

# 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.

Although electrical energy is invisible, and dissolved electrolytes are also invisible to our eyes, you will detect electricity flowing through water and how much electrolyte is present when you observe the light sensor glow. In this experiment, the electrolyte solution will act like a wire by letting the electricity flow from battery through the aluminum foil on the first craft stick, through water to the second craft stick, through the light, and back to the battery.

In this activity, you will detect the amount of electrical 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 electrical energy flowing through the liquid.

### Materials

**IMPORTANT:** Allow plenty of time to gather your materials. Especially note that you may have to order the mini-lamp from Radio Shack and it may take some time for it to be delivered.

Light - any Mini Lamp 1.5 V – 25mA (similar to Radio Shack model #272-1139)

3 wood craft sticks (you can get these from Ms. Skinner)

5 disposable plastic cups or other plastic containers, at least 9 oz.

Permanent marking pen or some other method of labeling the plastic containers

9V battery

Salt – Sodium Chloride

Plastic spoon

Aluminum foil

Transparent tape (such as Scotch tape)

Paper towels

Distilled water

### Procedure Part 1

1. Label five plastic cups: **Salt Water 1000**, **Salt Water 500**, **Salt Water 250**, **Salt Water 125**, **Pure Water 000**.
2. **Salt Water 1000:** To this container add ¼ tsp salt and 1 cup distilled water. Mix with plastic spoon or wood stick until all the salt dissolves. Do not stir with anything metal.
3. **Salt Water 500:** To this container add ½ cup Salt Water 1000 and ½ cup distilled water.
4. **Salt Water 250:** To this container add ½ cup Salt Water 500 and ½ cup distilled water.
5. **Salt Water 125:** To this container add ½ cup Salt Water 250 and ½ cup distilled water.
6. **Pure Water 000:** To this container add ½ cup distilled water only.

- Now you should have five plastic containers with  $\frac{1}{2}$  cup of solution in each cup.
- Completely cover two wood craft sticks with aluminum foil. Do not cover the third stick with aluminum foil, leave this bare wood.
- Next grab your test light. Use the transparent tape to attach the white wire to the positive end of the battery. It will have a "+" sign. If necessary, CAREFULLY cut some the plastic coating away to expose more copper wire. *Be very careful to only cut the plastic coating and not the wire!*
- Use the transparent tape to tape the black wire to a craft stick covered with aluminum foil.
- Tape the other craft stick covered with aluminum to the negative end of the battery. It may either have a "-" sign or be unmarked.
- 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.
- Dip the light sensor's two aluminum sticks in the cup labeled **Pure Water 000**. Did the light glow at all? Record your results in a Data Table and note how bright the light was for each solution.
- 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.
- Repeat steps 13 and 14 separately with the **Salt Water 125**, **Salt Water 250**, **Salt Water 500**, and **Salt Water 1000**. Note how bright the light was for each solution and record your results in your data table.

**IMPORTANT:** Do not leave the light sensor in the electrolyte solutions as it may cause your bulb to burn out.

### Procedure Part 2

- Cover the labels on all five cups and mix up the order of the cups.
- Test each cup with the light sensor and arrange them with lowest on the left to brightest light on the right. *Be sure to rinse the craft sticks with the distilled water and wipe them dry with a paper towel, before moving to the next cup.*
- Uncover the labels on the cups and record your results. How successful were you in placing the cups in the correct order?

### Procedure Part 3

- Test whether other liquids act like metal wire, and are an electrolyte solution. Identify two liquids that are electrolytes and two liquids that are not electrolytes.
- Compare your results (*the brightness of the light*) to the known electrolyte solutions you tested in Procedure Part 1. Record your results in a data table.

**IMPORTANT:** Be sure to rinse the craft sticks with the distilled water and wipe them dry with a paper towel, before moving to the next liquid.