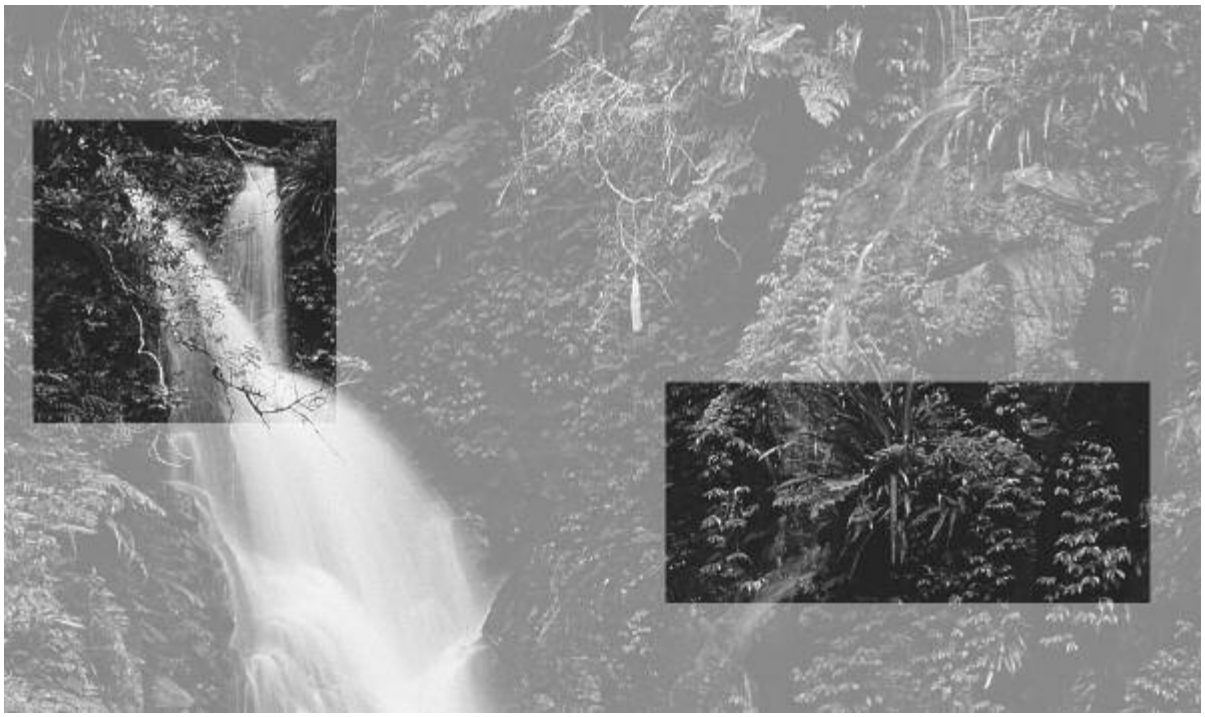
Before beginning this activity, it might be helpful to complete two activities, Layers of the Rainforest and Around the World. Both are located in Dr. D's Lab (2003–2004 season: Runaway Runoff) on the NASA SCI Files™ web site **http://scifiles.larc.nasa.gov/kids/D_Lab/d_lab.html**

Procedure

1. Brainstorm and list in your science journal what you know about a tropical rain forest.
2. Research the various layers of a rain forest and determine the types of plants in each layer.
3. Using butcher paper (blue or white), cover one wall or area from floor-to-ceiling.
4. Build the rain forest one layer at a time, starting with the top (emergent) layer.
5. Use construction paper, butcher paper, and newspapers to create trees. Trees in the emergent layer often rise from 50–60 m. Discuss what scale might be appropriate to use for these trees. The trees also host glorious blooms so be sure to include lots of flowers and any animals that might live there.
6. Continue until each layer of the rain forest is complete.

Extension

1. Invite other classes to visit the "rain forest."
2. Give guided tours or "eco" tours to students, parents, and other adults.
3. Investigate the people that live in the rain forests around the world. Create and give a presentation about your findings.



