**Day 5**

**Title: Photosynthesis & Cellular Respiration**

Friday Week 1

**Length of Time:**

1 class period between 45-50 minutes

**Environment:**

The classroom desks will be arranged in a horse shoe shape with the open end facing the teacher’s table/desk for all class opening and concluding activities. During lab activity, for group members that choose to complete the day’s labs, students will be working in the lab area most of the time. Students that choose not to complete the lab activity will continue discussing, planning, and researching their group’s project at their group’s desk area during the lab activities.

**Standards:**

**Indiana State Biology I Standards**

B.1.1 Describe the structure of the major categories of organic compounds that make up living organisms in terms of their building blocks and the small number of chemical elements (i.e., carbon, hydrogen, nitrogen, oxygen, phosphorous and sulfur) from which they are composed.  
  
B.1.2 Understand that the shape of a molecule determines its role in the many different types of cellular processes (e.g., metabolism, homeostasis, growth and development, and heredity) and understand that the majority of these processes involve proteins that act as enzymes.  
  
B.1.3 Explain and give examples of how the function and differentiation of cells is influenced by their external environment (e.g., temperature, acidity and the concentration of certain molecules) and changes in these conditions may affect how a cell functions.  
  
\*B.3.1 Describe how some organisms capture the sun’s energy through the process of photosynthesis by converting carbon dioxide and water into high-energy compounds and releasing oxygen.  
  
\*B.3.2 Describe how most organisms can combine and recombine the elements contained in sugar molecules into a variety of biologically essential compounds by utilizing the energy from cellular respiration.

**21st Century Skills**

Critical thinking  
  
Communication  
  
Collaboration

**Objectives:**

After completing a photosynthesis and respiration lab, student will be able to describe the process of photosynthesis and cellular respiration and how it contributes to the flow of energy in the biosphere.

Students will be able to model the structure of carbon, hydrogen and oxygen, as well as simple compounds made of those elements (ex. water and carbon dioxide) through a molecular modeling activity.  
  
Students will be able to model the action of an enzyme and explain its importance in biofuel production. Groups will model the effect of temperature and pH on enzymatic action.  
  
Students will model how changes in pH and temperature affect the rate of an enzymes action.  
  
After completing a think, pair, share activity along with a photosynthesis and respiration lab, students will be able to describe the process of photosynthesis and how it contributes to the flow of energy in the biosphere.  
  
Students will be able to describe the process of cellular respiration and its importance in the production of energy for every organism after completing a think, pair, share activity along with a photosynthesis and respiration lab.

**Materials:**

Photosynthesis and cellular respiration lab (grade 9)

OR

[Photosynthesis lab](http://www.elbiology.com/labtools/Leafdisk.html) (grades 11-12)

300 ml of bicarbonate solution for each trial.

Liquid soap

Leaf disks

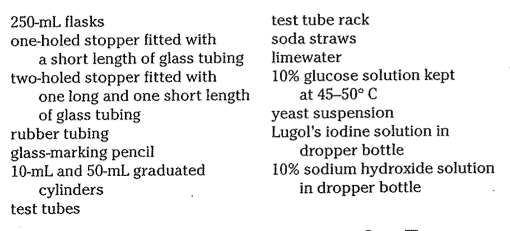
Hole punch

Syringes

Beakers

Light source

Respiration demo (grades 11- 12)



**Opening:**

“Please describe, in four sentences or less, what you remember about photosynthesis and respiration.”

**General Procedure**:

Students will perform the photosynthesis and cellular respiration labs and then do a think, pair, share activity to discuss what they learned from doing the labs.

Two approaches to these lab activities include:

1. Each group decides if they will have members attend and complete either or both the photosynthesis lab and/or the cellular respiration lab activities. Participating students will become that group’s experts on these topics. After completing the lab(s), the student experts return to their groups and teach their other group members about photosynthesis and cellular respiration. Each group member discusses, and uses internet if access is available for research, how photosynthesis and cellular respiration contributes to the flow of energy in the biosphere.

This approach allows the group members to tailor their activities to their own personal interests and toward the group’s goals and topic area. Allowing the students choice in their activities generates a feeling that students have greater ownership in their learning activities. The group can select which members will participate and complete which of the scheduled lab activities. This member will become the group’s expert on these topics while other members can work on project aspects that better fit their own unique skills and ability levels.

1. Every class member participates and completes each lab activity.

After the lab activities, students will think about the activities and what they learned from the labs. The students will pair with another student and share with each other what they learned from completing the labs.

One strategy to reinforce student learning and correct understanding is to have one partner share the steps of the lab and what they learned from the lab. The second student listens silently and can only nod or smile in encouragement. When the first students’ time is up, the second student has their turn to talk. Afterward, the two students check in with each other about any confusion or questions that they have from the lab activities. Students do this pair and share review without using notes. This activity allows students to hear a peer’s view about the procedures of the lab and about what they learned. Adolescents generally are more engaged in interacting with their peers than in hearing from adults. Second, the students themselves are reviewing what they learned thereby building more brain connections so that it is easier for the students to access this learned material later. Third, the students themselves are checking each other for the accuracy of their learning; students are learning greater independence and responsibility for their own learning.

**Assessment:**

At the end of the class, students will do an exit question, which is: “In four sentences or less, please describe how the processes of photosynthesis and cellular respiration contribute to the flow of energy through the biosphere.” This can be done as either an exit ticket activity or as a reflection question. Answers can be either verbal responses shared with peer partners (as above), written on a half sheet of paper or on a 3X5 card to be handed in as they leave the classroom for the teacher to review later. If this is the case, the teacher can informally check for student understanding and progress in learning and make changes in instruction as needed. Or, students can write their responses in their science journals.