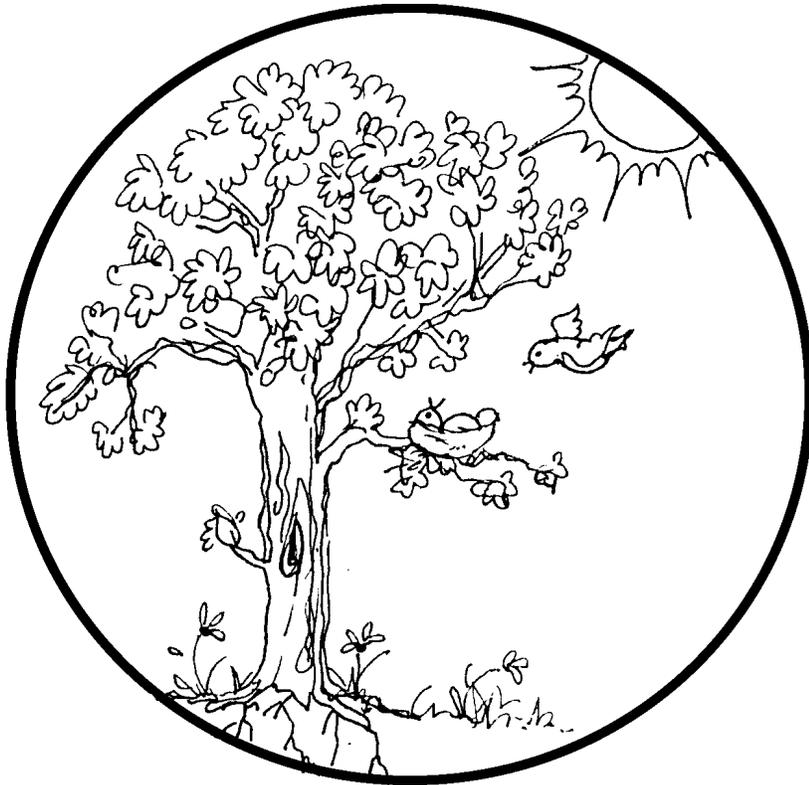




Life Cycle
Diversity in a Balance



FOURTH GRADE
PLANT LIFE



2 weeks
LESSON PLANS AND
ACTIVITIES

LIFE CYCLE OVERVIEW OF FOURTH GRADE

ORGANISMS

WEEK 1.

PRE: *Exploring the components of a cell.*

DURING: *Comparing cells, tissues, and organs.*

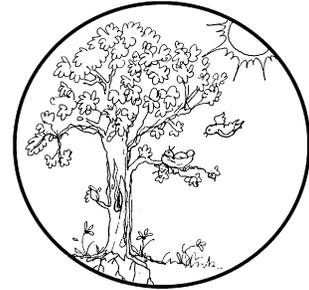
POST: *Classifying different organisms.*

WEEK 2.

PRE: *Understanding the reasons for invertebrate classification.*

DURING: *Comparing and contrasting invertebrates.*

POST: *Comparing characteristics of the 5 kingdoms.*



HUMAN BIOLOGY

WEEK 3.

PRE: *Describing how the human body works.*

DURING: *Discovering if boys are more flexible than girls.*

POST: *Exploring four types of tissues.*

WEEK 4.

PRE: *Exploring how the circulatory system works.*

DURING: *Comparing the pulse rate of males and females.*

POST: *Exploring the components of blood.*

PLANT LIFE

WEEK 5.

PRE: *Defining the characteristics of plants.*

DURING: *Comparing monocots and dicots.*

POST: *Identifying monocots and dicots in the field.*

WEEK 6.

PRE: *Explaining how light is transformed into food.*

DURING: *Discovering that starch is important to plants.*

POST: *Analyzing components of drugs.*

NATURAL ENVIRONMENT

WEEK 7.

PRE: *Investigating soil.*

DURING: *Exploring a soil profile.*

POST: *Investigating the ecosystem of the school yard.*

WEEK 8.

