

Electrolysis Apparatus 57002-SET

Warning:

- **Not a toy; use only in a laboratory or educational setting.**
- **California Proposition 65**
Warning: This product can expose you to chemicals including lead, nickel, and benzene, 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 Electrolysis Apparatus is used to demonstrate that electrically conductive liquids can be decomposed and resolved into their constituent elements by means of unidirectional electric current. The gaseous components formed are trapped and their relative volumes are measured.

Description

The assembled Electrolysis Apparatus is shown in the illustration. The glassware unit consists of three vertical tubes joined to a cross-tube near the bottom. Two tubes are of equal length and are graduated. The third tube, located between the others, is longer and it is topped by a globular reservoir.

Affixed to the top of each graduated tube is a stopcock. Graduations extend from the stopcocks downward to the 60 ml marks 0.2 ml divisions. The base of each graduated tube is flared and tapered to accommodate a rubber stopper, on which is mounted a platinum electrode assembly.

Each electrode assembly consists of a platinum electrode connected to a wire lead sealed within a glass tube, which passes through the rubber stopper. Lead wires protruding from the sealed glass tube connect to the terminal posts on the base.

Preparation

Assemble the cast base and the vertical rod. There are two thumb screws on the back of the black support base, slide them over the metal support rod and tighten. On the front side of the black support base, rest the bottom of the "H" shaped glass tube on the single support arm and gently snap each of the upper arms of the "H" tube into the tubing holds at the top of the base. Please note the tubing holders are easily adjusted horizontally to align with the "H" glass. Next, attach the reservoir tube to the "H" glass using the latex tubing provided. Gently snap the reservoir tube into the upper and lower tubing holders (small black tubing holders in the center of the black support base). The reservoir tubes bulb top will sit above the stopcocks at the top of the "H" glass tube.

Remove the rubber stoppers with the platinum electrode assemblies from the tubes in which they were packed. Insert an electrode in the open, tapered end of each graduated glass tube. Carefully press upward on the rubber stoppers to ensure tight closures.

Carefully straighten the lead wires protruding from the glass tubes and rubber stoppers, and then connect the leads to the terminals on the base. Connect another pair of leads from the terminals to a suitable DC power source such as a 12-volt battery. If a battery is used, install a knife switch on one lead as an on/off switch. Prepare a 2% solution of sulfuric acid as follows: measure 363 ml-distilled water into 500 ml borosilicate beaker with a spout; carefully and slowly add 4 ml concentrated sulfuric acid; stir to mix and allow cooling to room temperature.

WARNING: Always use caution when handling acid. Always add acid to water, not water to acid

Operation

The switch on the power supply should be in the OFF position. If a battery is used, the knife switch should be OPEN. Open the stopcocks and pour the 2% sulfuric acid solution into the large globular reservoir. Close the stopcocks when the liquid reaches their height in the graduated tubes. The long tube topped by the reservoir should be filled with liquid to within one-fourth of its capacity.

Start the demonstration by turning on the power supply. If a battery is used, close the knife switch. When 50 to 55 ml of water in one tube has been displaced by gas, shut OFF the power supply or, if a battery is used, OPEN the knife switch. Note the graduation mark at the interface of the gas and liquid phases in each tube.

Light a taper (wood splint) and rest it on an ashtray. Hold an inverted test tube over the outlet of the graduated tube containing the larger quantity of gas. Hold the stopcock open for two or three seconds. While the tube is still in the inverted position bring its mouth over the lighted taper. A pale blue flame indicates the gas is hydrogen.

Blow out the taper flame but leave the taper glowing. Hold the glowing taper over the outlet of the other graduated tube and open the stopcock. If the taper bursts into flame, the gas is oxygen.

Upon completion of the electrolysis demonstration, turn the power supply switch to the OFF position. If a battery is used, OPEN the knife switch. Disconnect the leads from the terminals on the base. Open the jaws of both sets of clamps. Open the stopcocks and carefully remove the glassware unit from the support stand. Invert the unit over a disposable plastic container so that the acid solution drains out. Remove the rubber stopper and electrode assemblies from the graduated tubes and set them aside. Carry the glassware unit to the sink and rinse it in cold water. Drain it until dry and clamp it back on the stand. Retrieve the stopper and electrode assemblies, rinse with cold water and carefully dry. Restore these electrodes to the test tubes in which they were originally packed.

Discussion

Distilled water is a very poor conductor of an electric current; a weak aqueous sulfuric acid is a much better conductor. When an electric current flows through electrically conductive liquid, hydrogen is formed at the cathode. The hydrogen bubbles upward and displaces the liquid in the graduated tube. Oxygen is formed at the anode and bubbles upward and displaces the liquid in the other graduated tube. Although the sulfuric acid dissociates, it is not exhausted in the process. In this respect it can be considered a catalyst.

Additional experiments with this apparatus can be conducted. For example:

- To decompose solutions of ammonia, hydrochloric acid, or sodium chloride
- To electroplate metals from solutions of silver nitrate, copper sulfate, or antimony tri-chloride

Maintenance

The Electrolysis Apparatus requires no special maintenance. Apply petroleum jelly or stopcock grease to the stopcocks occasionally to prevent their "freezing".