Teacher's Discussion Notes
Part 1

PHOTOSYNTHESIS Vocabulary:

Chlorophyll--A green substance which gives leaves their color. Chlorophyll absorbs energy from sunlight, which a plant uses to make food.
Chloroplast--A plastid that contains chlorophyll and is the site where photosynthesis and starch formation occur.
Photosynthesis--The formation of carbohydrates in the chlorophyll-containing tissues of plants exposed to light.
Stomata--A very small hole in the surface of a leaf. Oxygen and carbon dioxide from the air enter through the stomata; oxygen, carbon dioxide and water vapor leave through the stomata.

HOW DO PLANTS MAKE FOOD?

OBJECTIVE:
Students learn why plants are green and how water is transported in plants.

GUIDING QUESTIONS:
What happens inside plants when the sun is shining or when it is raining?
How do plants in the desert survive?
How important are plants to our environment?
What might happen if there were none?

DISCUSSION:

Of all the organisms in the natural world, green plants are the only ones that manufacture their own food. This process is called photosynthesis and begins when light strikes the plant's leaves (both sunlight and artificial light can power this process). Cells in the plant's leaves, called chloroplasts, contain a green pigment called chlorophyll which interacts with sunlight to split the water in the plant into its basic components.

Carbon dioxide enters the leaf through holes called stomata and combines with the stored energy in the chloroplasts through a chemical reaction to produce a simple sugar. The sugar is then transported through tubes in the leaf to the roots, stems and fruits of the plants. Some of the sugar is used immediately by the plant for energy; some is stored as starch; and some is built into a more complex substance, like plant tissue or cellulose.

Fortunately for us, plants often produce more food than they need, which they store in stems, roots, seeds or fruit. We can obtain this energy directly by eating the plant itself or its products, like carrots, rice or potatoes. Photosynthesis is the first step in the food chain which connects all living things. Every creature on earth depends to some degree on green plants.

The oxygen that is released by the process of photosynthesis is an essential exchange for all living things. Forests have been called the "lungs of the earth" because animals inhale oxygen and exhale carbon dioxide in the process of breathing, and plants take in carbon dioxide and give off oxygen in the process of photosynthesis.

But every year, over 28 million acres of tropical forest are cut and then burned to clear land for farming. Deforestation is also blamed for the "greenhouse effect" (global warming), which results from the build-up of carbon dioxide and other gases.

RESOURCES

Bonnet, Robert L. and Keen, Daniel G. Botany: 49 Science Fair Projects. Blue Ridge Summit, PA: Tab Books, 1989.

"How Green Plants Make and Use Foods." Minneapolis, MN: University of Minnesota Films, 1984.

Education/Research Systems, Inc. Project Learning Tree: Supplementary Activity Guide for Grades K-6. Washington, DC: The American Forest Council, 1988.

Teacher's Discussion Notes
Part 2

What are the basic requirements for growing plants indoors?

1. **Room to grow**. All plants like to have room to grow and develop. The above ground portions of the plant need space so leaves can expand and develop properly in order to carry out the job of making food. Roots also need room to grow. Plants growing in small, confined spaces will have their roots constricted resulting in reduced growth.

2. **Temperature**. Most plants are comfortable at temperatures that most humans like. Some may prefer warmer temperatures while others may prefer cooler temperatures for best growth. It is always good to know the natural habitat of the plant to provide conditions that are most "like home." Most plants like to have cooler temperatures at night and don't like to be in a drafty spot.

3. **Light**. Plants grown indoors like very bright light. Windows facing the south or west provide the best light. Try to place the plants as close to the windows as possible to take advantage of all the light. The further away from the window, the darker it becomes. Plants respond to low light by stretching toward the light source. This results in stems being thin and spindly. If natural light is provided, try to supply at least eight to 12 hours of bright light each day. Light can also be provided artificially. Due to poor window location or no window at all, this type of light source can result in excellent plant growth. You may also consider supplementing natural light with artificial. Cool white fluorescent tubes are a good source of light. Remember to position the light so it is about six to eight inches above the tops of the plants and leave the lights on for 14 to 16 hours a day.

4. **Water**. Water is the prime component in the plant's ability to manufacture and move nutrients within the plant. Without water, or with too much water, a plant dies. For this reason, watering is an important part of plant care. Most plants like to be watered when the soil is slightly dry to the touch. When watering, moisten the whole soil ball by using enough water so that is starts to come out of the drainage holes in the bottom. (This is why it is important to use containers with adequate drainage holes.) Watering intervals will be determined by the season of the year (less water is needed when light levels are low or the plant is in a reduced rate of growth), environmental conditions around the plant (dry rooms result in more water use by the plant), rate of growth of the plant, size of the container, amount of roots in the pot, and the type of plant (succulent plants need less than thin-leaved plants like lettuce).

5. **Air**. Plants utilize carbon dioxide in the air and return oxygen. Smoke, gases, and other air pollutants can result in damage to plants.

6. **Nutrients**. Most of the nutrients that a plant needs are dissolved in water and then absorbed by the plant through its roots. Applying fertilizers will help to keep the soil supplied with the nutrients a plant needs. You should be cautious about applying too much too often. Apply fertilizers when plants are actively growing and only in amounts and frequencies stated on the fertilizer package label. Fertilizers should not be looked upon as the correcting factor for poor light, poor drainage, poor soil, or just plain poor care. Liquid fertilizers are generally the easiest and safest to use. The three most important nutrients are nitrogen, phosphorous, and potassium.

7. **Time**. It takes time to grow and care for plants. Some plants require more time to reach maturity than others. Scheduling crops to come into flower at a certain time or to mature at a certain time can be both challenging and intriguing. Plants that normally grow outdoors have a certain number of days to flower or fruit. By using these estimates, you can time certain plants to come into flower or fruit on a certain date. This is a good lesson in both horticulture and math.

Student Activity Sheet

List and describe the seven requirements of growing indoor plants:

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B. _____
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C. _____
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D. _____
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E. _____
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F. _____
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G. _____
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