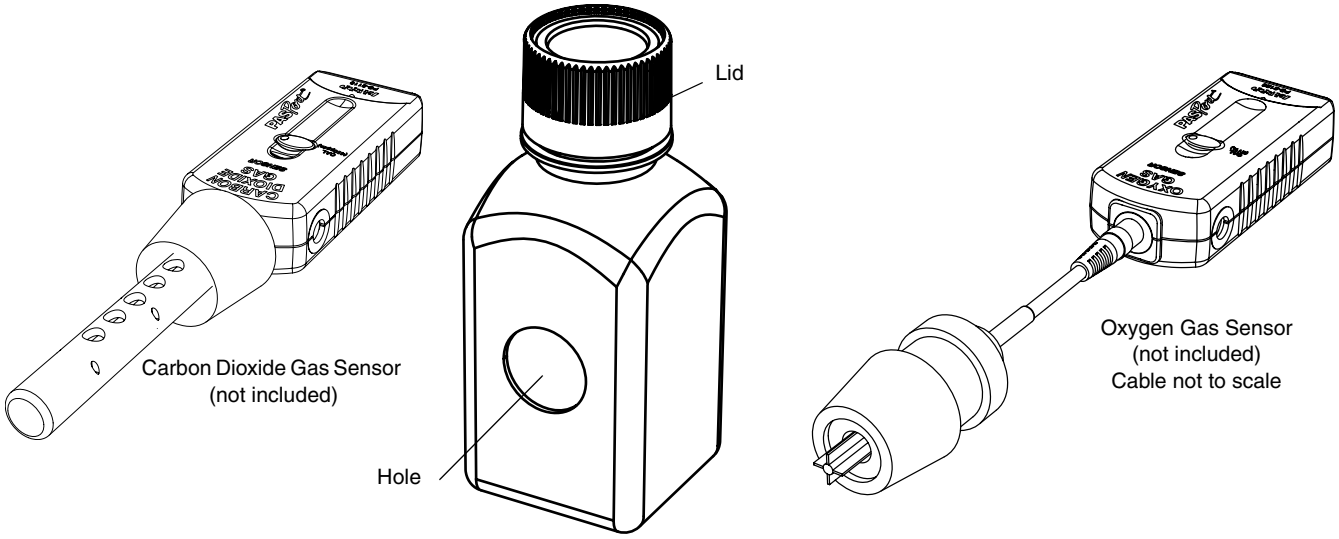
# Metabolism Chamber

**ME-6936**




## Introduction

PASCO model ME-6936 Metabolism Chamber is a 250-mL Nalgene© sampling bottle designed to work with a PASCO Oxygen Gas Sensor and a Carbon Dioxide Gas Sensor for simultaneous measurement of oxygen gas and carbon dioxide gas during the study of metabolism.

| Sensor | Model |
|---|---|
| PASPORT Oxygen Gas Sensor | PS-2126 |
| PASPORT Carbon Dioxide Gas Sensor | PS-2110 |
| Oxygen Gas Sensor | CI-6562 |
| Carbon Dioxide Gas Sensor | CI-6561 |
| **Recommended** | **Model** |
| Fast Response Temperature Probe | PS-2135 |
| PASPORT Sensor Extension Cable | PS-2500 |

One of the most popular methods of exploring cellular respiration in the biology lab is to measure the production of carbon dioxide and the consumption of oxygen by germinating seeds.

The PASPORT gas sensors are designed to work with a PASPORT interface such as the ones listed below.

| PASPORT Interface | Model |
|---|---|
| Xplorer GLX | PS-2002 |
| Xplorer | PS-2000 |
| PowerLink | PS-2001 |
| USB Link | PS-2100 |
| SPARK Science Learning System | PS-2008 |

The other gas sensors work with a ScienceWorkshop interface.

| ScienceWorkshop Interface | Model |
|---|---|
| ScienceWorkshop 750 | CI-7650 |
| ScienceWorkshop 500 | CI-6400 |

See the PASCO catalog or the PASCO web site at

www.pasco.com

for more information about PASCO sensors and interfaces.

# Sample Activities

## 1) Introductory Cell Respiration Lab

### Teacher Preparation

- Get Alaska pea seeds (or lima beans) - about 100 per lab group. Get glass beads approximately the same size as the pea seeds (about 25 per lab group).
- Three or four days before the lab, soak the pea seeds in a pan of water overnight. Soak approximately 25 seeds per lab group.
- Twenty-four hours later, remove the seeds from the water and place them on a moist paper towel.
- Place the seeds and towel into a plastic bag or plastic, lidded storage container and leave in a warm, dry place for twenty-four hours. NOTE: Do not seal the bag or the plastic storage container.
- Provide each lab group with 25 glass beads, 25 dry seeds, and 25 germinating seeds.

NOTE: Do not seal the plastic bag or plastic storage container.

### Data Collection

**1.** Start a new experiment on the data collection system.

**2.** Connect a carbon dioxide ($CO_2$) gas sensor and an oxygen ($O_2$) gas sensor to the data collection system. Use the sensor extension cable to connect the $CO_2$ sensor to the collection system.

