



Photosynthesis

Light intensity

BIOLOGY
Plant
Physiology

Driving Question:

What is the relationship between the photosynthesis rate and the light intensity?



Thinking about the question

In this activity you will monitor photosynthesis. Photosynthesis, performed by plant cells, is the process by which light energy is converted into the stored chemical energy of organic molecules. During photosynthesis carbon dioxide and water are, driven by light energy, converted into glucose and oxygen.

You will use the CO₂ gas sensor to measure the concentration of carbon dioxide in a chamber containing fresh green leaves. Furthermore you will compare the photosynthesis rate of green leaves in the dark and (bright) light.

Materials

In your investigations you will use:

- Data-logger or interface e.g. CMA CLAB,
- CO₂ gas sensor, and/or
- [optional] O₂ gas sensor,
- [optional] Light sensor,
- Bright light source,
- Special photosynthesis chamber or a sampling bottle delivered with the CO₂ sensor and a glass container filled with water (heat sink),
- Fresh green leaves e.g. fresh spinach,
- Aluminium foil.

Investigations

1. Use a special photosynthesis chamber or a sampling bottle delivered with the CO₂ sensor.
2. Connect the CO₂ sensor to input 1 of your data-logger. Let the sensor warm up.
3. Open Coach Activity 'Photosynthesis (light intensity)'.
4. Calibrate the CO₂ sensor in fresh air.
5. Place fresh green leaves such as fresh spinach leaves in the chamber and leave them for a while.
6. Wrap the chamber in aluminum foil so that no light reaches the leaves.
7. Refresh the air inside the container. When you use the sampling bottle shake it and catch the fresh air.
8. Place the CO₂ sensor in the opening in the container. Gently push the sensor down until it stops. The sensor is designed to seal off the opening.
9. Start the measurement.
10. After 10 minutes remove the foil and measure in daylight.
11. After the next 10 minutes turn the lamp on. When you use the sampling bottle, place a glass tank filled with water between the light and sampling bottle. This tank acts as a heat shield.
12. [Optional] investigate the CO₂ gas concentration changes using bright light (extra light source).
13. How does the CO₂ gas concentration change during the dark period?
14. What process is responsible for this?
15. What is the effect of daylight on the CO₂ gas concentration?
16. What is the effect of strong light on the CO₂ gas concentration?
17. What processes are responsible for such behavior?
18. Determine the rate of respiration in these three situations, no light, daylight and strong light (only possible with optional O₂ gas concentration data).
19. Determine the rate of photosynthesis in these three situations, no light, daylight and strong light.
20. How does the light intensity influences the rate of respiration?
21. How does the light intensity influences the rate of photosynthesis?



Resources:

Coach Activity: Photosynthesis (light intensity).cma7