FE 2-3 Extra Activity: Conductivity

A simple conductivity meter can be made with a light bulb and a battery. Use a simple conductivity meter to compare the relative salinity of solutions.

Materials – **share with other pair at your table*

- Two straightened paper clips
- Battery pack (two AA batteries in holder)
- LED light with resistor
- Three alligator clips
- *Three containers large enough to hold 10 ml of liquid (e.g. petri dish)
    - *Distilled water
    - *Tap water
    - *Salt water
- Piece of dark colored construction paper or a dark counter top
- Paper towels
- *Distilled water in wash bottle

Procedure

1) Investigate the electrical properties of your LED light.
    a) Using only the battery and the LED determine how to light the LED.
        i) Record your observations of how orientation affects your ability to light the LED and any other procedures required to generate light.

        ii) Invent and record a hypothesis for your observations.

    b) Compare your LED to that of your classmates.
        i) Record observations of color and brightness.

        ii) Invent and record a hypothesis for your observations.

    c) Determine if you can manipulate the battery pack and LEDs to:
        i) Light more than one LED at a time?

        ii) Create a brighter LED?

        iii) Record your observations and procedures that allow you to accomplish these manipulations.

        iv) Invent and record a hypothesis for your observations.

2) Expand your LED and battery circuit to create a conductivity meter that connects the battery to a solution to be tested and to the LED light.
    a) Use the third alligator clip to expand the circuit.
    b) Use the paper clips as the final electrodes that will be put into solution.
    c) Test your circuit by touching the two paper clip electrodes together to light the LED. If your LED does not light, manipulate the circuit until it does light.
    d) Draw your circuit set-up below:

3) Investigate the conductivity of distilled water (pure water), tap water, and salt water. You can measure the relative conductivity of liquid by observing the brightness of the LED, when the electrodes are placed in a solution that conducts electricity.

   a) Obtain 10 mL test solutions of mystery solutions A, B, and C.

   b) Test the conductivity of these solutions to determine which are distilled water, tap water, and salt water by placing the electrodes in each respective solution and observing the brightness of the LED. Your electrodes can be close but they cannot touch. In between testing solutions, rinse your electrodes off with distilled water from the wash bottle and dry with paper towels.

   c) You may need to place your LED on a dark background to more accurately observe its brightness.

   d) Use Table 3.7 to record your results. Remember that you are using your observation of LED brightness to make an inference about the conductivity of each solution.
      i) *No light = Nonconductor*
      ii) *Dim light = Poor conductor*
      iii) *Bright light = Good conductor*

   e) In Table 3.7, write the identity of each solution (distilled water, tap water, or salt water) keeping in mind that seawater is a "better conductor" than fresh water and that distilled water is more pure than fresh water.

Solution	LED Brightness (Observed)	Conductivity (Observed)	Solution Identity
A			
B			
C			

Activity Questions:

1) The LED lights need to be in a specific orientation in order to light up when connected to the battery pack. Describe the orientation and explain how you determined this.

2) Why do you think seawater is a better conductor than fresh water? What might be in the water that increases a solution's conductivity?

3) The conductivity of seawater is about one million times higher than distilled water. Did your results support this? Explain.

4) Would you rather be swimming in a lake or the ocean during a lightning storm? Why?