RESPIRATION—PEA LAB

Introduction:

Aerobic cellular respiration is the process by which cells extract energy from organic molecules. Glucose is the most common molecule used. It is oxidized according to the equation

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{energy}$$

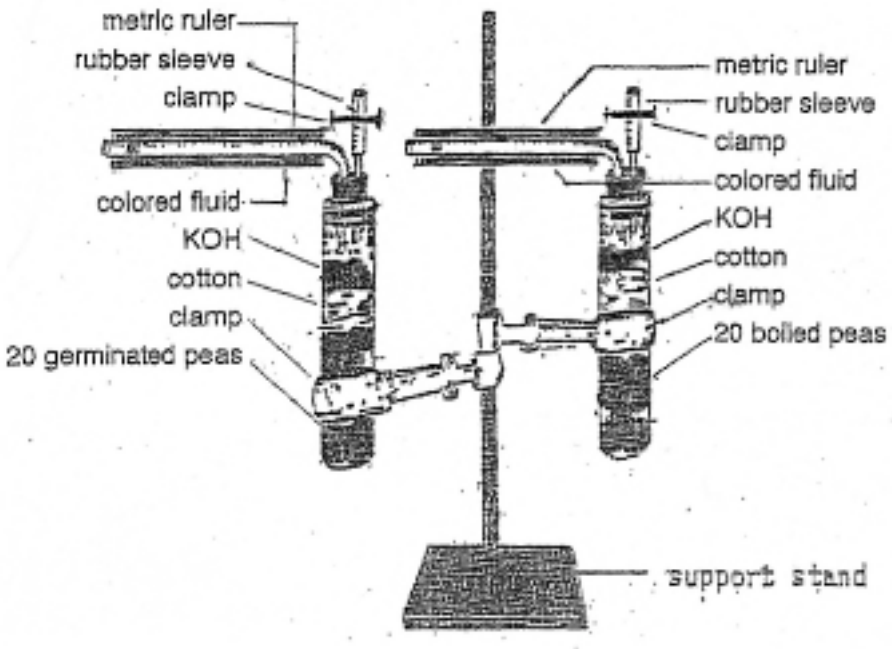
There are several means by which the respiration of an organism can be demonstrated. A few of these include the quantity of glucose used, the amount of carbon dioxide released, and the volume of oxygen consumed. The measurement of oxygen consumption is the most common. In this exercise you will explore respiration in plants and animals by measuring oxygen utilization.

Various methods can be used to measure respiratory rates (respirometry). Most techniques involve instrumental, chemical, or volumetric measurements of respiratory gases (i.e. CO_2 and O_2). In this exercise you will attempt to measure volumetric (gas volume) changes in oxygen by using simple respirometers as shown in Fig. 1.

The respiratory chambers represent closed systems. Any variation in the volumes (pressure) within the system in which an organism is respiring represents the difference between oxygen consumption *(decreases volume)* and carbon dioxide production *(increases volume)*. Since carbon dioxide is removed by the absorbent KOH, any volumetric changes within the system is due to oxygen consumption.

Materials Needed:

Figure 1. Seed Volumeter



Procedure:

1. Obtain all the materials shown in Fig. 1. All the tests will be made using this apparatus.

2. Use 20, room temperature, germinating pea seeds. This is your **respirometer**.

   Obtain weight of germinated (living) peas: _____

3. Secure a loose wad of cotton over the peas, do not pack tightly. Then add 1 cm thick layer of potassium hydroxide (KOH) pellets over the cotton. Make sure the pellets do not contact the peas! **Do not touch allow the KOH pellets to touch your skin as they are very caustic.**

4. Prepare another test tube the same way, except use 20 boiled pea seeds. This is your **control tube**.

5. Fit a stopper, with attached capillary and vertical tubing, snugly into each tube. Secure the test tubes in a vertical position with the utility clamps and support stand. Make sure the horizontal portion of the capillary tube is level.

6. Use an eyedropper to add enough colored water to the end of each capillary tube so that 1 cm of the colored water will be drawn in. Make sure the clamp is open.

7. Allow the system to equilibrate for 5 minutes. Mark the position of the outer meniscus of the colored water on the tube with a wax pencil.

8. Tightly clamp off the rubber sleeve and allow the peas to respire for 15–20 minutes. After this time, mark the outer meniscus again and measure the distance the colored water drop has traveled from the 1st mark in mm.

9. Record the results in the table below. If the colored water moves rapidly, you should stop before the colored water reaches the bend in the tube and record that time.

10. If a second run is desired, release the clamp on the rubber sleeve and readjust the colored water by tilting the capillary tube, returning the colored water drop to the outer end of the tubing. Perform a second run using the same peas and record your results in the table. Erase the marks then remark the new colored water position with a wax pencil.

Name_____

Respirations—Pea Lab Report Sheet

Table 1. Pea Seed Analysis

* *r = radius of inside diameter of tube in mm.*

	A	B	C	D	E
	RESPIROMETER *(Germinated peas)* **Measured Distance in mm**	**CONTROL** *(Boiled peas)* **Measured Distance in mm**	**CORRECTED DISTANCE** **Column A – Column B**	**VOLUME O_2 CONSUMED** **Column C times πr^2***	**AVERAGE O_2 CONSUMED** **Column D divided by *gm of peas* & *time* *(10 minutes)***
TRIAL 1	mm	mm	mm	mm^3 O_2	$\frac{mm^3\ O_2}{g \times min}$
TRIAL 2	mm	mm	mm	mm^3 O_2	$\frac{mm^3\ O_2}{g \times min}$

1. Why was it necessary to remove CO_2 from the test tubes?_____

   _____

   _____

2. What was the object of using boiled peas? _____

   _____

   _____

3. Why did the colored water column move toward the respirometer?_____

   _____

   _____