

WARD'STM

Volumeter Instructions

14 W 8300

The volumeter is used to detect small changes in volume resulting from exchange of gases in photosynthesis or respiration. The volumeter is a closed system with the capability to measure the volume changes represented by the movement of a drop of liquid or an entrapped air bubble in a capillary tube.

The volume of oxygen given off during photosynthesis can be determined using an algal culture. Conditions must be carefully controlled to determine the amount of volume change. Temperature and barometric pressure must be kept constant during the experiment. This can be done by using the volumeter jar as a water bath. For experiments, two tubes can be used. The third tube is a control; it should be filled with distilled water equal to the amount of culture fluid in the two experimental tubes. The volume of gas in the control must be equal to that in the experimental tubes.

To set up the Volumeter:

1. Use a syringe or pipet to inject a small drop of colored water into the capillary tubes.
2. Put the algae in two of the tubes. Put distilled water in the third. Make sure volumes are equal.
3. Fill the jar to the halfway mark with 25°C water.
4. Insert a laboratory thermometer (not supplied) into the jar through the small hole in the lid.
5. Insert the test tubes into the jar.
6. Insert the capillary tubes into the longer pieces of tubing from the two-hole rubber stopper assembly. Use a ring stand and clamps to keep the capillary tubes level.
7. Insert stoppers into the three test tubes. Leave the pinch clamps off the other piece of rubber tubing until the fluid levels in the tubes reach equilibrium.
8. Place the Volumeter in a water bath at 25°C (optional).
9. Allow unit to reach equilibrium—about five minutes. Adjust the positions of the fluid bubbles by means of a syringe or pipet. Clamp the open rubber tube. Mark the position of the bubble.
10. Take a record readings on each tube every five minutes.

Variations on this experiment can show differences in oxygen evolution caused by temperature changes, and by differences in intensity and spectral content of light. Similarly, changes in gas volume resulting from the metabolism of small animals can be observed. Differences between photosynthesis and respiration of plants can be evaluated by operating the Volumeter under light and under dark conditions. Most biology texts have references to the use of a volumeter. An excellent general reference is *A Sourcebook for the Biological Sciences* by Morholt, Brandwein and Joseph, published by Harcourt, Brace and Jovanovich.

The Volumeter is partially set up and includes:

1. 1 large glass jar.
2. 3 test tubes, each with two-hole stopper and clamp assembly which includes two pieces of attached tubing
3. 3 calibrated glass capillary tubes. Each mark (1cm) = .063mL.
4. 1 four-hole plastic lid insert to support test tubes in the jar.
5. 1 plastic syringe, 5mL.

In addition, you will need:

1. A small metric ruler.
2. Glass marking pencils.
3. A laboratory (immersion) thermometer.
4. Algae, plant, or small animal specimens for experiments.
5. A small amount of a colored water solution.
6. A water bath is helpful but not essential.
7. It is helpful to have a ring stand and clamps to hold the capillary tubes level during observations.

NOTES:

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