ScienceCube

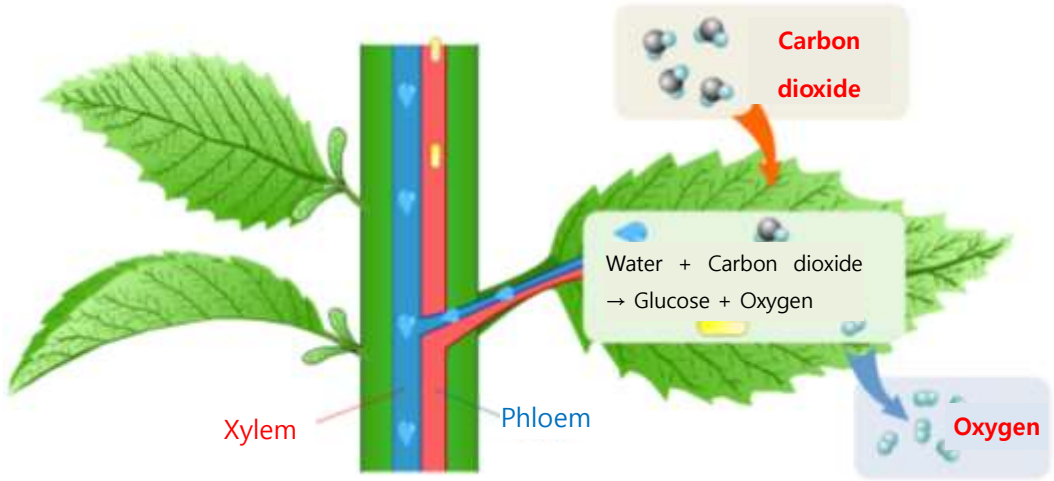
Photosynthesis

1. **Identifying the substances produced by photosynthesis.**
2. **Explaining the changes in the amount of photosynthesis according to the intensity of light.**

Fundamental Concept

1. Substances Produced by Photosynthesis

Water + Carbon dioxide $\xrightarrow[\text{Chloroplast}]{\text{Sunlight}}$ Glucose + Oxygen



< Overall Process of Photosynthesis>

2. Factors Affecting the Amount of Photosynthesis

A. Light Intensity: As the light intensity increases, the amount of photosynthesis increases, but it does not increase beyond a certain limit (called the light saturation point).

B. Carbon Dioxide: As the concentration of carbon dioxide increases, the amount of photosynthesis increases, but it does not increase beyond a certain concentration.

C. Temperature: As the temperature increases, the amount of photosynthesis increases, reaching a peak at around 35°C-38°C, but decreases beyond that.

3. Photosynthesis and Respiration Rates According to Light Intensity

(1) Light Saturation Point

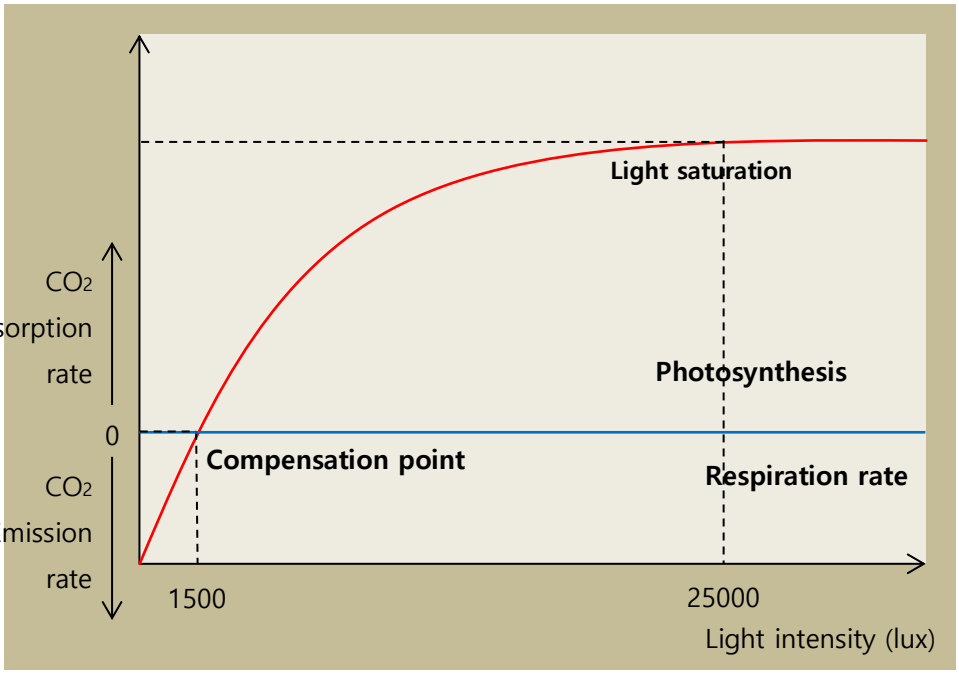
: The light intensity at which the rate of photosynthesis no longer increases.