PRE: *Identifying plants in a saline environment.*

DURING: *Creating a San Francisco Bay mud fauna food web*

POST: *Examining a fresh water aquarium ecosystem.*

LIFE CYCLE - PLANTS (4A)

PRE LAB

OBJECTIVES:

1. Classifying plants.
2. Defining the characteristics of plants.

VOCABULARY:

classification

MATERIALS:

plant classification worksheet

BACKGROUND:

The plant kingdom includes one celled organisms (diatoms) as well as complex organisms like angiosperms. Some plants and trees (tracheophytes) have vascular tissue or well-developed conducting tissue through which water and solutes are transported to various parts of the plant. Other plants are non-vascular (bryophytes) and do not possess internal transport systems. Most non-vascular plants live in water or in wet environments that facilitate the direct diffusion of water and nutrients. Vascular plants, however, live on land and possess special features adapted to this environment such as roots, stems and leaves. As in most classification systems, not all botanists agree on the same classification system or the same categories. In this program we are using the following simplified classification scheme:

Brown-green algae refers mainly to one-celled plants called diatoms. These form major component of the oceans and are important because they are at the bottom of the food chain and are responsible for some oil formation.

Brown-red algae refers to the large plants of the sea, including kelp and seaweed. Plants in the marine environment do not need the elaborate vascular conducting system of land plants for transporting nutrients because the marine environment has all these nutrients available. Bryophyta, which include mosses and liverworts, are mainly inconspicuous plants growing in moist habitats. They are not fully adapted to life on land because they need water to reproduce. Bryophytes do not get very large.

Sphenophyta or horsetails are easily recognized by their jointed stems and rough, ribbed texture. Early settlers used horsetails to help clean pots and pans because of their rough texture. You find these plants in wet environments.

Ferns (filicopsids) are familiar vascular land plants that reproduce by using spores

Students use a worksheet to classify plants.



Aspen trees with flowers growing on the ground.

rather than seeds. Ferns prefer wet, moist climates.

Gymnosperms (which includes Ginkgoes) or conifers (pine-like trees) are mainly cone-bearing plants. There are only about 550 species of living conifers. They dominate the forest of the Northern Hemisphere, but are known in the tropics and Southern Hemisphere. The leaves of most conifers are needle-shaped and are all simple or have scales.

Angiosperms (flowering plants) produce a seed cover for reproduction and are the most common small plants and trees. They are divided into monocots (grasses) and dicots (larger flowering plants).

PROCEDURE:

1. Using the worksheet, students are to write down notes about each group of plants as you provide them with information. Instruct the students to write a sentence about each group's characteristics and uses.

2. If you want students to learn more about the different groups you may want them to view the web sites listed below. You may want to do a search on bryophytes and sphenopsids to see if any new sites would be useful to your students.

<http://osu.orst.edu/instruct/for241/>

Dichotomous key of conifers in the Pacific northwest. Well designed and easy to use.

<http://www.hcs.ohio-state.edu/hort/plants.html>

Ohio State list of about 1500 plants with images.

<http://nature.snr.uvm.edu/www/mac/plant-id/>

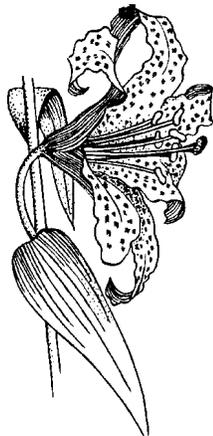
University of Vermont, School of Natural Resources. Site has both angiosperms and gymnosperms.

<http://www.visuallink.net/fern/index.html>

American Fern Society maintains this site and has basic biology to different species of ferns.

SIMPLE PLANT CLASSIFICATION

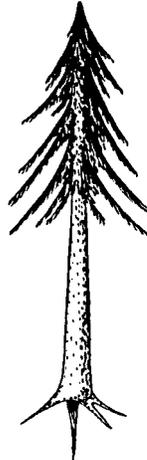
ANGIOSPERMS



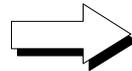
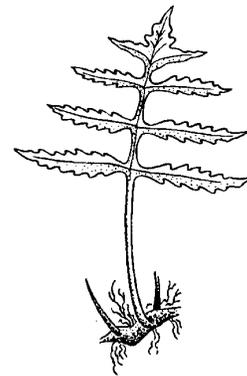
SPHENOPTERIDS



GYMNOSPERMS



FERNS



BRYOPHYTES



ALGAE



OLIFE CYCLE - PLANTS (4A)

LAB

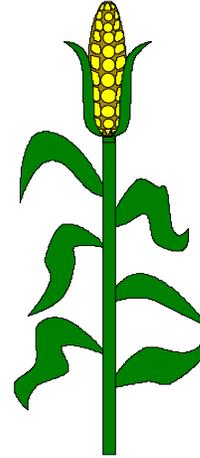
Students compare corn and bean seeds.

