Electricity Demonstration

Approximate time: 1 hr

Materials

- Electricity Slideshow
- voltmeter
- 9V battery
- Alligator Clips
- Small light bulb
- Distilled Water
- Sugar
- Salt
- 2 plastic cups
- Lemons (4)
- Copper Pennies (Be sure they are made after 1983 to ensure they are copper)
- Zinc Screws
- LED light
- X acto knife (for cutting slits into the lemons for the pennies and screws)

Process (Follow slide show)

- Agenda
- Introduction
  - What is science?
  - What do scientists do?
  - Brief introduction of demonstrator's educational background
- Electricity
  - What is it? (flow of electrons)
  - Where is it used? (appliances…etc.)
  - What does electricity do? (provides power for us to do work)
  - Where does it come from? (solar, nuclear, wind, etc.)
- Circuits
  - What is a circuit? (pathway for electrons to follow)
  - Where do you find circuits? (in walls, light switches, etc.)
  - What are the parts to a circuit? (load, wire, switch, power source, resistor, etc.)
  - Explain to students that you are now going to build a circuit. Review the materials that you will need to make this happen.
  - Ask for volunteers to come to the front of the room to connect alligator clips (to 9V battery and small light bulb; you can use an extra alligator clip as the switch in

the circuit) and hold up the light so the rest of the class can see it light up when the switch is closed

- Movement Activity
    - Ask for 5 student volunteers
    - Explain the pathway that the electrons (student volunteers) will follow- Example: Start at me, go to that corner, then that desk and come back to me then stop.
    - Have student volunteers demonstrate the movement of electrons through a circuit
    - Next, explain to students that you will act as the load of the circuit where work will be expressed. When the electrons travel around the circuit and make their way back to you, they will have to give you a high five. Explain that if you were a light bulb, you would be turning on when the electrons give you a high five.
    - Afterward, ask students if it usually takes that long for work to happen in a circuit (no) so electrons must move really fast in real life (but encourage volunteers to continue at their initial speed instead of running)
    - Add one more surprise component: Have students travel around the circuit but go block the path and tell the first electron that s/he cannot continue through the circuit. Ask the class what part of a circuit you are being (some will say switch- ask whether or not you would be open or closed (you would be open since you are not providing the electrons with a direct path to travel through))
    - If time allows, you can also add a resistor to the circuit; place a chair in the pathway and instruct the electrons to safely go over the chair. Ask students how that affected the flow of electrons (answer: it slows them down). You may start a discussion about the importance of resistors and why they are used (to reduce the flow of electricity if the load does not require as much voltage as the power source is giving off)
- Conductivity
    - Ask students for examples of materials that are good conductors and are not good conductors
    - It is likely that someone will mention water as being a good conductor; let students know that they will be testing that out
    - Ask students if they have ever been told to stay off of open water in a lighting storm. Ask them why they think this is (will likely answer because they could get electrocuted)
    - Ask for predictions by show of thumbs up or down of whether or not students think water is a good conductor
    - Explain to students what distilled water is (water gone through a purification process to eliminate chemicals) and ask for volunteers to help you out

- With the circuit constructed earlier, have student volunteers hold different parts up and place the ends of the alligator clips (that were previously used as the switch) in a cup of distilled water and watch what happens (the light will not turn on)
- Ask students if distilled water is a good conductor (it is not). Explain that whatever is dissolved in the water may help it conduct electricity.
- Try it with sugar water; get students to make predictions again- the light will not turn on
- Try it with salt water (use a lot of salt); get students to make predictions again- the light will turn on
- Review that although distilled water does not conduct electricity, water found in nature has different chemicals dissolved in it and so it is in fact dangerous to be on open water during a lighting storm

- Lemon Battery
  - Explain that you will be trying to create a lemon battery for the next experiment
  - Ask what materials you will need for this experiment (everything you need for a circuit: lemons as a power source, alligator clips, load)
  - Have students make predictions about what the copper pennies and zinc screws will be used for (positive and negative terminals in the lemons- pennies are positive, zinc is negative)
  - Use the voltmeter to measure the voltage in the 9V battery (which should be around 9V)
  - Make two slits with the x acto knife in one lemon (on opposite sides- one for the screw, one for the penny)
  - Get volunteers to insert the screw and penny
  - Use the voltmeter to measure the power of the lemon battery; compare this to the 9V battery (it will be much less)
  - Explain that you will be using an LED light because it requires less power to work (note that the LED has designated positive and negative leads and must be connected properly to the terminals in the lemon)
  - Get predictions about whether or not the lemon batter has enough power to turn on the LED
  - Get volunteers to set up the circuit (connect alligator clips from lemon to LED- penny to positive terminal and screw to negative terminal) and try it out- light will not turn on
  - Ask students how you can increase the voltage or power in the circuit (add more lemons)

  - Repeat the experiment with 4 lemons (add terminals to each lemon, measure the combined voltage with the voltmeter, get predictions about whether or not there will be enough power for the LED light, and try it out)
  - Connect the 4 lemons in series- the light will turn but it will be very faint so students may wish to approach the circuit to get a better look

- Conclusion
  - Review main ideas of the presentation and activities that were demonstrated
  - Ask if there are any questions regarding electricity