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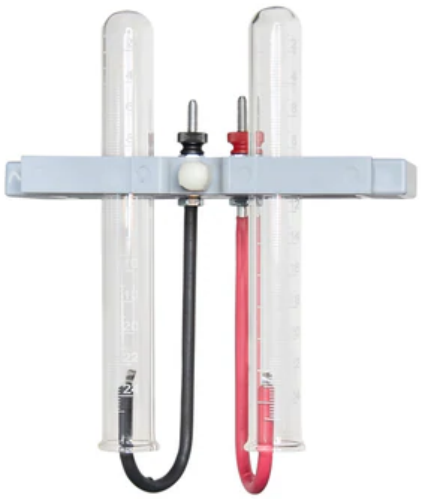
Brownlee Classic without Jar #48222

Warning:

- **Not a toy; use only in a laboratory or educational setting.**
- **California Proposition 65 Warning: This product can expose you to chemicals including nickel which are known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to www.P65Warnings.ca.gov.**



Introduction

The Brownlee Classic without Jar is a useful device for the study of electrolysis. Platinum electrodes are attached to insulated connecting rods. The rods are attached to binding posts, mounted on a nonconducting support. The support is designed to rest across the top of a 800 ml beaker.

Learning Objective:

1. Decompose water into hydrogen and oxygen gas.
2. Test and measure the volume of hydrogen and oxygen produced.
3. Explain the chemical transformation that occurs and why.

Theory

When an electric current passes through a chemical compound or solution, the potential difference between electrodes will cause its charged constituents, called *ions*, to move towards the oppositely-charged electrode. This process is called electrolysis.

The electrolysis of water, for example, results in the accumulation of hydrogen ions around the negative electrode (*cathode*) and oxygen ions around the positive electrode (*anode*). The hydrogen ions will acquire negative charges from the cathode and turn into hydrogen gas; the oxygen ions will pick up positive charges from the anode and become oxygen gas.

What's Included:

- 2 Platinum Electrodes
- 2 Graduated Test Tubes
- 1 Support

Helpful, but Not Included:

- 1 M Sodium Sulfate Solution (Na_2SO_4)
- Distilled Water
- Wood Splints
- 1 Glass Stir Rod
- 1 Beaker

CAUTION:

Always use eye protection when performing this experiment and when preparing the sulfuric acid solution. Always add the acid to water, slowly. Safety gloves and goggles should be worn when handling the acid solution.

When igniting the gas with the splint, wear safety gloves and goggles and point the open end of the tube away from yourself and all others. These safety instructions are intended to be a guide only and should not be viewed as complete or a substitute for good laboratory practice.

Experiments

- Prepare 1 M Sodium Sulfate solution by dissolving 13g of solid sodium sulfate in 100 ml of distilled water. Stir until completely mixed.
- Fill the beaker 2/3 full with this solution.
- Fill the test tubes with the same solution. Close the test tube with a thumb **(wear gloves!)** Turn the test tube upside down, lower it under the solution and remove the thumb to allow the test tube to rest on the bottom of the beaker. Make sure the test tube is full of solution.
- Place the support with electrodes across the top of the beaker.
- Slowly lift up the test tubes, slip them over the electrodes and fasten them in the clips. Be careful not to allow solution to fall out of the test tubes.
- Connect the binding posts to a 6V battery with wires. The red binding post (anode) is connected to the positive end, and the black binding post (cathode) is connected to the negative end. A 10V DC power supply of fixed or variable output can be used in place of battery.
- Bubbles will grow around the electrodes and rise to the bottom of the test tubes. The tube with more gas contains hydrogen. Eventually it will be filled with gas. Disconnect the battery or power supply.
- Carefully remove the test tube from the support, still bottom up, and apply a burning splint to the opening. A whistling explosion characteristic of hydrogen will be seen when the gas is ignited.
- Remove the other tube containing oxygen gas and place a glowing splinter to its opening. The splinter will burst into flame.
- The test tubes are graduated so you can measure the amount of gas collected. What is the ratio of hydrogen produced to oxygen? Why?