OBJECTIVES:

1. Exploring angiosperms.
2. Comparing monocots and dicots.

VOCABULARY:

angiosperm
dicotyledon
monocotyledon



MATERIALS:

corn and bean seeds (soaked in water 1 day before)
iodine
peanut
knife (not sharp) to cut seeds

BACKGROUND:

Angiosperms or flowering plants are the most dominant group of the vascular plant world. The term angiosperm was devised to describe one of the most definitive elements of flowering plants, namely the enclosure of the potential seeds within a hollow ovary. The angiosperms are considered to be advanced as compared with the gymnosperms and other tracheophytes (plants and trees). Flowering plants occur in a wide range of habitats including both salt and fresh water. The basic food supply of the world is derived from the seeds and fruits of angiosperms (rice, wheat, corn) and fibers, wood, drugs, and other products of great economic value.

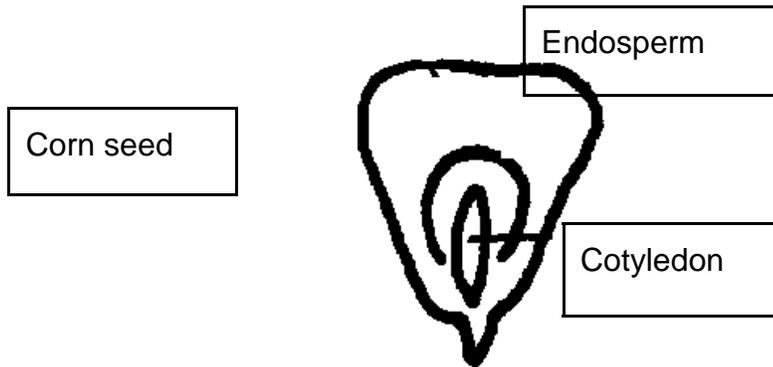
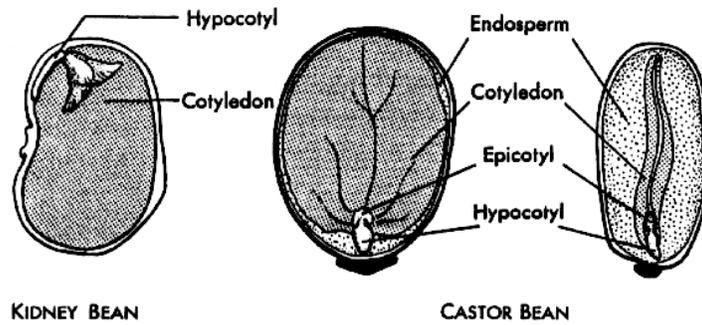
The studies by John Ray in the 1700's on the structure of seeds led him to discover the difference between monocotyledon (monocots) and dicotyledon (dicots) plants. There are estimated to be about 165,000 different types of dicots and 55,000 types of monocots.

Monocots have only one cotyledon, dicots have two cotyledons. A cotyledon contains stored food and serves as a food reservoir. Aside from the difference between the seeds of monocots and dicots there are other different structures that separate monocots and dicots. Monocots have long, narrow leaves with parallel veins (such as grasses.) The parts of monocot flowers are arranged in threes or in multiples of three. Dicots have broad leaves with branched veins. The parts of dicot flowers are arranged in fours and fives or multiples of fours and fives. Although the distinction between monocots and dicots is not always as sharp and clear as once thought, it is a useful taxonomic grouping.

PROCEDURE:

1. In this lab students will differentiate between monocot and dicot seeds. Make sure you soak the seeds in water one day prior to the laboratory session. The directions are written on the lab sheet. Students should be instructed to examine the seeds carefully and to draw exactly what they see.

2. An endosperm is the nutritive tissue in the developing seeds of angiosperms. A cotyledon is the seed or first leaf of angiosperms and gymnosperms. A bean and a peanut are dicots; corn is a monocot.



