

Water Wire

Electricity flowing through water

Water is a liquid but it can behave like solid metal wire. Copper wires in your home carry electricity to your lights when you turn on the switch. Water can also carry electricity to a light, when an electrolyte is present. Pure water will not allow electricity to flow through it but as soon as you add salt like sodium chloride, this salt water begins to conduct electricity. Any salt is called an electrolyte when it is used help to conduct electrical currents through a liquid. We have enough electrolytes in our body to conduct electrical signals from our brains to muscles causing them to contract and relax as we walk or run. We usually get enough electrolytes like sodium chloride and potassium chloride from our regular diet to allow these electrical signals to flow. We get plenty of sodium and chloride from the table salt that is used to flavor foods and even some drinks. And, foods such as bananas and raisins are a rich source of potassium. In this activity, you will detect the amount of energy that can flow through a sodium chloride electrolyte solution with a light sensor. A bright light will show you have a large amount of energy flowing through the liquid and a dim light will show you have a small amount of energy flowing through the liquid.

Procedure Experiment I

1. Write on five plastic containers: Salt Water-1000, Salt Water-500, Salt Water-250, Salt Water-125, and Pure Water-000.
2. Salt Water-1000: To this container add $\frac{1}{4}$ tsp salt and 1 cup distilled water. Mix with craft stick until all the salt dissolves.
3. Salt Water-500: To this container add $\frac{1}{2}$ cup Salt Water 1000 and $\frac{1}{2}$ cup distilled water.
4. Salt Water-250: To this container add $\frac{1}{2}$ cup Salt Water 500 and $\frac{1}{2}$ cup distilled water.
5. Salt Water-125: To this container add $\frac{1}{2}$ cup Salt Water 250 and $\frac{1}{2}$ cup distilled water.
6. Pure Water 000– to this container add $\frac{1}{2}$ cup distilled water. (Now you should have 5 plastic containers with $\frac{1}{2}$ cup of solution in each cup.)
7. Completely cover two of the craft sticks with aluminum foil. Do not cover the third stick with aluminum, leave this bare wood.
8. Next grab your test light. Have your adult partner use the transparent tape to attach the white wire to the positive end of the battery. It will have a “+” sign. If necessary, cut some the plastic coating away to expose more copper wire. Have an adult help with cutting.
9. Have your adult partner use the transparent tape to tape the black wire to a craft stick covered with aluminum foil.
10. Then have an adult partner tape the other craft stick covered with aluminum to the negative end of the battery. It may have a “-” sign or be unmarked.
11. Take the aluminum covered craft sticks and place them about an inch apart from each other and lock them in place with the bare craft stick with transparent tape. Your electrolyte light sensor should now be ready.
12. Dip the light sensor’s two aluminum sticks in the cup labeled Pure Water-000. Did the Light glow at all? Record your results and note how bright the light was for each solution. “What Did You Observe?”
13. Rinse the craft sticks with the distilled water and wipe them dry with a paper towel, making sure there is no liquid left on the sticks.
14. Repeat steps 8 and 9 with the Salt Water-125, the Salt Water-250, Salt Water-500, and Salt Water-1000.
15. Thoroughly clean the work area and wash your hands. If possible, place the plastic cups and foil from the craft sticks in a recycling bin.

Materials

3 mini craft sticks
Aluminum foil
Light (*any Mini Lamp 1.5 V - 25mA similar to Radio Shack, model #272-1139*)
9V battery
Transparent tape
Permanent marking pen
5 disposable plastic cups (9 oz.)
1 paper towel sheet
Distilled water
Salt – Sodium Chloride

Procedure for Challenge Experiment

1. Hide the labels on all five cups and mix up the order of the cups.
2. Can you use what you observed with the labeled cups to place the cups in order from lowest to highest?

3. Test each cup with the light sensor and arrange them with lowest on the left to brightest light on the right.
4. Reveal the labels and you should find the cups in order 000, 125, 250, 500, 1000 from left to right.

Where's the Chemistry?

Although electrical energy is invisible, and dissolved electrolytes are also invisible to our eyes, you detected electricity flowing through water and how much electrolyte was present when you saw the light sensor glow. In this experiment, the electricity from the battery was passed through the aluminum foil on the first craft stick. The electrolyte solution water acted like a wire by letting the electricity flow from battery through the first craft stick, through water to the second craft stick, through the light, and back to the battery. The Light got brighter the more salt electrolyte present. The more electrolyte, the more electrical energy could flow through water! So in this experiment Pure Water-000 had no electrolyte and no light and Salt Water-1000 had the most electrolyte and was the brightest light.

Try this... Test whether other liquids act like metal wire, such as milk, soda or lemonade, if they do the light turns on and there is an electrolyte present. Hint: Sodium Chloride Salt is not the only electrolyte.

Activity from International Year of Chemistry website - American Chemical Society