



#8672

CELLULAR ENERGY AND METABOLISM

Grade Levels: 9-13+
15 minutes
BENCHMARK MEDIA 1999

DESCRIPTION

Explains the scientific concepts of photosynthesis, respiration, and enzymes. Laboratory experiments demonstrate: the rate of photosynthesis in greenhouse plants; the amount of oxygen used by the body during respiration at varying speeds; and the reaction times of different enzymes.

ACADEMIC STANDARDS

Subject Area: Life Sciences

- ◆ Standard: Understands the structure and function of cells and organisms
 - Benchmark: Understands the processes of photosynthesis and respiration in plants (e.g., chloroplasts in plant cells use energy from sunlight to combine molecules of carbon dioxide and water into complex, energy-rich organic compounds and release oxygen to the environment)

INSTRUCTIONAL GOALS

1. To explain the process of photosynthesis.
2. To discuss factors which affect the rate of photosynthesis.
3. To depict respiration and the transfer of energy from food.
4. To discuss factors which affect the rate of respiration.
5. To introduce enzymes as biological catalysts.
6. To discuss factors which affect the rate of enzyme action.

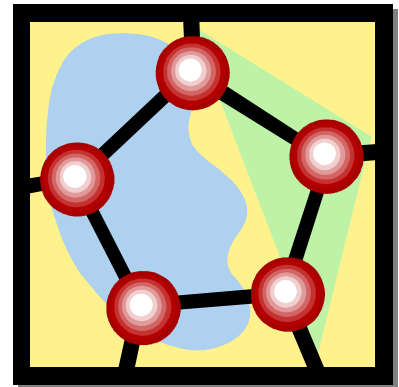
BEFORE SHOWING

1. Explain that three key concepts will be explained: photosynthesis, respiration, and enzymes.
2. Explain that laboratory demonstrations will be shown and end with questions. Students will have an opportunity to provide their answers AFTER SHOWING.

DURING SHOWING

Discussion Items and Questions

1. View the video more than once, with one showing uninterrupted.
2. Pause the video after the amount of CO₂ used indicates the rate of photosynthesis. Explain.
3. Pause the video after the demonstration of pondweed photosynthesizing in water. Analyze the data displayed.
4. Pause the video after watching respiration releasing energy from food for humans. Describe what this respiration process is called.
5. Familiarize the equation for respiration.
6. Pause the video after each sequence showing the use of a gas analyzer linked to a data-logger to record information on production of CO₂ and uptake of O₂ during respiration. Analyze the graphs shown on how exercise demands a greater rate of respiration.
7. Pause the video after a portable blood test kit is used to show lactic acid levels before and after sprinting. Describe what this respiration process is called.
8. Pause the video after each sequence is shown on how an enzyme acts. Explain.
9. Pause the video after the enzyme activity experiment. Explain the higher the temperature, the greater the rate of enzyme action.
10. Pause the video after animated sequences model how enzyme molecules can change in shape. Explain.
11. Familiarize the equation for the breakdown of catalase by hydrogen peroxide and the production of oxygen.

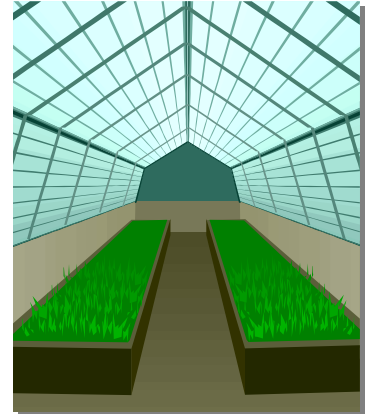


AFTER SHOWING

Discussion Items and Questions

1. Compare and contrast the functions of photosynthesis and respiration.
2. What is the formula for photosynthesis?
3. What other variables could affect the rate of photosynthesis? What experiment would determine their effect? (Increasing the amount of water?) (Increasing the intensity of particular wavelengths in light?) (Increasing the supply of carbon dioxide?)
4. What is the formula for respiration? What other variables would affect the rate of respiration? (The lesser amounts of oxygen in the atmosphere at increasing altitudes above sea level or the artificial mixture of oxygen in such breathing apparatus as that used in space exploration, and deep-sea diving?)
5. What are the differences between *aerobic* and *anaerobic* respiration? What are the formulas, and the relative energy production of each?

6. In the video, an experiment with amylase breaking down starch at three different temperatures of 5, 20, and 35 degrees Celsius respectively shows that the catalyst worked fastest at 35 degrees Celsius. Why? (Amylase has evolved to work best in the range of body temperature, 98.6 degrees Fahrenheit or 37 degrees Celsius. Without enzymes, biological reactions would be too slow at the temperature at which cells exist.)
7. What would happen were the enzyme amylase and the substrate starch in solution to be kept at 60 degrees Celsius? (Enzymes denature at temperatures over 42 degrees Celsius and become ineffective because their molecular configuration no longer fits that of the substrate.)



RELATED RESOURCES



Captioned Media Program

- The Oxygen Story #3279

World Wide Web



The following Web sites complement the contents of this guide; they were selected by professionals who have experience in teaching deaf and hard of hearing students. Every effort was made to select accurate, educationally relevant, and "kid-safe" sites. However, teachers should preview them before use. The U.S. Department of Education, the National Association of the Deaf, and the Captioned Media Program do not endorse the sites and are not responsible for their content.

- **DISCOVERYSCHOOL.COM**

<http://school.discovery.com>

Click on "For Teachers," then visit Kathy Schrock's Guide for Educators and you'll be led to many Web links under "Science and Technology."

- **THE BIOLOGY PROJECT**

<http://www.biology.arizona.edu>

An interactive online resource for learning biology developed at the University of Arizona. Richly illustrated and tested on thousands of students, it is designed for high school and college.