LIFE CYCLE - PLANTS (4A)

PROBLEM: Can you differentiate between a monocot and a dicot seed?

PREDICTION: _____

MATERIALS: 24 hour soaked corn and bean seeds, dilute iodine solution, 1 peanut in shell, hand lens or microscope

PROCEDURE I. CORN SEED

1. Examine the soaked corn seed your instructor has cut in half. Add dilute iodine solution to one half of the seed. Make a careful drawing of exactly what you see using a hand lens or a microscope.
2. The part which turns blue-black is the endosperm, the light purple area is the cotyledon. Be sure to label your drawing.
3. Can you find the young leaves inside the seed? _____ How many are there? _____ Which part of the seed do you think is the seed coat? _____

BEAN SEED

1. Carefully remove the seed coat from the bean seed and examine what you find.
2. Separate the two halves of the bean seed with your fingers. Be careful you don't damage the sample.
3. Again, apply dilute iodine solution to one half and make an accurate drawing.
4. Can you find the endosperm, young leaves (how many?) _____ cotyledon? _____, and seed coat? _____.
5. Try to open another corn seed like you did the bean seed. Can you do it?

CORN	BEAN

PROCEDURE II. Using the peanut, carefully illustrate the following sequence on the back of the paper: 1. the peanut with shell 2. the peanut in open shell. 3. a cut section of the peanut (label seed coat, cotyledon, and endosperm) Is this a monocot or dicot?

CONCLUSION: _____

LIFE CYCLE - PLANTS (4A)

POST LAB

OBJECTIVES:

1. Identifying monocots and dicots at school.
2. Comparing monocot and dicot plants.

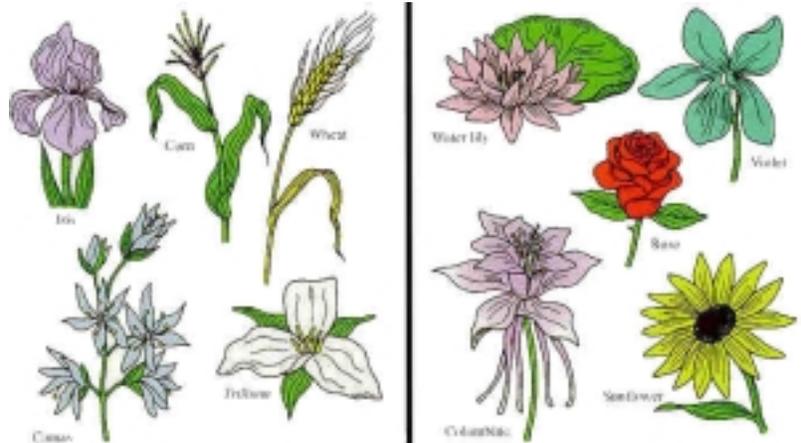
Students classify plants found in their school yard.

VOCABULARY:

dicot
monocot

MATERIALS:

tape
construction paper
guide



BACKGROUND:

Monocots on the left; dicots on the right

Students observe plants each day, whether they are in a natural setting or in a pot. This exercise will help children to identify and classify each plant that they see at school. The majority of plants that most children see are the flowering plants or angiosperms. The majority of angiosperms are dicots, The dicots have flower parts in multiples of four or five while monocots have flower parts in multiples of three. The dicots have leaves with a network of veins while monocots have leaves with parallel veins. The xylem and phloem in a dicot are arranged in a ring while they are randomly arranged in a monocot. The monocot seed has one seed leaf while the dicot has two seed leaves. For example a peanut is a dicot while rice and corn are monocots. The roots of dicots show secondary growth which the roots of the monocots do not.

PROCEDURE:

1. Ask students to predict whether there are more species of dicots or monocots at school. Write the responses on the board.
2. Have students go out into the school yard in the area designated by you and collect one specimen of each plant species you find. (If you don't want to destroy the plants you may want the students to make plant rubbings or drawings.)
3. Bring the specimens to the class, arrange and tape the specimens artistically on a piece of paper, labeling whether the specimen is a monocot or dicot. Go over the following information and diagrams.