Plant Nomenclature

Purpose

To learn the nomenclature and parts of a plant

Note: *Be sure to put these cards in a safe place so as to use them with the other nomenclature cards you will be creating later.*

Materials

books about plants
copy of plant sheet *(page 25)*
red pencil
scissors

Procedure

1. Cut along the dotted lines of the plant sheet (page 25) to form individual plant cards.
2. Using reference books and a red pencil, shade in the root part of the plant on one plant card.
3. Write the word "roots" at the bottom of the page. See diagram 1.
4. Repeat steps 2 and 3 for each part of the plant: stem, root, root hairs, leaves, anther, pistil, petals, and stamen.
5. Using books, the Internet, or other reference sources, write a brief description of each part of the plant on the top back portion of each plant card.
6. Cut along the line at the bottom of each plant card to detach the word from the picture and create a label. See diagram 2.
7. Shuffle the cards and labels. Practice matching the labels to the correct picture for each part of the plant.

Extension

1. Compare the parts of a flowering plant to the parts of other plants such as trees, shrubs, vegetable plants, and so on.
2. Obtain a real plant and use the labels to identify the parts of the plant.
3. Observe different roots, stems, and leaves of various plants and compare and contrast them.
4. Try to pull a dandelion from the ground. With the help of an adult, dig the dandelion up and observe its roots. Research the two main types of roots found in plants, taproots, and fibrous roots. Give examples of each.

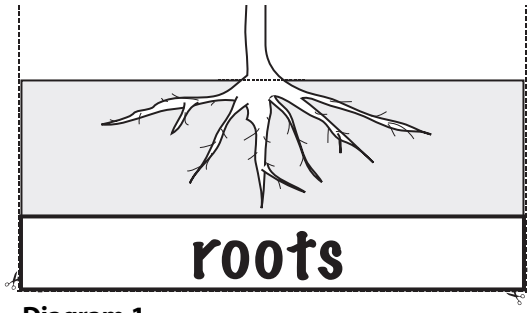


Diagram 1

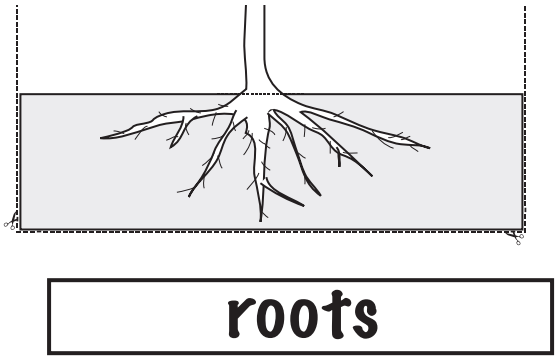
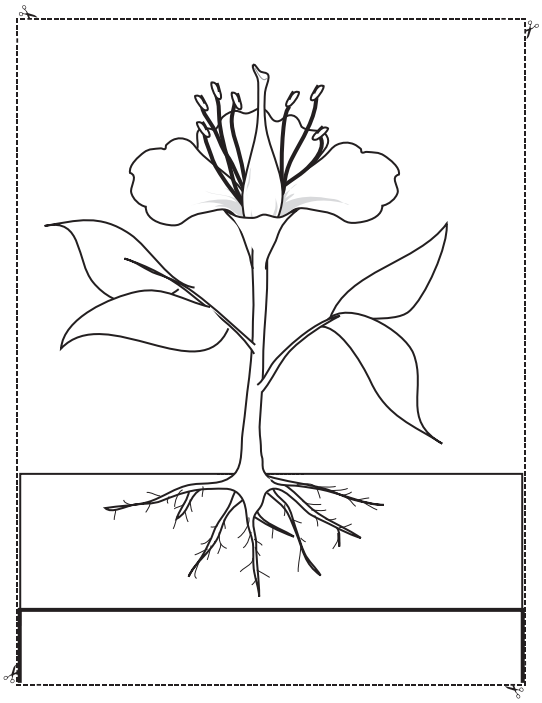


