Sea Cell

Physics / Chemistry
High
Regressions / Data Collection

Introduction: It is in the media constantly. Companies completing for you dollars. A pink bunny pounds a drum while it's competitor tells you about proven laboratory tests that declare their product is the better one. But what is at the heart of this global debate over something as mundane as a battery? The heart of the issue is the production of free electrons, that when properly organized, can do work for us: run a flashlight, play a radio, start a car, or power life saving devices.

This activity is designed to help you learn and understand how a basic power cell of a battery works, and to show you the relationship between electrolyte concentration and voltage output.

Objectives: Students will be able to…

1. Determine the relationship between electrolyte concentration and voltage within a cell.
2. Accurately record, organize, and analyze data.
3. Demonstrate proper and safe use of chemicals and equipment.
4. Mathematically manipulate data to graphically display it using a graphic calculator.

Related Key Words:

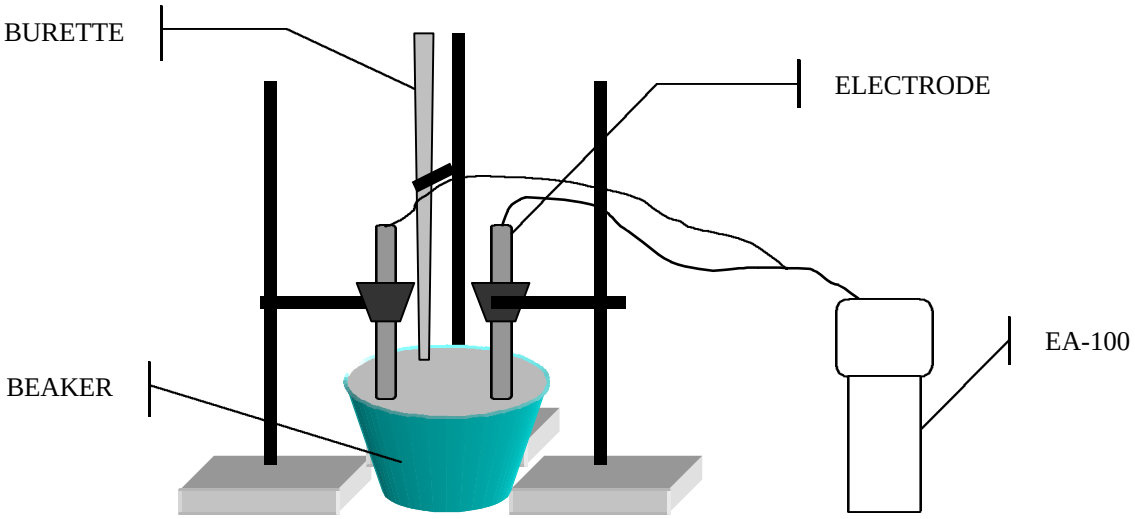
anode	cathode	electrode	voltage
current	power cell	battery	electrolyte

Materials:

1 - CASIO CFX9850-Ga Plus or CFX9850-G COLOR GRAPHING CACLAULTOR
1 - CASIO EA-100 CASIO Data Analyzer (CDA)
1 – Voltage probe
400mL Distilled water
100mL 2M NaCL Solution (11.7 grams of sodium chloride in enough distilled water to make 100mL of solution)
2 – Wire leads w/clamps
2 – 6" X1/4" aluminum rods
1 – 600mL Beaker
1 – 400mL Beaker
3 – Ring stands
2 – Test tube clamps
1 – Burette with clamp
2 – One-hole rubber stoppers

Purpose: Students will collect data on voltage as the concentration of electrolyte solution is increased.

STEP 1— Assemble the electrodes by inserting the aluminum rods into the rubber stoppers. Allow about one inch to protrude at the top of the stopper. (see diagram below)



STEP 2— Clamp the electrodes, each to a separate ring stand, using the test tube clamps. The stoppers will serve as insulators.

STEP 3— Clamp the burette to the third stand with the burette clamp.

STEP 4— Arrange the stands so that the two electrodes can be inserted as far as possible into the 600mL beaker and where the burette can easily be dispensed into the beaker.

STEP 5— Attach one end of each wire lead to an electrode.

STEP 6— Attach the other ends of the leads to the voltage probe leads.

STEP 7— Connect the voltage probe to the Ch. 1 port of the EA-100. Push the red "ON/OFF" button to activate the data analyzer.

STEP 8— Look for the word "DONE" on the left side. If you do not see it, push the [HALT] button one time.

STEP 9— Press [SHIFT] then [MODE] to begin the set up procedure.

STEP 10— Set the time interval to 500 msec by pressing the [DataLOG] button until 500 appears, then press [TRIGGER].

STEP 11— Choose the number of samples to be taken to 200 by pressing the [DataLOG] button until 200 appears, then press [TRIGGER] again.

STEP 12— Next choose "1" for actual time recording. DO NOT press [TRIGGER] at this time!

STEP 13— Fill the burette to the "0" line with the 2M NaCl solution.

STEP 14— Fill the 600mL beaker with 250mL of distilled water and insert the electrodes.

STEP 15— Simultaneously press the [TRIGGER] button and open the burette to allow the solution to dispense at about a 1/2mL per second rate.

STEP 16— When sampling is complete, the EA-100 will display "DONE" on the screen.

STEP 17— Link the EA-100 to the calculator, making sure the cable ends are pushed in securely.

STEP 18— Select PRGM from the main menu and push [EXE].

STEP 19— Use the arrow key to highlight the *Receive* program and push [EXE].

STEP 20— When the screen says DONE, view our graph by choosing STAT; [F1] GRPH; [F6] for SET; highlight: Graph Type; [F2] XY line ; EXIT; [F1] for GPH1.

STEP 21— Sketch your graph on a piece of graph paper properly marking your axes.

Questions and Problems:

Level 1: Answer the following questions in complete, well-structured sentences.

1. Construct your data table on a separate sheet of paper.
2. Which part of the voltage probe was the anode and which was the cathode? How do you know?
3. What is happening? How is a current being created?
4. State your interpretation of your graphical data.
5. Relate your conclusions to your hypothesis in a narrative.
6. Describe in your own words what you think is the relationship between voltage and electrolyte concentration.

Level 2:

1. Does there seem to be a limit to the relationship? If so. What?
2. What factors might alter the relationship?
3. What could you do differently to test your hypotheses?
4. Using a piece of graph paper, redraw the graph to show the effect of concentration on voltage.

Extensions: Have student research the design of power cells and batteries. Have students test batteries for durability and longevity. Students can also research the effect disposable batteries have on the environment.