LIFE CYCLE - PLANTS (4A)

**GUIDE
KEY CHARACTERISTICS**



Monocots

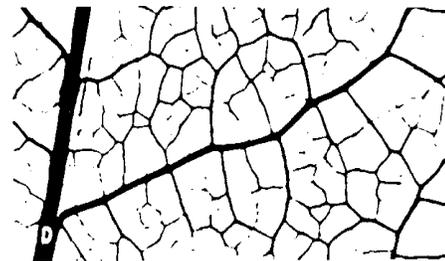
MONOCOTYLEDONS	DICOTYLEDONS
1. One cotyledon or seed leaf.	1. Two cotyledons or seed leaves.
2. Generally marked parallel leaf venation.	2. Generally marked netted venation of leaves.
3. Flower parts typically in groups of 3 or multiples.	3. Flower parts typically in groups of four or five.



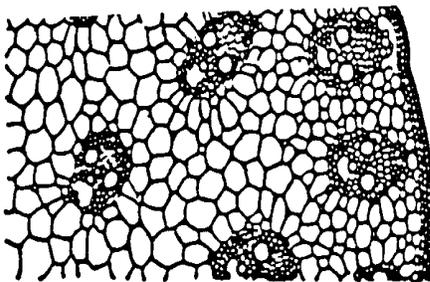
Dicots



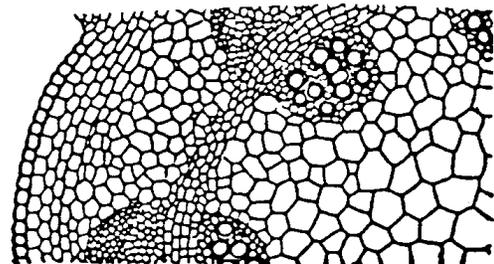
leaves of a monocot



leaves of a dicot



cross section of monocot stem



cross section of dicot stem

LIFE CYCLE - PLANTS (4B)

PRE LAB

Students will learn how plants transform light into food via photosynthesis.

OBJECTIVES:

1. Exploring photosynthesis.
2. Explaining how light is transformed into food.

VOCABULARY:

carbon dioxide
chlorophyll
light
photosynthesis



MATERIALS:

worksheet

BACKGROUND:

The most important characteristic of plants is their ability to manufacture food . Typically this process, known as photosynthesis, occurs primarily in the green leaves of plants. Photosynthesis occurs only in the chloroplasts of plant cells because these are the organs that contain the green pigment chlorophyll. The rate of photosynthesis is dependent on light concentration, temperature, water, and organic and inorganic materials available to a plant. Three aspects of light are important for photosynthesis: intensity, quality, and duration. Intensity depends on the amount of sunlight falling on a given chloroplast per second. The rate of photosynthesis will increase if the light intensity is increased. The water available to a plant also influences the rate of photosynthesis.

Photosynthesis is the physical and chemical process involved in the trapping of the sun's energy and the use of this energy to manufacture food. Green plants utilize water and carbon dioxide and in the presence of sunlight and chlorophyll manufacture food. Food-making normally occurs in the leaf cells of a plant. Chlorophyll is the substance which gives leaves their green color, and is found within the chloroplasts (small green bodies in plant cells) of leaves. All the things needed by a plant to manufacture food are transported to the leaves through the roots and stems. The plant cells can convert sugar into starch for storage or combine it with other materials to build proteins, vitamins, or fats.

PROCEDURE:

1. The worksheet examines photosynthesis via chemical equations (with words) and has the students illustrate the equation in pictures using the symbols given. The key

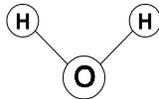
is for the students to see how you can easily write down what is happening in a simple equation.

2. Point out to students to make a legend of each of the components so their diagram can be interpreted. You may want to give the following clues to help them out.

