Name: _____ Date: _____

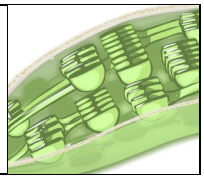
Student Exploration: Cell Energy Cycle

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

What is the purpose of this activity? What are you supposed to be learning?

_____

_____

Activity A: **Photosynthesis**	Get the Gizmo ready: • Check that the PHOTOSYNTHESIS tab is selected. Check that **Description** is turned on.	

Introduction: Photosynthesis occurs in the **chloroplast**, an organelle found in plant and algae cells. Within the chloroplast, a green pigment called **chlorophyll** converts the **radiant energy** of sunlight into **chemical energy** that the plant can use.

Question: What are the reactants and products of photosynthesis?

1. Explore: Drag each molecule from the CHEMICALS pane to the chloroplast on the PHOTOSYNTHESIS pane. If a molecule is a reactant, it will stay in the chloroplast.

   Which molecules are reactants in photosynthesis? _____

2. Observe: Click **Add light** and look at the **Output**. What are the products of photosynthesis?

   _____

3. Summarize: A chemical equation shows reactants on the left side of an arrow, and products on the right, like this: *reactant* + *reactant* → *product* + *product*.

   Based on your observations, what is the chemical equation for photosynthesis?

   _____

   Turn on **Show chemical equation** to check.

4. Connect: Explain why photosynthesis is important to photoautotrophs.

   _____

   _____

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Activity B: **Cellular respiration**	Get the Gizmo ready: • Click **Reset**. • Select the RESPIRATION tab.	

Introduction: Cellular respiration occurs mainly in the **mitochondria**, organelles found in all complex cells, including animals, plants, fungi. (Bacteria and other simple organisms do not contain mitochondria.) The Gizmo shows a red mitochondrion surrounded by yellow cytoplasm.

Question: What are the reactants and products of cellular respiration?

1. Explore: Drag each molecule from the CHEMICALS pane to the RESPIRATION pane.

   Which molecules are reactants in cellular respiration? _____

2. Observe: Click **Next three times**. What is three (3) things produced?

   _____

   Energy (E), is stored in the form of **ATP** (adenosine triphosphate) molecules. A total of 32 – 36 molecules of ATP are produced by the complete cellular respiration process.

3. Analyze: Cellular respiration involves two steps. **Anaerobic respiration** takes place in the cytoplasm (yellow), while **aerobic respiration** takes place in the mitochondrion.

7. Which phase uses oxygen – **anaerobic** respiration or **aerobic** respiration? _____

8. Which phase produces more ATP? _____

9. Summarize: Based on what you have seen, what is the overall chemical equation for cellular respiration? _____

   Turn on **Show formula of chemical equation** to check.

10. Extend your thinking: When you think of the word “respiration,” you might think about the process of breathing, which is actually called *ventilation*. (The respiratory system consists of the windpipe, lungs, etc.) How is breathing related to cellular respiration? (Hint: What do you inhale? What do you exhale? How are these related to respiration?)

    _____

11. If all organisms require ATP as the “energy currency” for metabolic reactions, what organisms do you believe perform cellular respiration – heterotrophs only, photoautotrophs only, or all organisms? Explain.

    _____

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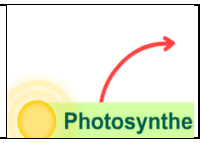
Activity C: The carbon-oxygen cycle	Get the Gizmo ready: • Click **Reset**. • Select the CYCLE tab.	

Question: How is photosynthesis related to cellular respiration?

1. Predict: Look at the red arrows, and think about the photosynthesis and respiration reactions. Each red arrow connects a set of reactants to the products of the reaction.

   A. Which molecules would you expect to find at the top of the diagram? Explain.

   _____

   _____

   B. Which molecules would you expect to find at the bottom of the diagram? Explain.

   _____

   _____

2. Observe: Drag the **Oxygen**, **Glucose**, **Carbon dioxide**, and **Water** into the CYCLE pane.

   A. Which substances are reactants in photosynthesis? _____ _____

   B. Which substances are products of photosynthesis? _____ _____

   C. Which substances are reactants in respiration? _____ _____

   D. Which substances are products of respiration? _____ _____

3. Compare: How are the reactants and products of photosynthesis and respiration related to one another?

   _____

4. Review: In photosynthesis and respiration, energy is converted from one form to another. Light is a form of radiant energy. Glucose and ATP molecules store chemical energy.

   A. In photosynthesis, sunlight is converted into what type of energy, and what molecule stores this energy? _____

   B. The energy transformed by respiration stored is stored in what molecule? _____

5. Think and discuss: In plants, is photosynthesis more like eating food or respiration? Explain.

   _____

   _____

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