



# Photosynthesis and Cellular Respiration Kit

## A ThINQ!<sup>™</sup> Investigation

Catalog #12005534EDU

General Biology

**Student Guide**

**BIO-RAD**

## Lesson 1

### Modeling the Inputs and Outputs of Photosynthesis and Cellular Respiration

#### **PART 1: Observing indicator color change**

- 1. Before blowing into the indicator solution, what color is it?*
- 2. What did you notice about the color of the solution after you blew into it using the straw?*
- 3. What might explain the change in color? What are you blowing into the solution that could cause a color change?*
- 4. Draw a model of what you think happened in the indicator solution. Include relevant details, labels, and arrows to indicate changes that happen in the system.*

*Explanation — Write 2–3 complete sentences to describe your model.*

- 5. Discuss and share ideas with your classmates about what might explain the change in color. After discussion, draw a revised model that includes any new information you learned.***

***Explanation — Write 2–3 complete sentences to describe your model.***

## PART 2: Linking Photosynthesis and Cellular Respiration

6. *Fill in the table below with the details of photosynthesis and cellular respiration.*

	Photosynthesis	Cellular Respiration
Inputs		
Outputs		
Organelle		
Example organism(s)		

7. *Describe the relationship between photosynthesis and cellular respiration. Use the information in the table above to support your answer.*

8. *Fill in the table below based on your current observations. Check an indicator color guide to see the full range of colors of the indicator solution.*

	Increase of CO <sub>2</sub> in solution	Decrease of CO <sub>2</sub> in solution
Observed indicator solution color change		
Solution pH change		

9. *Using information from the tables above, predict what would happen to the indicator solution if you put a plant in it.*

## Lesson 2

### Experimental Design with Algae Beads

#### **PART 1: Using Algae Beads as a Model Organism**

*10. Draw and describe what the algae beads look like.*

*11. Look at the debeaded algae under the microscope. Sketch what you see.*

*12. What would happen if you put algae beads in the carbon dioxide indicator? Why?*

- 13. Draw a model of what you would expect to happen if you put algae beads in the carbon dioxide indicator. Refer to the table of inputs and outputs of photosynthesis and cellular respiration you completed in lesson 1.**

***Explanation — Write 2–3 complete sentences to describe your model.***



## **Experimental Design and Planning**

*Investigation question (1–2 sentences):*

*Available materials:*

*Relevant background information (3–4 sentences):*

*Independent variable:*

*Dependent variable(s):*



**Constants:**

**Controls. Explain what each is controlling for:**

**Safety notes:**

Written Steps	Drawn Steps

***Describe the data that will be collected:***

***How will the data be analyzed?***

***Predict what you think will happen. Sketch out what the data will look like if they support your prediction.***

**Lesson 3****Photosynthesis and Cellular Respiration Investigation****PART 1: Conducting Your Experiment**

*It is important to record what you actually do in an experiment even when you are following a written protocol. That way you can take note of anything you do differently from the original plan. Record your steps in the left-hand column of the table below as you conduct your experiment. Record any observations you make in the right-hand column of the table below.*

Steps	Observations and data collection

Steps	Observations and data collection

## **PART 2: Analyzing Experimental Results and Revising Models**

*Rewrite your investigation question here:*

*Write a **claim** that answers your experimental question:*

*Provide **evidence** to support your claim:*

*Explain your **reasoning** for how the evidence supports your claim:*

*Provide a **scientific explanation** for the results of your experiment.*

***Create a revised model of algae beads in indicator solution that includes the new information you learned from the results of your experiment.***

***Explanation — Write 2–3 complete sentences to describe your model.***

## Post-Lab Questions

In nature, organisms are usually part of a dynamic and complex ecosystem. They exchange energy and nutrients among themselves and with the environment. In your investigation, you used algae and carbon dioxide indicator solution to study the balance between photosynthesis and cellular respiration. How could you investigate photosynthesis and cellular respiration in an ecosystem?

### ***How to study photosynthesis and cellular respiration in an ecosystem***

A group of students were interested in investigating photosynthesis and cellular respiration in an ecosystem. Since they were familiar with using algae beads as a model photosynthetic organism, they asked their instructor if they could add an animal (heterotroph) to the carbon dioxide indicator solution. Their instructor suggested using small aquatic snails and slightly larger tubes.

### ***Experimental Setup***

To set up their investigation, the students assembled two experimental tubes: each contained carbon dioxide indicator solution, algae beads, and aquatic snails. One container was placed under light and the other was placed in the dark (covered in foil).

In addition the students set up two control containers: each contained carbon dioxide indicator solution and algae beads but no aquatic snails. One container was placed under light and the other was placed in the dark (covered in foil).

	Tube Labels			
	LAS	DAS	LA	DA
5 algae beads	✓	✓	✓	✓
1 snail	✓	✓		
Placed in the light	✓		✓	
Placed in the dark		✓		✓

Label Index:

L = Placed in the light

D = Placed in the dark

A = Algae beads in the sample

S = Snails in the sample



1. **Identify the two controls the students used in this experiment and explain the role of each.**

**After 30 minutes the students observed the carbon dioxide indicator in each tube for any color changes. The table below indicates what they found.**

Tube	Initial Indicator Color	Final Indicator Color	Photosynthesis	Cellular Respiration
LAS	Red-orange	Dark Red		
DAS	Red-orange	Yellow		
LA	Red-orange	Purple		
DA	Red-orange	Yellow		

2. **In the table above, write “algae” and/or “snails” in the columns labeled “Photosynthesis” and “Cellular Respiration” to indicate which process or processes are happening in each sample and which organism(s) is performing them.**
3. **What other controls could the students have included in their experiment? Describe the role of each new control.**

**4. For the new controls you listed in question 3, what color would you predict the carbon dioxide indicator to be after 30 minutes? What process or processes would you predict to be taking place? Create a table below for your answers.**

**5. Draw a model that illustrates the processes happening in the experimental samples (DAS and LAS) from the students' experiments. Be sure to include the inputs and outputs of both photosynthesis and cellular respiration.**

**Use your model to predict how the snails would be affected if the students' investigation were to continue for too long.**

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