Terrestrial Sequestration – Photosynthesis and Cellular Respiration

Science

Goal: Students define key terms and link plant cellular functions based on experimental data and observations.

Objectives: Students will ...

- Observe the differences between photosynthesis and cellular respiration
- Observe the links due to climate changes
- Relate how climate change affects their lives

Materials (for each group):

- 6 test tubes
- 2 test tube racks
- 6 rubber stoppers
- 1 250ml beaker
- 150ml of phenol red
- plant leaves (aquatic plant – Elodea)
- CO_2 generator (250 ml flask with rubber stopper and tubing)
- baking soda
- vinegar
- lamp
- microspoon spatula
- 30 copies of Terrestrial Sequestration – Student Sheet

Time Required: 45-60 minute class period

Standards Met: S1, S2, S3, S4

Procedure:

PREP

- Set up lab stations, enough to have no more than 4 students per group.
- Review background information.
- Make phenol red.
- Purchase Elodea (available online or at local pet stores).

IN CLASS

- Explain to students that they will be investigating the carbon cycle as it relates to global climate change.
- Get students into groups of 3 or 4.
- Hand out Terrestrial Sequestration – Student Sheets.
- Review the background information.
- Review the student procedure and expectations.
- Circulate as students begin the lab.
- Students should continue to monitor the experiment, record data in the chart and answer the questions. When comparing the color in the test tube, place in front of a white background.

Assessment:

- Participation in the activity
- Completed Terrestrial Sequestration – Student Sheet

Terrestrial Sequestration – Teacher Background Information

Photosynthesis is a biochemical process in which plants, algae, and some bacteria harness the energy of light to produce food. Ultimately, nearly all living things depend on energy produced from photosynthesis for their nourishment, making it vital to life on Earth. It is also responsible for producing the oxygen that makes up a large portion of the Earth's atmosphere.

Cellular respiration allows organisms to use (release) the energy stored in glucose. The energy in glucose is first used to produce ATP. Cells use ATP to supply their energy needs. Cellular respiration is therefore a process in which the energy in glucose is transferred to ATP.

This Lab will use phenol red as an indicator to determine whether CO_2 is being consumed or produced during this activity. We know that plants perform photosynthesis in the presence of light. They also perform cellular respiration. To demonstrate this we will observe what happens in a light and dark environment as we add Elodea to a test tube of acidic phenol red. We will observe any changes in CO_2 by using the ph indicator phenol red. Phenol red is a yellow color at a pH 6.4 or lower and a red color at a pH of 8.2 or above.

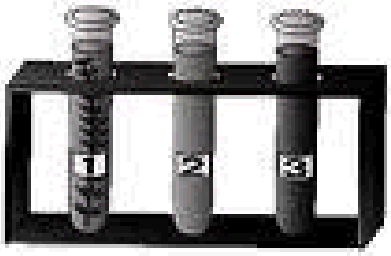
Elodea is an aquatic plant that will take up carbon dioxide from the water during photosynthesis, raising the ph level and release carbon dioxide into the water when respiring, lowering the ph. When Elodea is exposed to light it will begin photosynthesizing removing carbon dioxide from the solution. Respiration of the plant is constant, since the plant always needs energy.

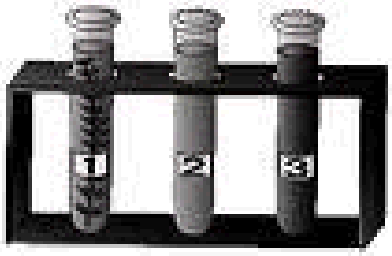
One problem you'll encounter when studying respiration in plants is that in the presence of sunlight they begin photosynthesis and this counteracts respiration. One way to measure respiration is by placing the Elodea in the dark.

Terrestrial Sequestration– Student Sheet

Follow the steps below to successfully complete the lab.

Procedure:





- Place 3 test tubes in each test tube rack.
- Fill the third test tube in each test tube rack ¾ full from the 150ml of phenol red (this will be the constant), and put a rubber stopper on both test tubes.
- Make a CO_2 generator by filling the bottom of the 250ml flask with baking soda. Place the two-hole rubber stopper (containing the plastic tubes and rubber tubing) on the flask and slowly inject vinegar into the baking soda through the plastic tubing using a syringe. The long rubber tubing is placed in the beaker containing the remaining phenol red. CO_2 will bubble through the solution turning the phenol red acidic. The color changes to orange-yellow. (**The more acidic the phenol red, the longer it will take the Elodea plant to absorb the CO_2**).
- Submerge a sprig of Elodea completely into the first test tube in both test tube racks.
- Fill the remaining 4 test tubes (including the ones with the Elodea) ¾ full with the acidic phenol red solution that you just made using the CO_2 generator.
- Cover each test tube with a rubber stopper.
- Each test tube rack should have 3 test tubes. The first test tube should contain the Elodea in the acidic phenol red, the second contains just acidic phenol red, and the third is phenol red (the constant).
- Place one test tube rack (containing the 3 test tubes) under the light source.
- Place the other test tube rack (containing the 3 test tubes) in the dark.
- All test tubes should be sealed with rubber stoppers, aluminum foil, or parafilm to reduce the reactions with the air.
- In approximately 60 minutes, you'll notice a color change.
- Record the data on the chart and answer the question.

Hypothesis:
What do you think will happen when you place the aquatic plant, Elodea in acidic phenol red in a light and dark environment for a period of 60 minutes?

_____

_____

Complete the Table

Phenol red with Elodea	**Observations (color change)**
In the Dark	
In the Light	

What did this experiment tell us about the role of plants in our environment?

WORKSHOP COPY

Terrestrial Sequestration – Student Sheet

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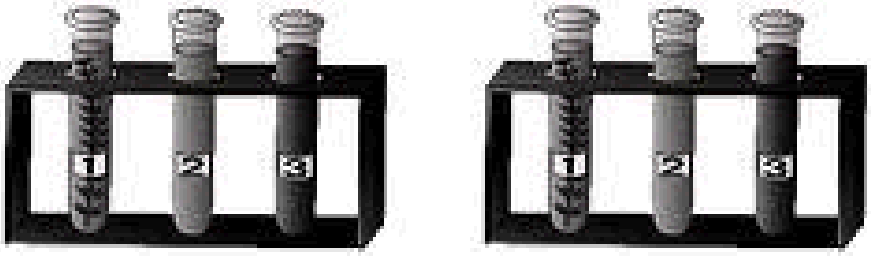

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