**3.** Calibrate the $CO_2$ sensor and calibrate the $O_2$ sensor.

**4.** Change the unit of measurement for the $O_2$ sensor from "%" to "ppm".

**5.** Set up two graphs to display simultaneously. One one graph, display $CO_2$ concentration on the y-axis and Time on the x-axis. On the other graph, display $O_2$ concentration on the y-axis and Time on the x-axis.

**6.** For the first trial, place 25 glass beads into the Metabolism Chamber.

**7.** Start recording data.

**8.** Insert the $CO_2$ sensor into the top of the Metabolism Chamber and the $O_2$ sensor into the hole on the side of the Metabolism Chamber. Firmly press the rubber stoppers of the sensors into the chamber. The Metabolism Chamber must remain vertical; do not lay it on its side.

**9.** Adjust the scale of the graphs to show all data.

**10.** After 10 minutes, stop recording data.

**11.** Name the data run.

**12.** Remove the sensors and the glass beads from the Metabolism Chamber. Wave the chamber so that the air in the chamber mixes with air in the room.

**13.** For the second trial, place 25 dry seeds into the Metabolism Chamber.

**14.** Start recording data. Replace the sensors into the Metabolism Chamber. Remember that the chamber must remain vertical.

**15.** Adjust the scale of the graphs to show all data.

**16.** After 10 minutes, stop recording data.

**17.** Name the data run.

**18.** Remove the sensors and the dry seeds from the chamber.

**19.** Wave the chamber so that the air in the chamber mixes with the air in the room.

**20.** For the third trial, place 25 germinating seeds into the Metabolism Chamber.

**21.** Start data recording. Replace the sensors into the Metabolism Chamber.

**22.** Adjust the scale of the graphs to show all data.

**23.** After 10 minutes, stop recording data.

**24.** Name the data run.

### Data Analysis

**25.** Apply a linear fit to the data runs to find the slope of the line.

**26.** Compare the rates of $CO_2$ production in the dry seeds versus the germinating seeds.

**27.** Compare the rates of $O_2$ consumption in the dry seeds versus the germinating seeds.

**28.** Compare the rates of $CO_2$ production and $O_2$ consumption for the germinating seeds.

## 2) AP© Biology Lab 5: Cellular Respiration

### Teacher Preparation:

- Get Alaska pea seeds (about 100 per lab group).Get glass beads approximately the same size as the pea seeds (about 25 per lab group).
- Three to four days before the lab, soak the pea seeds in a pan of water overnight. Soak approximately 75 pea seeds per lab group.
- Twenty-four hours later, remove the pea seeds from the water and place them on a moist paper towel.
- Place the pea seeds and the towel in a plastic bag or plastic, lidded storage container and leave it in a warm, dry place for another 24 hours. Do not seal the bag or plastic storage container.
- On the day of the lab, prepare boiled germinating pea seeds and chilled germinating pea seeds (about 25 each per lab group).
- For each lab group, put 25 germinating pea seeds into boiling water for 5 minutes. After removing them from the water, allow them to cool, pat them dry, and place them in a beaker labeled “boiled germinating pea seeds”.
- For each lab group, put 25 germinating pea seeds into a beaker labeled “chilled germinating pea seeds”. Place the beaker in an ice water bath. Keep the beakers in a refrigerator until ready to use.
- For each lab group, put 25 germinating pea seeds into a beaker labeled “germinating pea seeds”.
- Provide each lab group with 25 dry pea seeds, 25 glass beads, 25 germinating pea seeds, 25 boiled germinating pea seeds, and 25 chilled germinating pea seeds.

### Data Collection

**1.** Start a new experiment on the data collection system.

**2.** Connect a carbon dioxide ($CO_2$) gas sensor and an oxygen ($O_2$) gas sensor to the data collection system. Use the sensor extension cable to connect the $CO_2$ sensor to the collection system.

**3.** Calibrate the $CO_2$ sensor and calibrate the $O_2$ sensor.

**4.** Change the unit of measurement for the $O_2$ sensor from "%" to "ppm".

**5.** Set up two graphs to display simultaneously. One one graph, display $CO_2$ concentration on the y-axis and Time on the x-axis. On the other graph, display $O_2$ concentration on the y-axis and Time on the x-axis.

**6.** For the first trial, place 25 glass beads into the Metabolism Chamber.

**7.** Start recording data.

**8.** Insert the $CO_2$ sensor into the top of the Metabolism Chamber and the $O_2$ sensor into the hole on the side of the Metabolism Chamber. Firmly press the rubber stoppers of the sensors into the chamber. The Metabolism Chamber must remain vertical; do not lay it on its side.

**9.** Adjust the scale of the graphs to show all data.

**10.** After 10 minutes, stop recording data.

**11.** Name the data run "Glass Beads".

**12.** Remove the sensors and the glass beads from the Metabolism Chamber. Wave the chamber so that the air in the chamber mixes with air in the room.

**13.** Repeat the data recording procedure (steps 7 to 12) for dry pea seeds, germinating pea seeds, boiled germinating pea seeds, and chilled germinating pea seeds.