Tip) The light saturation point for lettuce is about 25,000 Lux..

(2) Compensation Point

: The light intensity at which the rate of photosynthesis equals the rate of respiration, resulting in no net gas exchange.

Tip) The compensation point for lettuce is about 1,500 Lux.



< Photosynthesis and Respiration Rates According to Light Intensity>

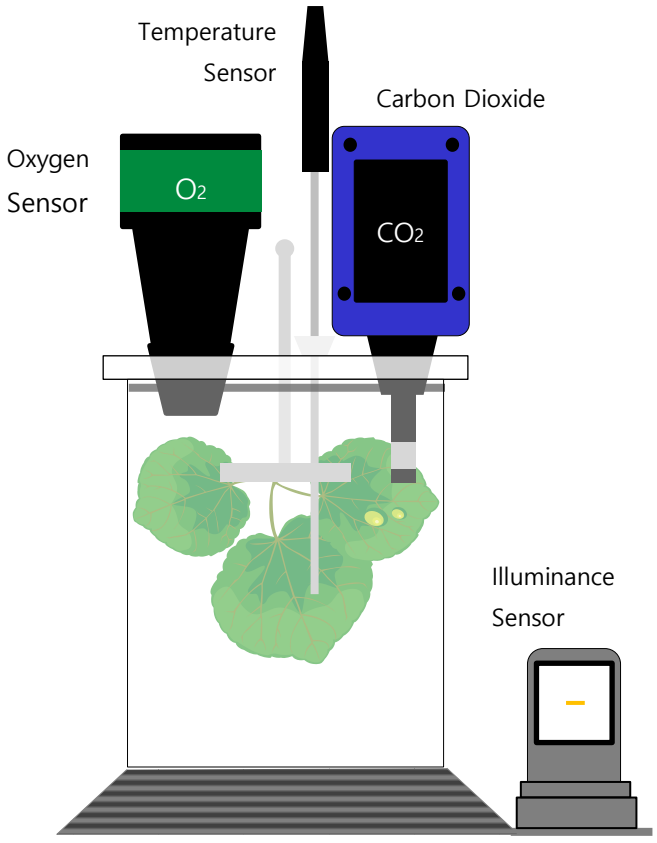
Experiment

Materials Needed

Interface, Science# Program, photosynthesis experiment apparatus, oxygen sensor, carbon dioxide sensor, light sensor, temperature sensor, lettuce

