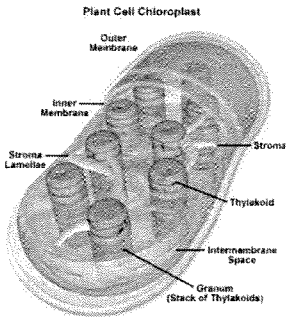
Photosynthesis Worksheet

Chloroplasts

Photosynthesis is a process in which sunlight energy is used to make glucose. The site of photosynthesis is in the chloroplast – a organelle found in the leaves of green plants. The main functions of chloroplasts are to produce food (glucose) during photosynthesis, and to store food energy. Chloroplasts contain the pigment, chlorophyll. Chlorophyll absorbs most of the colors in the color spectrum, and reflects only green and yellow wavelengths of light. This is why we see leaves as green or yellow – because these colors are reflected into our eyes.



1. What is photosynthesis?
2. Where does photosynthesis occur?
3. What are chloroplasts and where are they found?
4. What are the two main functions of chloroplasts?
5. Why do most leaves appear green?
6. What is the primary pigment found in the chloroplast?

Photosynthesis

Glucose is another name for sugar. The molecular formula for glucose in $C_6H_{12}O_6$. Plants make sugar by using the energy from sunlight to transform CO_2 from the air with water from the ground into glucose. This process, called photosynthesis, occurs in the chloroplast of the plant cell. During this process, oxygen (O_2) is created as a waste product and is released into the air for us to breath. The formula for photosynthesis is:

$$CO_2 + H_2O + \text{sunlight} \text{ ---- } C_6H_{12}O_6 + O_2$$

This formula says that carbon dioxide and water molecules are combined with the energy from sunlight to produce sugar and oxygen. The reactants in photosynthesis (what is used) are CO_2, water and sun. The plant gets water from the ground through its roots. The plant collects carbon dioxide from the air. Much of the carbon dioxide comes from living organisms that exhale it, but some also comes from factory smokestacks and car fumes.

7. What is the formula for photosynthesis?
8. What three things are used to make glucose in photosynthesis?
9. Where does the water come from?
10. Where does the water enter the plant?
11. What are some sources of CO_2?
12. What type of energy does the plant use to convert CO_2 and H_2O into sugar?

The products (what is made) are glucose and oxygen. The glucose produced is used by the plant for energy and growth. We also use this glucose by eating plants. The oxygen produced is released into the air for us to breath. Photosynthesis is essential for all life on earth, because it provides food and oxygen.

13. What is produced in photosynthesis?
14. What is the glucose used for?
15. What is the oxygen used for?

The Absorption of Light by Photosynthetic Pigments

Background: Pigments are light-absorbing molecules in plants that gather the sun's energy. Chlorophyll is the principal pigment found in plants. There are two main types of chlorophyll found in green plants: Chlorophyll "a" and Chlorophyll "b." Plants also contain red and orange pigments such as carotene and a yellow pigment known as xanthophylls that are also light-absorbing molecules. When white light (which contains all of the colors of the visible spectrum- red, orange, yellow, green, blue, indigo, and violet) shines on chlorophyll, the Chlorophyll "a" absorbs most of the red, orange, blue and violet, and it reflects most of the green and yellow. Because light is a form of energy, any compound that absorbs light also absorbs the energy from that light. When Chlorophyll "a" absorbs light, much of the energy is transferred directly to electrons in the chlorophyll molecule, raising the energy levels of these electrons. These high-energy electrons make photosynthesis work.

The chart at right shows the percentages of different wavelengths of light absorbed by the two different kinds of chlorophyll. Go to Excel and use Chart Wizard to copy the chart and create a graph of the absorption of light by these photosynthetic pigments.

Absorption Spectrum for Chlorophyll

Wavelength (nanometers)	% Absorption Chlorophyll a	% Absorption Chlorophyll b
350	5	0
425	60	30
450	10	70
500	5	25
550	5	5
575	8	5
625	15	25
650	25	30
725	40	50
775	0	0

Activity Directions: On a separate sheet construct a graph of the data above. Make sure all axes are labeled and the graph effectively shows the data. Remember to use "scatter" option. Answer the questions below. Use the Wavelengths of Visible Light chart below to help answer the questions:

1. At what wavelength does Chlorophyll "a" absorb the greatest amount of light?
2. How much light is reflected by Chlorophyll "a" at that wavelength?
3. What 2 colors are best absorbed by Chlorophyll "a"?
4. What 2 colors are best reflected by Chlorophyll "a"?
5. At what wavelength does Chlorophyll "b" absorb the greatest amount of light?
6. How much light is reflected by Chlorophyll "b" at that wavelength?
7. What 2 colors are best absorbed by Chlorophyll "b"?
8. What 2 colors are best reflected by Chlorophyll "b"?
9. Do your answers to 3 & 4 and 7 & 8 explain why these 2 chlorophylls look different? Please explain.
10. What specifically happens to the light that is absorbed by the chlorophyll?
11. What happens to light that is not absorbed?
12. What colors would an artificial plant-growth light favor to promote plant growth effectively?
13. Based on this worksheet, why are plants green?

Wavelengths of Visible Light

Color	Wavelength (nm)
Red	740-625
Orange	625-590
Yellow	590-565
Green	565-520
Blue	520-500
Indigo	500-435
Violet	435-380

JUST FYI: 1 nanometer (nm) = 0.0000000001 meter (one billionth)
1 nanometer (nm) = approximate length of 10 atoms in a row!
1 meter(m) = 1,000,000,000 nanometers (nm)