### Data Analysis

**14.** Apply a linear fit to each of the five $CO_2$ data runs to find the slope of each line.

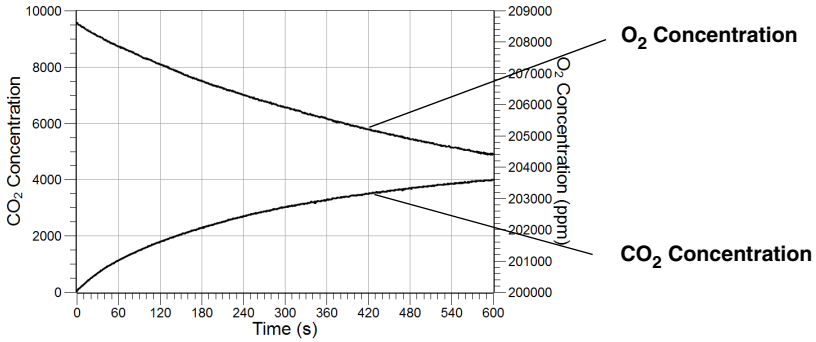
**15.** Apply a linear fit to each of the five $O_2$ data runs to find the slope of each line.

**16.** Compare and analyze the rate of $CO_2$ production and $O_2$ consumption in the following:

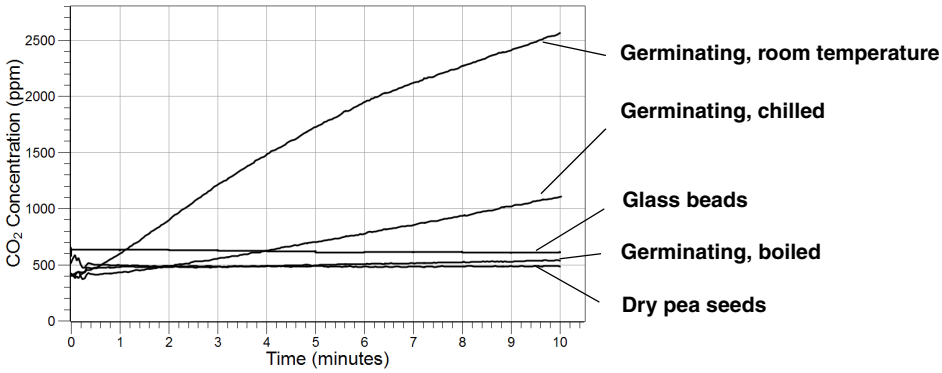
- glass beads versus germinating pea seeds
- germinating pea seeds versus chilled germinating pea seeds
- germinating pea seeds versus boiled germinating pea seeds
- chilled germinating pea seeds versus boiled germinating pea seeds

# Sample Data

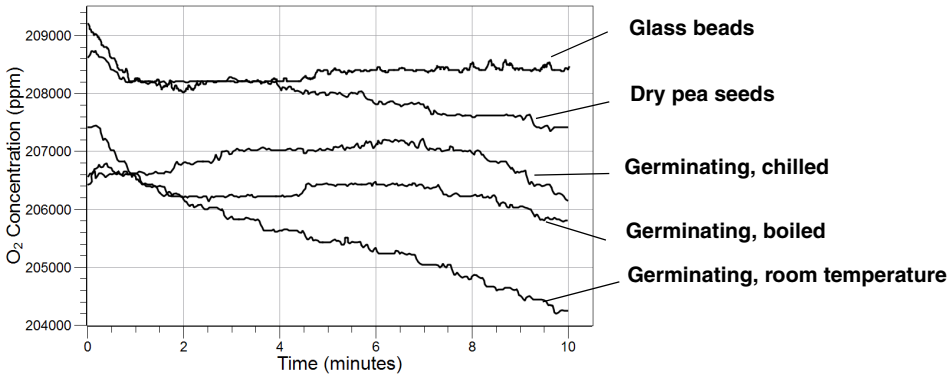
Graph 1: Germinating pea seeds in Metabolism Chamber at room temperature - $CO_2$ (ppm) and $O_2$ gas (ppm) versus Time (s).




Graph 2: Sample Data from AP© Biology Lab 5: Cellular Respiration. Germinating pea seeds in Metabolism Chamber at varying temperatures - $CO_2$ (ppm) versus Time (s).




Graph 3: Sample Data from AP Biology Lab 5: Cellular Respiration. Germinating pea seeds in Metabolism Chamber at varying temperatures - $O_2$ (ppm) versus Time (s).




**NOTE: See the PASCO Model PS-2876 Advanced Biology Manual for a more detailed version of the respiration labs.**

# Technical Support

For assistance with any PASCO product, contact PASCO at:


| | |
|---|---|
| Address: | PASCO scientific<br>10101 Foothills Blvd.<br>Roseville, CA 95747-7100 |
| Phone: | 916-786-3800 (worldwide)<br>800-772-8700 (U.S.) |
| Fax: | (916) 786-7565 |
| Web: | www.pasco.com |
| Email: | support@pasco.com |


For more information about the Metabolism Chamber and the latest revision of this Instruction Manual, visit:

www.pasco.com/go?ME-6936

**Limited Warranty** For a description of the product warranty, see the PASCO catalog.