

CHOOSING ELECTROLYTES

The Question

What type of solution is the best electrolyte for a wet cell?

The Hypothesis



Form a hypothesis for this investigation based on the question. Use the terms “manipulated variable” and “responding variable” in your hypothesis.

Procedure



- 1 In your notebook, make a table for recording voltages for the different solutions.
- 2 Attach the clamps to the copper and zinc electrodes. Place the electrodes in the beaker, making sure they don't touch each other. Your set-up should resemble the one in Figure 1.23.
- 3 Use connecting wires to hook the electrodes up to the voltmeter. Connect the negative terminal of the voltmeter to the zinc electrode.
- 4 Fill the beaker with distilled water, so that the bottom halves of the electrodes are immersed. Note the level of the liquid or mark it on the beaker. Record the voltage.
- 5 Disconnect the electrodes and empty the beaker, then rinse them all with distilled water.
- 6 Set up the beaker and electrodes again, using a different solution. Fill the beaker to the level noted in step 4 with one of the solutions you want to test.
- 7 Repeat steps 4–6 until all the solutions have been tested. Each time, be sure to rinse the beaker and electrodes with distilled water before pouring in the next solution.
- 8 When you have finished testing the solutions, follow your teacher's instructions for disposing of them.

Analyzing and Interpreting

- 9 Are all the liquids electrolytes? Why or why not?
- 10 Why do you think some substances are better electrolytes than others?

Forming Conclusions

- 11 Write a summary describing the type of solution that is the best electrolyte for a wet cell. Use your data to support your conclusion.

Applying and Connecting

Electrolytes are also found in the body in the form of many different dissolved ions, such as sodium (Na^+), potassium (K^+), calcium (Ca^{2+}), magnesium (Mg^{2+}), and chloride (Cl^-). These dissolved ions serve several functions in the body. One of the most important is to help establish voltages across the cell membranes of nerve cells. Resting nerve cells maintain an internal voltage of about -70 mV. When these cells are stimulated, Na^+ ions rush into them, changing the voltage briefly to about $+35$ mV. This momentary voltage change makes up the impulses that allow nerve cells to send messages all over the body.

Extending

A variety of substances can function as electrodes in cells. These include aluminum, iron, carbon, tin, lead, and nickel. Design and conduct an experiment that tests different pairs of electrodes to see which pairs produce the greatest voltage.

Materials & Equipment

- two 500-mL beakers
- voltmeter or voltage sensor
- zinc and copper electrodes
- electrode clamps
- connecting wires
- distilled water for rinsing
- various liquids including distilled water, tap water, sugar solution, salt solution, lemon juice, vinegar, dilute hydrochloric acid of varying concentrations, dilute potassium hydroxide of varying concentrations, or other solutions provided by your teacher



Figure 1.23 Testing electrolytes