Diagram 2

Plant Nomenclature – Plant Sheet

1



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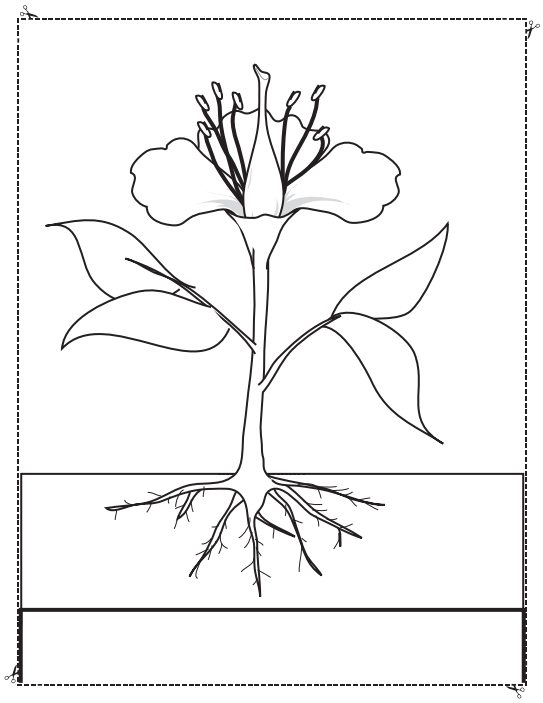

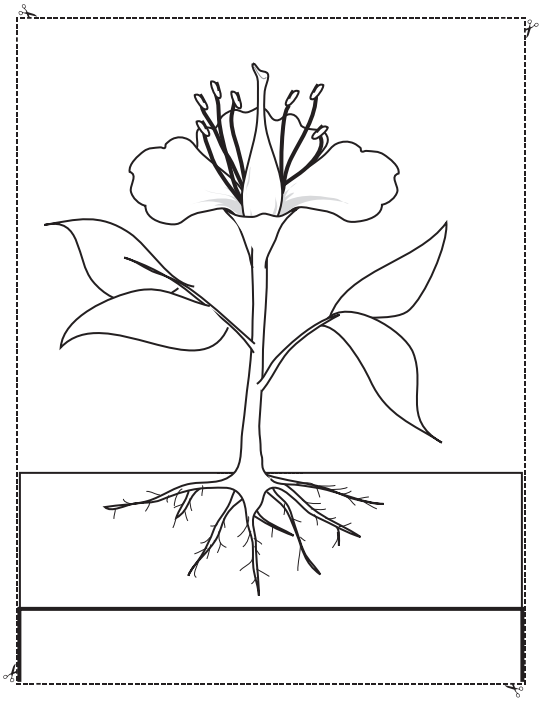

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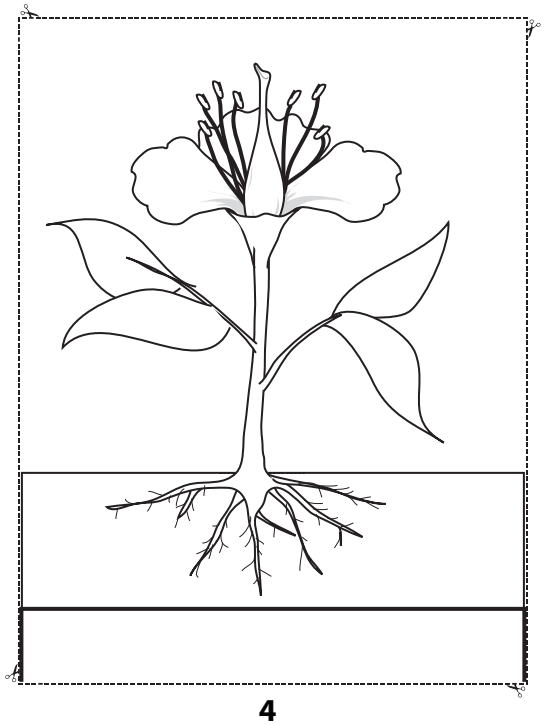

4

It's Basically Basic

Purpose

To understand that plants have basic needs for survival (light, air, water, and minerals)

Plant 1: Control plant
Plant 2: Light
Plant 3: Water
Plant 4: No light
Plant 5: No water

Materials

colored pencils
dark area
labels
marker
5 small plants in pots
science journal
sunny area
water

Procedure

1. Observe each of the five plants and record your observations in your science journal.
2. Using colored pencils, draw a picture of each plant, paying careful attention to the number of leaves, color of the leaves and stem, and any other feature determined to be important.
3. Using a label and marker, label each plant 1, 2, 3, 4, or 5.
4. Carefully water plants 1–4. Be sure that you give each plant the same amount of water.
5. Place plants 1, 2, 3, and 5 in a sunny area.
6. Place plant 4 in a dark area that never receives sunlight. Note: All areas should be inside in a controlled temperature environment so that only one variable is being manipulated.
7. Observe your plants over the next couple of weeks and record your observations in your science journal. Water plants 1–4 as needed, but be sure to always give each one the same amount of water. Don't water 1 unless you also water plants 2, 3, and 4. DO NOT water plant 5.
8. Discuss your observations and draw conclusions.

