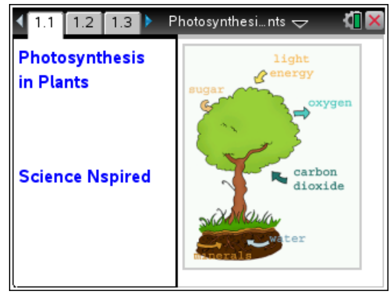
Photosynthesis in Plants

Student Activity

Name ________________

Class ________________

Open the TI-Nspire document *Photosynthesis_in_Plants.tns.*



Very few recipes have an ingredients list that is so short or so simple. The recipe card could read like this:

(1) Take equal parts carbon dioxide, gas, and water.

(2) Allow the CO_2 and H_2O to meet inside a plant cell.

(3) Expose the plant cell to light.

(4) Make sure the correct equipment is available in the plant cell and that the temperature is right.

(5) In only a few minutes, you will have some sugar and some oxygen gas. Get rid of the oxygen and feed Planet Earth with the sugar!

(6) Repeat.

Seriously? Who would believe this?! And yet, it's true! Plants, as well as some simpler organisms such as algae, carry on **photosynthesis**. This process involves using a gas (CO_2) from the air, liquid water (H_2O) from the ground, light energy, and some cellular equipment and supplies. The end result is to produce enough food for almost every organism on Earth—including themselves! Next time you look at a plant and think to yourself, "BORING! They just stay in one place and don't do ANYTHING!" – think again! There is enough going on inside that plant to put the busiest kitchen to shame!

There are many things that can change how fast or slow photosynthesis happens or how well it works.

In the first simulation of this activity, you will change the amount of the light on a plant and observe how this impacts photosynthesis rates.

In the second simulation, you will change the color (**wavelength**) of visible light and see how it affects photosynthesis rates.

Part 1:

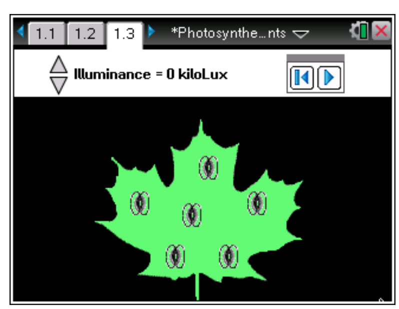
Move to page 1.2.

Read the background information on page 1.2.

Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

Move to page 1.3.

On page 1.3 you will see a picture of a leaf with 6 ***stomata*** that will be used as a monitor of the rate of photosynthesis as the ***illuminance*** (or light intensity) is increased. In real life, stomata are microscopic, and there are often thousands of them on one leaf. During this 1st simulation, stomata that open mean a greater rate of photosynthesis.



1. When you are ready, click the Start button. Then click the up arrow ▲ to change the wavelength of light, (λ- *pronounced lambda*), to which the leaf is exposed. Again, watch both the stomata and the illuminance, (light intensity), value as you proceed.

<u>Pay attention to the stomata as you make your adjustments.</u>

2. To run the simulation again, you may click the Reset button and start over. As you increase the light intensity, a graph is generated on page 1.4.

Move to page 1.4.

Q1. Sketch the graph you generated in the space to the right.

Move to pages 1.5 – 1.7. Answer questions 2-4 here and/or in the .tns file.

Q2. As the illuminance, or light intensity, increases, the rate of photosynthesis __________.

A. increases B. decreases C. stays the same

Q3. As the rate of photosynthesis increases, which substance would you expect to decrease?

A. oxygen
B. carbon dioxide
C. glucose
D. chlorophyll

Q4. During which month would you expect photosynthesis rates to be highest in the Southern Hemisphere?

A. January
B. April
C. June
D. August

Part 2:

Move to page 2.1.

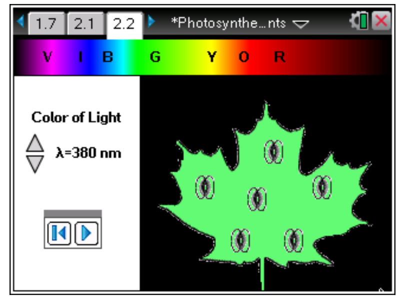
Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

Read the brief background information on page 2.1.

Remember: $CO_2 + H_2O = \lambda$ => Sugar and O_2

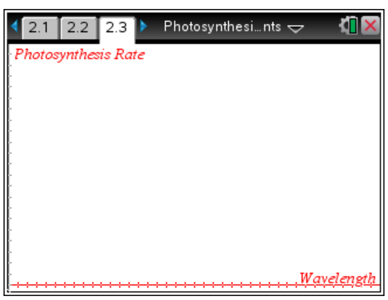
Move to pages 2.2 – 2.4.

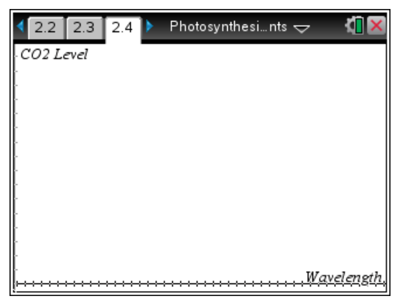
3. On page 2.2, you'll see another picture of a leaf with stomata. In this 2nd simulation, you will change the ***wavelength***, (or color), of visible light to which the leaf is exposed. The ***visible spectrum*** (ROYGBIV) is displayed across the top of the screen.



As with the simulation in Part 1, the more stomata that are open, the greater the rate of photosynthesis. Pay attention to both the spectrum and the stomata as you make your adjustments. When you are ready, click the Play button, and then click the up arrow ▲ to change the wavelength*.* Changing wavelength changes the color of the light to which the leaf is exposed. After you reach the upper limit of the wavelength (780 nm), move to pages 2.3 and 2.4 and observe the graphs that were generated.

Q5. Sketch both graphs in the spaces below.





Q6. Explain why the graphs look the way they do.

Photosynthesis Rate:

Environmental CO_2 Level:

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Move to pages 2.5 – 2.13. Answer the questions 7-15 below and/or in the .tns file.

Q7. Which colors of light are best for photosynthesis?

A. Blue
B. Green
C. Orange
D. Black

Q8. Which wavelengths of light are best for photosynthesis?

A. 440-480 nm
B. 520-600 nm
C. 670-730 nm
D. All are the same

Q9. Which colors of light are used the least for photosynthesis?

A. Purple
B. Blue
C. Green
D. Red

Q10. Think about this: How does your answer to Question 9 explain the color of most plants?

Q11. What does photosynthesis do to environmental CO_2 levels?

A. Increase CO_2
B. Decrease CO_2
C. No change in the levels
D. Produces more CO_2

Q12. What happens to oxygen (O_2) levels?

A. Increase in O_2
B. Decrease in O_2
C. No change in O_2
D. Requires additional O_2

Q13. Based on what you know about CO_2 and photosynthesis, how do plants change the air we breathe?

Q14. What would happen if a plant were exposed ONLY to green light? Why?

Q15. Describe a place on Earth where photosynthesis rates are normally very high. Explain why you chose this place.