Class: Grade 9 Science

Lesson Title: Series & Parallel Circuits

Class Size: **24**
Time: **60 mins**

Curriculum Outcomes:
308-16 describe the flow of charge in an electrical circuit
308-17 describe series and parallel circuits involving varying resistance, voltage, and current

Learning Objectives:
1. To familiarize students with the workings of Series and Parallel Circuits, and to help them understand the functions of all elements involved, especially in regards to circuits, including the use of resistors (light bulbs) and switches.
2. To deepen the students' understanding of ampere/current, voltage, and resistance.

Materials:
- See-through cups (one per student)
- marbles/balls to represent electrons
- flashlights to represent resistors
- signs that indicate who serves as a battery and who serves as a switch

Suggestions:
- Make sure that you have sufficient room to conduct this activity and provide students with real life examples (Ie. Christmas tree lights, flash light). During the activity, randomly take away students' cups and ask them how this interruption would affect the electrical current.

Introduction:
1. Discuss features of electric circuits that students can recall from memory (possibilities):
   - Metal wires with electrons that flow through them (positive and negative attraction and repulsion)
   - Series vs. Parallel Circuits
   - Electron flow creates potential for work; if you have a circuit with no resistors, short-circuits
2. Explain what a kinulation is (broken up into kinesthetic and simulation). Tell them that these are used to help students learn difficult concepts that are otherwise difficult to picture. It allows students to become part of the demonstration, and therefore easier to remember and learn. Ask students if they would like to try one.

Activity:
1. Ask students to form a circle and hand out a cup to each student.
2. Once the students have provided some of the answers, hand out the according signs that read "BATTERY" and "SWITCH" to students, explain that they serve as conductors.
3. Now that the students have created a series circuit, and roles have been assigned, start giving out balls to the student that represents the battery and ask for the balls to be transferred from one cup to another, in accordance with the electrical current. The teacher could also let the students figure out where the current would start (*keeping in mind that the electrons are negatively charged and are thus repelled by the negative side of the battery).
4. Explain the concept of ampere to students and ask them what would happen if another lamp (resistor) was added to the series circuit (A: resistance would double and amps would decrease by half).
5. Ask students to form a parallel circuit and go over the same scenario as in #4 (A: resistance would stay the same and all resistors would be provided with the same voltage).

Conclusion – Possible wrap-up questions:
1. What benefits do you see in becoming part of the demonstration of the concept?
2. Is anything clearer to you because of being involved?
3. What type of system (parallel or series) would seem most beneficial for power grids? Can you see any downfalls (costs associated with parallel are greater, but if everyone was on series, one house blowing a fuse could knock out an entire neighborhood).