A Shocking Discovery

Hands-on Activity about Water and Electricity

Key Question

Can water become an effective conductor of electricity for the space station?

Background

Water and electricity don't mix! This is something that you have heard time and time again. But why?

Water itself does not conduct electricity. In order for any substance to carry a charge, two conditions must be met. There must be charged particles in the substance—ions or electrons, for example. These particles must be free to move within the substance. Therefore, the reason that water can sometimes conduct electricity is because of the minerals already present in the water.

Absolutely pure water does not conduct electricity very well at all. Yet, even the most pure water will conduct a tiny amount of electricity. A tiny amount, only 1 in 10 million molecules of water will divide into H^+ and OH^- ions. This condition will cause current to flow, but it is almost undetectable.

Water, as we know it, contains salt impurities. Any salt, not just table salt, will cause water to conduct electricity. The reason is that when salts are dissolved in water, they break up into ions that have electric charge. If you place wires in the water, the positive charged ions will flow toward the negative wire, and the negative ions will flow toward the positive wire, causing an electric current to run through the water.

Note: Take care in preparing for this exploration. All parts must be firmly attached so that the electrical circuit can be tested a number of times without breaking or requiring to be fixed.

Time

Approximately 50 minutes

- Setup: 30 minutes—setup
- Exploration: 10 minutes
- Concluding and analyzing: 10 minutes

Materials

- Three D-cell batteries
- Three thin strips of wood (the length of the three D-cell batteries); pencils will work
- Masking or electrical tape
- Small flashlight light bulb
- Aluminum foil strip (three inches longer than the length of the three D-cells)
- Saucer
- Distilled water
- Salt
- Piece of clay
- Set of measuring spoons

Part 1

Procedure

1. Create one long battery of the three D-cells. Use the balsa strips and tape to make the three-celled battery secure. The three-celled battery must be able to stand on end on a flat surface.

2. Use clay to attach the end of the aluminum foil strip and the flashlight bulb to the positive end of the battery. The order of connection is positive pole of battery, aluminum foil, and bulb. Use the clay to secure both the aluminum foil and bulb to the battery.

3. Put four tablespoons of distilled water in the saucer.

4. Stand the battery in the water in the center of the saucer.

5. Place the aluminum strip in the water.

Questions

1. What happened when the aluminum strip was placed in the water?

2. Why did this happen?

Part 2

How is the electrical circuit changed by turning the distilled water into a solution?
Mission specialists must become aware of the sensitivity of the equipment on board space station alpha. A change in chemicals, in electrical current, in magnetic field, or an improperly functioning piece of equipment, may endanger the crew.

Procedure

1. Remove the battery from the water in the saucer and add a ¼ teaspoon of salt and stir to dissolve. Replace the battery and put the aluminum foil in the water/
   salt solution. Is there a change in the intensity of the light?

2. Repeat the experiment and add another level, ¼ tsp. of salt. Does the intensity of the light change?

3. Is there a point at which the adding of salt ceases to have an effect on the observed intensity of the light. Can you find this point?

4. Touch the foil to the negative end of the battery. Is the light brighter or weaker than during your exploration of the water/salt solution?

Data Analysis
Record your observations.

Questions

1. What can you hypothesize regarding how the conductivity of water might come in handy on Space Station Alpha?

2. Why does your body conduct electricity?

Extension Activities

Under the guidance of your teacher, you may try adding other substances to the water to see if you can find a more effective water-based solution for conducting electricity.