

## Salt III: Can You See the Light?

### Overview

This lesson reinforces the connection between salt ions in solution and electrical energy. Students will be allowed to explore a "conductivity of solutions apparatus" and be given a brief overview of its operation. They will then be given a container of water, a tube of salt and a tube of sugar and be asked to figure out how they can use these materials to make the light shine. They will be asked to write and explain their hypotheses as to which material or combination of materials will make the light shine. Students are then free to discover that neither the salt crystals nor the sugar crystals alone will allow the light to work. They can then make sugarwater or saltwater and see that it is the salt in solution that allows the flow of electrical energy, lighting the light. A connection is made between the electrical properties of the dissolved salt in the apparatus and the electrical energy generated by salt dissolved in the body,

### Goal

Students observe electrical properties of salt.

### Specific Outcomes

- Use science instruments
- Take lecture notes
- Write and test an hypothesis
- Record steps of their procedure
- Make, record and communicate observations
- Practice teamwork and peer collaboration

### Materials

- Class Notes / Hypothesis sheet
- 12 "conductivity of solutions apparatus" kits
- 12 plastic tubes each filled with 50 g. of salt
- 12 plastic tubes each filled with 50 g. of sugar
- 12 plastic specimen cups
- 12 ziploc bags filled with salt
- 12 water bottles filled with water
- 12 plastic containers for mixing solutions
- 12 plastic spoons
- Observation / Procedure sheet
- Ion / electrode evaluation sheet with stickies
- Poster with clean up instructions.

**Grade Level:** 5

**Subject Areas:** Science

#### Key Concepts:

- The ions of salt separate in water
- Salt ions in solution have electrical properties

#### Key Cognitive Skills:

- Observation
- Comprehension
- Analysis
- Hypothesis
- Note Taking
- Data collection

**Duration:** 60 minutes

**Setting:** Indoors

Desks should be positioned for use as workstations.

#### Background Information

The messages that travel through the brain and along the nervous system are electrochemical, composed of electrical and chemical signals. Neurotransmitters are chemicals that participate in neuronal signal transmission. The Action Potential (AP) is the electrical impulse that travels along the axon during neuronal signal transmission. The Action Potential is generated by an influx of sodium ions into the axon. The

influx of sodium ions changes the electrical balance maintained along the axon. The charges on the sodium ions and the difference in charge between the exterior and interior of the neuron drive the electrical forces of the neuron.

To aid students' connection between salt in solution and electricity, we will be using a "conductivity of solutions apparatus." The beaker of the apparatus is filled with liquid and the electrodes for the light are separated in the liquid. If the liquid is simply water, there is no way for the electrons to flow between the copper and graphite electrodes, so there is no flow of electrons through the lightbulb filament and hence, no light. If saltwater is used as the liquid, the positively charged sodium ions gather at the negatively charged graphite electrode and receive the electrons from the circuit. The negatively charged chloride ions gather at the positively charged copper electrode and donate electrons to the circuit. The action of the ions allows the flow of electrons through the circuit and the light shines. If the liquid used is sugarwater, there are no ions to receive or donate electrons at the electrodes. There is no flow of electrons through the circuit and hence, no light.

## Procedure

*Engage: (10 minutes)*

- Distribute class notes sheet
- Review / Introduction

Class discussion in which the following concepts should arise:

- Electricity is the movement of charged particles
- Salt generates body's electrical energy
- Salt ions separate in water
- These separated ions are in the body
- In solution, ions just want to go to the strongest opposite charge
- It is the separated ions that are used to generate electrical energy
- Write pertinent concepts on board to be copied in class notes
- Inform class of burn danger associated with shorting out the circuit
- Handout apparatus and allow students to explore circuit

*Explore: (5 minutes)*

Students explore apparatus to see how to directly "close" the circuit.

*Explain: (10 minutes)*

- Students take notes on class notes sheet
- Discuss posters of circuit
- Stress that electrical energy runs from negative to positive through the circuit
- Allow student to come to front to illustrate point on posters and encourage class to label model on their class notes sheet.
- Reinforce the concept of a closed circuit, demonstrating with an apparatus and illustrating on poster..
- Demonstrate for students how to use the materials they will be given.
- Stress the importance of testing the materials singly before testing combinations.

*Expand: (25 minutes)*

- Students write hypothesis on materials which should "chemically close" the circuit.
- Materials supplied to pairs of students at workstations, after their hypotheses have been checked by an instructor.
- Students test their hypotheses and other materials and combinations in time allowed.

- Students record procedure they use to test hypotheses
- Students record their observations during procedures.
- Students clean up work stations using instructions on poster or transparencies, with verbal assistance.

Evaluate: (10 minutes)

- Class discussion of results of tests
- Stress dissolution of salt allows ions to move and electricity to flow.
- Reinforce dissolved salt in body and the electrical energy it generates in the nervous system
- Distribute ion / electrode evaluation sheet with stickies on which students show the electrodes of the apparatus surrounded by the appropriate salt ions.
- Collect completed sheets from class.
- If time permits, allow students to place ions around the correct electrodes on posters at the front of the class.