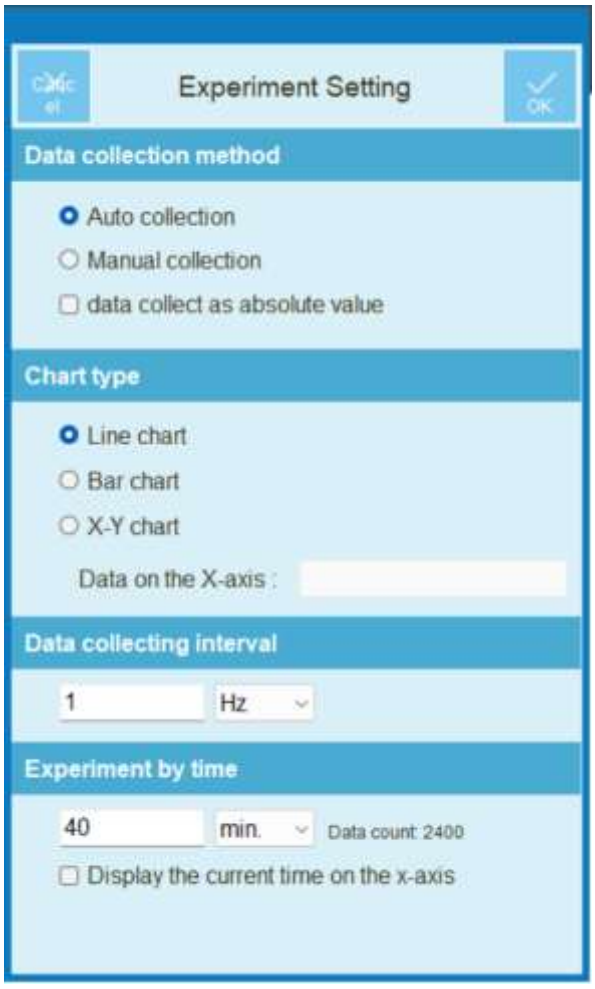
Preparation of Experimental Apparatus

1. Use clamps and rubber rings to fix the lettuce inside the chamber.
   Tip) To ensure the lettuce receives proper light for photosynthesis, fix 2-3 leaves without overlapping them.
2. Secure the oxygen sensor and carbon dioxide sensor inside the chamber.
3. Fix the temperature sensor in the chamber using a rubber stopper.
4. Fix the light sensor in place with a light sensor holder.
5. Install the LED lamp facing the light sensor.
6. Cover the setup with a blackout curtain to block light.



Interface Setup

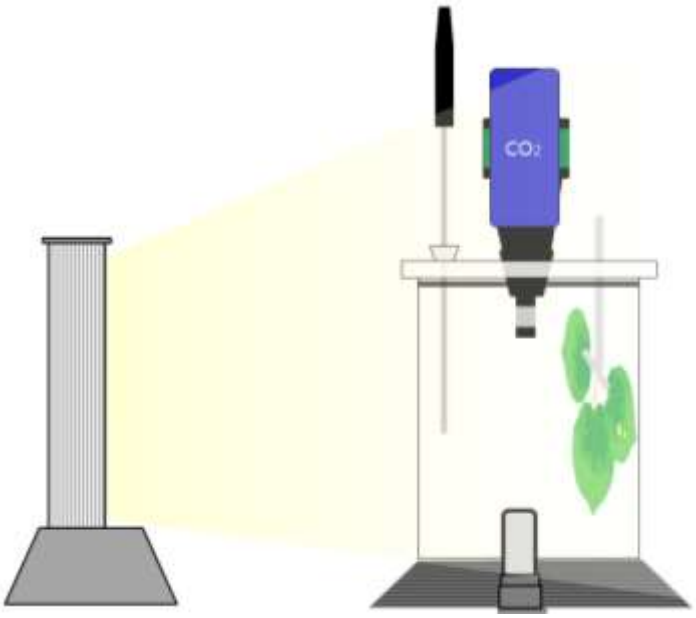
1. Run the Science# program.
2. Connect the oxygen sensor, carbon dioxide sensor, light sensor, and temperature sensor to the interface.
3. Click to set up the experimental environment as shown below or click to automatically set up.



 자동설정

Data Collection

1. Click to start collecting data.
2. After 10 minutes of data collection, remove the blackout curtain and adjust the position and brightness of the LED lamp to achieve 1,500 Lux.
3. Change the light intensity to 5,000 Lux and 10,000 Lux, respectively, for 10 minutes each, repeating the above process.



Data Analysis

Recording

1. Measure the changes in carbon dioxide, oxygen, temperature, and light intensity at 10-minute intervals while changing the light intensity. Draw graphs showing the changes in these physical quantities according to light intensity.