carbon dioxide =



water =



sugar =



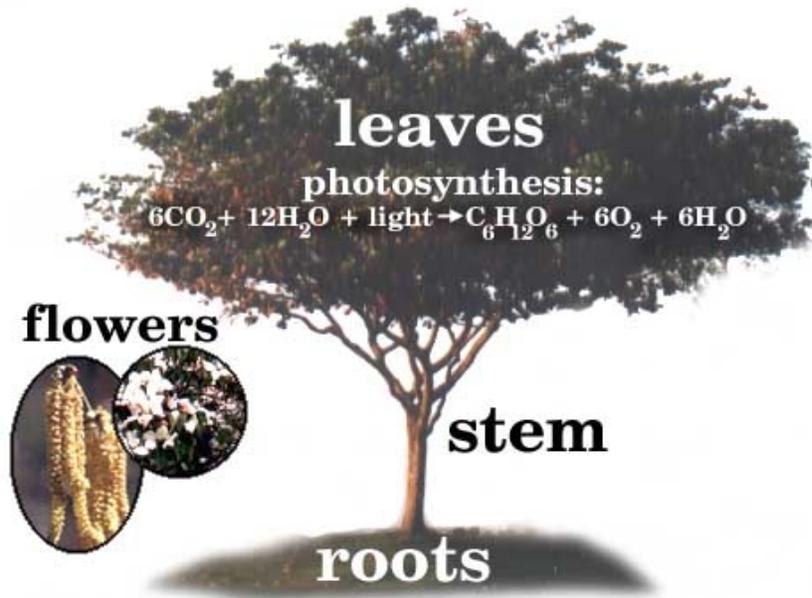
oxygen =



chlorophyll =



PHOTOSYNTHESIS



carbon dioxide + water
yields (with help from chlorophyll and sunlight)
sugar + oxygen + water

Using the word equation above, make a cartoon equation for photosynthesis. Make a legend of your symbols. Don't forget the + signs and arrows.

LIFE CYCLE - PLANTS (4B)

LAB

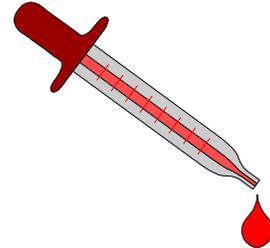
Students test plants for starch.

OBJECTIVES:

1. Discovering that starch is important to plants.
2. Analyzing which plants have starch within their cells.

VOCABULARY:

carbohydrate
photosynthesis
starch



MATERIALS:

pieces of substances listed in Procedure
iodine (tincture - brown color)
medicine dropper
mortar and pestle (or other container)

BACKGROUND:

Starch grains are found in the chloroplasts of the higher plants and if leaves containing starch are kept in darkness for a moderate amount of time the starch grains will disappear. If these sun deprived leaves are exposed to light, starch reappears in the chloroplasts. Starch is the first visible product of photosynthesis.

The principle way that food is stored in plants is as starch. Starch can be found in all stems even the main trunk. Starch can be found in those layers that are many years old as well as those that are still living. Studies of food reserves in twigs of fruit trees show that starch accumulates toward the end of the growing season. A very large part of the food used by any individual bud in its early spring growth comes from the storage tissues in the immediate neighborhood of that bud. Tubers, rhizomes, and corn (underground stems) are especially adapted for food storage in the form of starch. Bulbs like garlic and onion store food in the form of sugar rather than starch.

The key principal in this lab is for students to realize that starch is an important by-product of photosynthesis, and is used through the life cycle of plants. When foods are stored, they are usually in the form of nonsoluble materials. Before such foods can be utilized, they must first be converted to a soluble form. For example, when a seed is planted and watered, the first thing that happens (after water is absorbed and swells the seed) is the digestion of starch, fats, and proteins. The resulting sugars, fatty acids, glycerol and amino acids are then available and are utilized in the subsequent production of new cells, which develop into roots, stems and leaves. Once the leaves have formed

the plant no longer is dependent upon the foods stored in the seed. Photosynthesis can now take place and foods are produced.

PROCEDURE:

The rapid conversion of sugar into starch, a storage product, enables the use of iodine to test for starch as an indication of the occurrence of photosynthesis. In many leaves excess sugars (excess in that more sugars are produced during photosynthesis than are used by the leaf) are rapidly converted to starch, which yields a blue black color when treated with iodine-potassium iodide solution.

1. Instruct students to test each of the items listed on the worksheet with a drop of the tester solution. You may substitute items depending on the availability of materials.

2. Crush all the solid substances and place all liquid substances into containers before applying iodine. Make sure you have tincture of iodine. The clear "iodine" will not work on this experiment. Place the samples on a piece of wax paper or a recycled food tray.

