Electrochemistry

Student Worksheet

Name_____

Overview: You are ready to experiment with both chemistry and electricity! You'll use a battery and some wires to pass a current through different solutions to find out which ones allow electricity to flow.

What to Learn: You'll understand that when an electric current passes through a salt solution, it causes charged ions to break apart ($NaCl \rightarrow Na^+ + Cl$). Now, that solution is able to conduct electricity, as seen by a lit bulb.

Materials

- Test tube rack
- 9V battery clip
- 9V battery
- Flashlight lamp
- Gloves
- Electrical wires
- Aluminum foil (MSDS)
- Water
- Sugar
- Salt, NaCl (MSDS)
- Sodium carbonate (MSDS)
- Measuring spoon

Lab Time

1. Flip over your test tube rack. Today it will double as a holder for your light bulb. Notice there is an opening at one end, with two small holes in a ring.
2. Take a wire that has the insulation stripped off the end, and place it through one of the holes in the ring. Thread it out the other hole and wrap it on itself at the top of the ring. When the bulb is placed in the opening, the sides of the bulb should come into contact with this wire.
3. Take a second wire and push it up through the small opening at the top of the test tube rack and back down again. Screw in the light bulb, making sure this wire is sandwiched between the end of the light bulb and the plastic piece at the end.
4. Test your setup by plugging in a battery clip to the 9V battery. Connect the wires coming from the battery clip to the two wires now attached to the test tube stand by tightly wrapping the wires around the leads on the battery clip. Do not worry about positive and negative charges for this experiment. At this point you have created a circuit and your light bulb should be shining.
5. Modify the circuit by disconnecting the black and red wires. Attach a separate black wire (that has already been stripped) to the red wire.
6. Put one strip of aluminum foil over one side of a cup, and a second piece over the other side of the cup. When the cup is filled with liquid, the foil should come into contact with the liquid.
7. Attach the end of one black wire to the aluminum foil on the cup. Repeat with the other black wire. Make sure to securely fasten the wires. This re-creates the circuit.

8. Fill the cup with water. Observe. Does the light bulb turn on?
9. Put 1-2 teaspoons of sugar in the cup and observe.
10. Empty out the cup, add clean water, and put 1-2 teaspoons of salt into the cup. Observe.
11. Empty out the cup, add clean water, and put 1-2 teaspoons of sodium carbonate ($NaCO_3$) into the cup and stir. Add another 1-2 teaspoons of sodium carbonate. Add one more teaspoon and observe. Cap chemical and place to the side.
12. If desired, clean out cup and experiment with different liquids to see if they conduct electricity. Orange juice? Lemon juice? Tomato juice? Grapefruit juice?

Electrochemistry Data Table

Solution	Did The Bulb Light Up?	Describe Brightness of Bulb
water		
water + sugar		
water + salt		
water + $NaCO_3$ (1-2 tsp)		
water + $NaCO_3$ (1-2 more tsp)		
water + $NaCO_3$ (1 more tsp)		

Exercises Answer the questions below:

1. Which solutions conducted electricity? How do you know?

2. Why did adding more sodium carbonate to the water cause the light bulb to glow brighter?

3. Write the chemical equation you witnessed in today's experiment.

4. What happened to the salt (NaCl) when a current passed through the cup?

Exercises

1. Which solutions conducted electricity? How do you know? (Salt water and sodium carbonate solution, because they made the bulb light up.)
2. Why did adding more sodium carbonate to the water cause the light bulb to glow brighter? (There were more ions moving toward their opposite poles, allowing more electricity to flow through the circuit.)
3. Write the chemical equation you witnessed in today's experiment ($NaCl \rightarrow Na^{+} + Cl^{-}$)
4. What happened to the salt (NaCl) when a current passed through the cup? (The ions split apart, and the positive sodium ions went to the negative pole. The negative chloride ions went to the positive pole. The movement of these ions allowed the current to flow through the water)

Closure: Before moving on, ask your students if they have any recommendations or unanswered questions that they can work out on their own. Brainstorming extension ideas is a great way to add more science studies to your class time.