Conclusion

1. What happened to plant 5? Why?
2. What happened to plant 4? Why?
3. From conducting this experiment, what did you determine are two of the basic needs of plants?
4. What are the other basic needs of plants?
5. How are plants' basic needs similar to animals' basic needs. How are they different?

Answer Key

Classic Classifying

1. The buttons should have been the easiest group to sort. Even though the buttons were different from each other, they may have been sorted by only one characteristic such as size, color, or number of holes, and so on.
2. The common characteristics of the peanuts might include color, shape, size, texture, and so on. These characteristics make it more difficult to classify the peanuts because there is not enough that is "different" about each one.

Tubes for the Move

1. The leaves in the celery stalk turned the color of the food coloring. The colored water was carried through the tubes in the celery stalk to the leaves.
2. There are small tubes in the stalk that carry water and nutrients to the other parts of the celery plant.

The Leafy Debate

1. The water came from the leaves of the plant. What is happening is called "transpiration," the process whereby the leaves on green plants give off water that they do not need. As water moves into root cells, it goes up through the plant to be used. Any unused water vapor exits through the leaf.
2. You can infer that very large forests such as tropical rain forests transpire a great amount of water into the atmosphere. Without trees and other plants, deforested areas are not able to put moisture back into the air. Without the moisture going back into the air, rainfall would decrease.
3. The roots of plants take in water from the soil, and the leaves of the plants transpire any unused water as water vapor back into the air. Moisture in the air can rise and condense to form clouds and eventually rain.
4. Answers will vary but might include that rain forests offer homes to millions of different species of life, some unknown to scientists. Many of the plants are used for medicines. Rain forests also play a vital role in weather patterns around the world.

Danger! Deforestation

1. The jar under the funnel without leaves contained the most sediment because without leaves and other debris, the dripping water easily washed away the soil.
2. The jar without the leaves and debris filtered the water the quickest because there was nothing to hold the water back.
3. When rain forests are slashed and burned, it leaves the land barren just like the funnel that had no leaves or debris. When it rains (dripping water), the rain easily washes away the soil and causes erosion.
4. Answers will vary.

It's Basically Basic

1. Answers will vary, but if the plant goes without water for a long time, the leaves will turn yellow and brown and eventually drop off or shrivel and dry up. Plants need water to survive. Water is necessary for sugar production, which provides food for the plant.
2. Answers will vary, but if the plant is placed in the dark for a long time, it will begin to turn yellow and brown and eventually begin to die. Without sunlight, a plant cannot make sugar, which is food to the plant. Without food, a plant cannot survive.
3. This experiment proves that plants have two basic needs: light and water. Answers will vary but should include that plants also need air (carbon dioxide) and minerals (food) to survive. Another need could be that plants need space because if plants become overcrowded, some will die.
4. Animals and plants also need air, water, and food to survive; however, animals breathe oxygen instead of carbon dioxide, and they eat plants and other animals for food. Animals also need shelter.

On the Web

Around the World

1. Rain forests are in temperate and tropical regions, with the most well-known ones occurring in a belt around the equator between the Tropic of Cancer and the Tropic of Capricorn.
2. The amount of solar energy received at a particular location on Earth depends on the angle at which the sunlight strikes Earth. Areas in the tropics receive the most direct rays. Year-round temperatures in these areas are always hot, except at high elevations. As the Sun's rays heat the Earth's surface (water and land), hot air rises. As the hot air rises, it cools and condenses, forming clouds. Eventually the clouds become saturated and it rains. The tropical area near the equator is more water than land. Heating this great amount of water creates a lot of moisture in the air and causes bountiful rainfall.