3. Place one or two drops of iodine on the items. Instruct students to record what happens. In the space below, enter + or - to indicate whether it gave a positive or negative starch test result.

bread - starch (from wheat)
potato - starch
candy - no starch
banana - starch
apple - starch
cracker - starch (from wheat)
meat - no starch
potato chip - starch
lettuce - starch
water - no starch
bean - starch
orange juice - no starch
butter - no starch
oil - no starch
leaves - starch
paper - starch
plastic - no starch
onion - no starch

LIFE CYCLE - PLANTS (4B)

PROBLEM: Why is starch important to plants?

PREDICTION: _____

MATERIALS: dilute iodine, medicine droppers, small containers

PROCEDURE: Iodine can test for starch. Crush all the solid substances and place all liquid substances into containers before applying iodine. Place one or two drops of iodine on the items below, record what happens. In the space below, enter + or - to indicate whether it gave a positive or negative starch test result.

ITEM	RESULT	ITEM	RESULT
bread		water	
potato		bean	
candy		orange juice	
banana		butter	
apple		oil	
cracker		leaves	
meat		paper	
potato chip		plastic	
lettuce		onion	

Iodine is used as an indicator for the presence of starch. It is a dark orange liquid but when applied to something that contains starch, it turns what color?

CONCLUSIONS: How is starch produced by a plant?

LIFE CYCLE - PLANTS (4B)

POST LAB

Students research to find drugs derived from plants.

OBJECTIVES:

1. Discussing medicinal uses of plants.
2. Analyzing components of drugs.

VOCABULARY:

caffeine
drug
euphoric
excitant
hallucinogen



MATERIALS:

books on different drugs
Internet

BACKGROUND:

Plants range in size from 0.5 microns to 175 meters in length to hundreds of tons in weight. Rates of plant growth can vary from minutes to years. Plants are some of the most diverse and intriguing of all organisms on this planet. They are needed to keep us alive; they produce much of the oxygen in the atmosphere; they relieve pain and they cause much pain. This discussion of plants and their medicinal purposes can develop into a provocative discussion on drugs because a large amount of drugs or their synthetic derivatives come from plants.

The early interest in plants was probably due to use of plants materials for the treatment of human illnesses or for pleasure. Records show that plants played an important part in early western and eastern civilizations. Although today, chemists have been able to make synthetic drugs that mirror the effects of natural plants there are many plants that are still used. Belladonna, opium, psyllium, rhubarb, eucalyptus, licorice, nux vomica, and cinchona, are the sources of the important alkaloids, atropine, morphine, strychnine, and quinine respectively. Digitalis, a drug used for certain heart disorders, and used by many people, is derived from a plant. The most common drug obtained from plants is caffeine. Caffeine can be found in seeds (coffee, cocoa, cola), leaves (tea, mate (leaves from holly), yaupon, and bark (yoco). Historically caffeine has been used in most civilizations.

Drugs are usually taken because they give the user a feeling of euphoria. Euphoria is a feeling of general well-being. Hypnotics are drugs that cloud reasoning,

consciousness, and though. Excitants, or stimulants, cause one's body to be stimulated into a faster heartbeat and a faster metabolic rate. Hallucinogens cause people to see, hear, or feel sensations that are not real.

Two commonly used stimulant drugs are tobacco and caffeine. Hypnotics include mescaline (mushrooms). Hallucinogens include peyote, agaric, marijuana, and morning glory. Euphorics include coca (rich in cocaine) and opium (morphine, codeine). These drugs can be useful to doctors because many relieve symptoms or pain of diseases. However, if misused, drugs can become harmful to one's body and general health.

PROCEDURE:

1. Discussing illicit drugs with students is sometimes difficult. Begin the discussion by stating that there are substances derived from plants that can help us and there are those that can hurt us. Use the information in the Background section to help you introduce some of the helpful and hurtful drugs.

2. Unfortunately there are few good books to use with students that deal with the subject of drugs. There are some web sites that provide good solid information on drugs that come from plants. Below are some examples, but we highly recommend that you conduct a search using one of the available search engines.

<http://www.erols.com/blopatin/reference/aspirin/>

Story of Aspirin.

<http://www.vhs.com/literature/caffeine.html>

Information on caffeine.

<http://www.arf.org/isd/pim/cocaine.html>

Information on cocaine.