2. Present the changes in physical quantities according to light intensity in a table.

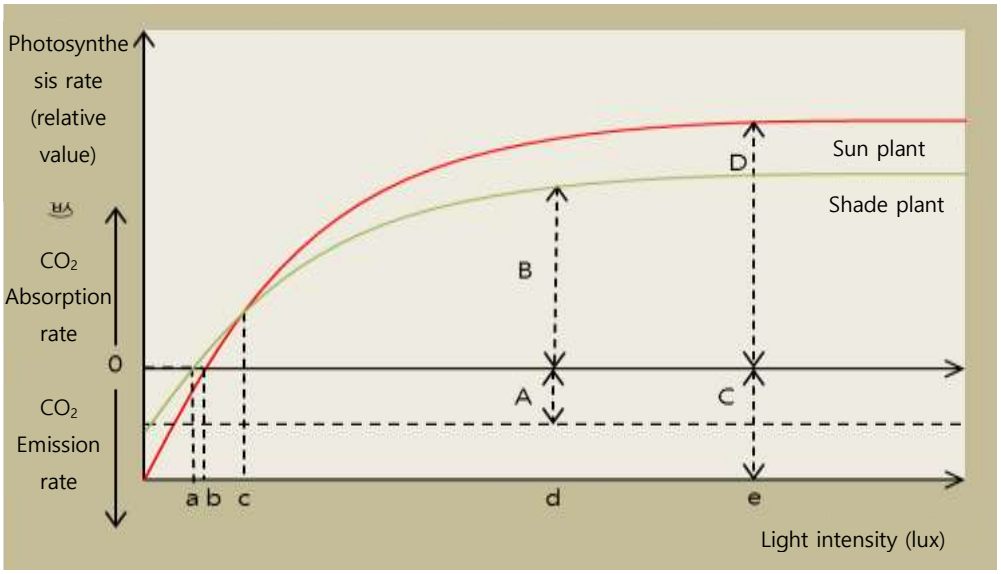
Data Application and Extended Activities

1. List the physical quantities that change during respiration and photosynthesis.

2. Describe the relationship between light intensity and the amount of photosynthesis.

3. The following graph shows the amount of photosynthesis according to light intensity for

sun plants and shade plants.

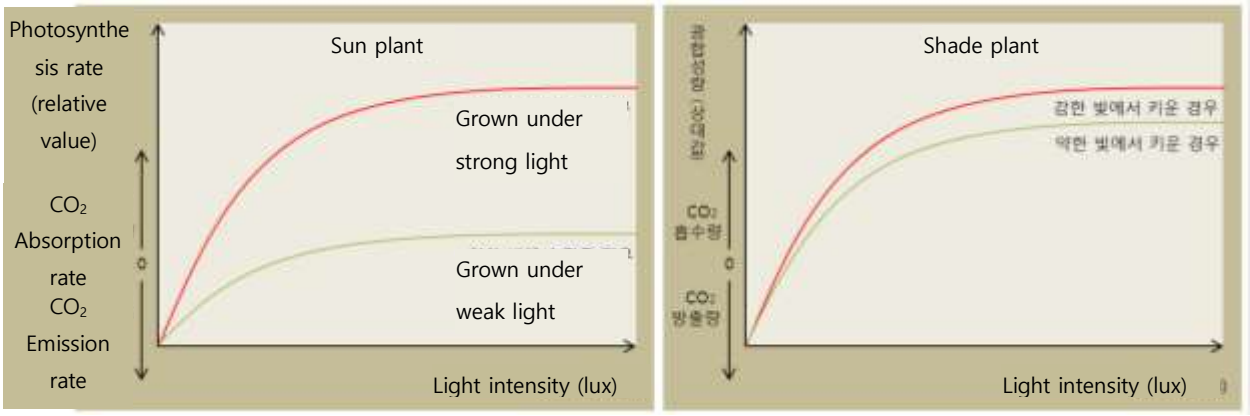


Mark the correct statements with O and the incorrect statements with X based on the above information..

Statement	O / X
The compensation points of sun plants and shade plants are b and a, respectively, and the compensation point of sun plants is higher than that of shade plants.	
The light saturation points of sun plants and shade plants are e and c, respectively, and the light saturation point of sun plants is lower than that of shade plants.	
The respiration rates of sun plants and shade plants are C and A, respectively, and the respiration rate of sun plants is higher than that of shade plants.	
The net photosynthesis rates of sun plants and shade plants are B and D, respectively.	
The total photosynthesis rates of sun plants and shade plants are C+D and A+B, respectively.	

4. Sun plants and shade plants of the same type were grown under strong light and weak

light, respectively. Their photosynthesis rates according to light intensity were then measured in the same place..



Select the correct interpretations:

a. The light saturation point can vary depending on the light conditions under which the plants were grown.

b. The maximum photosynthesis rate of sun plants grown under strong light is much higher than that of sun plants grown under weak light.

c. Sun plants and shade plants adapt differently to light conditions during growth..