Education 432: Secondary Principles & Practices
Lesson Plan Template

Science 9: Electricity Lesson 3	
Teachers' Name: Mr. Andrew Kroon	**Grade: 9**
Subject: Science 9	**Topic: Electricity (Current, Voltage, and Resistance)**

A. Learning Goals & Success Criteria

Learing Goals: For this lesson we hope to…
- Draw connections between static electricity and electrical current/circuits
- Learn how to draw circuits and circuit elements
- Learn and understand basic terms including current, potential difference, energy and resistance
- Use safety instructions to safely use electrical circuits and measuring devices
- Record and calculate electrical quantities

Success Criteria: Success will be demonstrated by students' ability to…
- Connect previous class material to new content from this class
- Produce circuits based on drawings/diagrams and vice versa
- Use formulas and given or measured values to do calculations
- Properly attach and read voltmeters and ammeters
- Understand the relationship between resistance, voltage, and current

B. Lesson Outcomes

GCOs/Competencies:	Knowledge, Skills, and STSE
SCOs:	Students will be expected to… - Describe the flow of charge in an electric circuit (308-16) - Explain the importance of using precise language in science and technology (109-14) - Identify and suggest explanations for discrepancies in data (210-7) - Compare qualitatively static electricity and electric current (308-15) - Use instruments effectively and accurately for collecting data (209-3) - Provide examples of science knowledge that have resulted in the development of technologies (111-1) - Communicate questions, ideas, intentions, plans, and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language, and other means (211-2)

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C. Lesson Phases	
Intro Time: 5 minutes Body Time: X minutes	**Introduction:** - Start by collecting static stations worksheets from students - Then to get them thinking about electricity, ask some thinking questions • How does something become negatively charged? • Can protons (positive charges) move? What about neutrons? • How do sparks form? • What is an object that charge can move freely within? What about one that it can't? **Body:** - Re-cap lab activity from previous class • Ask students what should have happened at each station to make sure they were paying attention during the lab. • Hand back any lab sheets that were left from the last class, and collect any finished ones. For students that forgot their sheets Tuesday or students who aren't finished, they have until Monday to finish it. • Lab sheets aren't for marks, just to see who was paying attention and to see who understands the content - Switching gears from static electricity, we are now moving onto current and circuits, but we there are many connections from how a circuit acts to how static electricity works. - Circuit Elements • Batteries/cells have 2 terminals (positive and negative – like the charges. This is why when you put a positive terminal to another positive or a negative to a negative, nothing happens) • Electrons flow from the negative terminal through wires and around to the positive terminal, connecting back to the law of attraction and repulsion • A battery is a collection of multiple cells (both are a source of energy) • Resistors or loads are components of a circuit that turn electrical energy into other forms of energy (examples include lamps, motors, radios, tv, etc.) • They are called resistors because they resist electrical current. Every resistor in a circuit takes electrical energy and turns into another form of energy, slowing down the current. • Switches are sued to turn a circuit on (closed), or off (open)

	• Show images or draw examples on the board of the components of a circuit (battery/cell, resistor, switch - open and closed -, lamp, etc.) • Switches, wires, and resistors are all conductors, or have a conductor as a key component (tying back to static electricity) - Current • The movement of charge through conductors (usually wires) in a circuit • Current (I) is measured in amperes (A). An ampere is equal to a coloumb (C) per second (s). A coloumb is a unit of charge (Q), so current is equal to how much charge passes through a certain point per second. This can be compared to the speed of a boat going up a river (meters/sec) • For example, if the current at one point in a circuit is equal to 5 amperes, that means that there are 5 coloumbs of charge passing through that point every second. • The formula for current is I=Q/t • Current at a certain point in a circuit is measured using an ammeter (show how to draw an ammeter on a circuit diagram) • Different appliances require different amounts of current to function - Potential Difference • The electrons in a battery have the ability to do work, otherwise known as energy. This energy stored within a battery is known as electrical potential energy. • Energy (E) is measured in joules (J) • Potential difference refers to the difference between potential energy (per coloumb of charge) at one point in a circuit vs another point in the circuit. • Based on the description potential energy per coloumb of charge, potential difference is described as joules per coloumb (J/C), otherwise known as a volt (V). • The formula for potential difference (or voltage) is V=E/Q • Potential difference can be compared to the amount of energy put into pushing the boat up the river. - Resistance • Resistor is any element that uses electric energy to turn it into another form of energy, a light uses electric energy to produce light, a motor uses electric energy to produce mechanical energy, etc.

Closing Time: X minutes	• Resistance can be described as the amount of energy it takes to push a coloumb of charge through a certain conductor (whether this be a resitor or just the wire), or how well a resistor slows the current in a circuit • Resistance is equal to voltage (potential difference) divided by current (formula: R=V/I) and it is measured in ohms (Ω) which is equal to a volt per ampere (V/A). • This can be compared to how rough the water in the river is. The current is how fast the boat goes up the river, the potential difference is how hard the rowers are rowing, potential energy is how hard they rowers COULD row, and the resistance is how hard the water pushes back or how rough the water is. If you paddle really hard in rouch water and then just as hard in calm water, you are going to go much faster (higher current). These could also be compared to pushing a crate or a box. The current is how fast you can push the box, the voltage is how much energy you use, the potential energy is how much energy you COULD use, and the resistance is how much friction is against you. If you push really hard on a carpeted floor and then just as hard on a smooth hardwood floor, youre going to go much faster (higher current). • So the resistance of a conductor is equal to the potential difference across it, and the current flowing through **Closing:** - Example Time! - Current : • If 300C of charge are moving through any point in a circuit in 30 seconds, what is the current of the circuit? (10A) • An ammeter on a circuit measures a current of 5A, how many coulombs are moving through the circuit in 60 seconds? (300C) • An ammeter on a circuit measures a current of 8A, how long does it take for 640C of charge to move through the circuit? (80s) - Potential difference (voltage) : • A resistor in a circuit uses 5000J (5kJ) of potential energy for 125C of charge, what is the potential difference across the resistor? (40V) • A voltmeter on a circuit with a lamp reads a potential difference of 9V across the lamp. The lamp uses 1800J (1.8kJ) of potential energy, how much charge is being moved through the lamp. (200C) • A voltmeter on a circuit with a lamp reads a potential difference of 12V across the lamp. There are 900C of charge moving through the lamp, how much potential energy is used by the lamp? (10800J or 10.8kJ)

	- Resistance : • An ammeter on a circuit with a resistor reads 7A. The battery supplies 21V to the circuit. What is the resistance of the resistor? (3Ω) • A 9Ω resistor is in a circuit with an ammeter that reads a current of 6A. What is the potential difference across the resistor? (54V) • A 5Ω resistor is in a circuit with a voltmeter that reads 15V. What is the current through the resistor? (3Ω) - Students then get an exit slip with more questions similar to the examples that were just done - If they don't finish the exit slip I will give them a few minutes at the start of the next class to finish them up - For next class remind students to bring chromebooks and chargers

D. Assessment Tasks

Introduction Phase Assessment(s):

- Doing recaps of things covered in previous classes tests the students' retention skills.
- The lab sheets are to make sure everybody is engaged and paying attention to what they are doing, and focusing their observational learning.

Body of Lesson Phase Assessment(s):

- I'll be asking questions throughout each topic we cover to allow students a chance to engage with the new material, as well as answering questions to help connect new material to previous classes material
- Comparing the material to easy to understand things such as a boat or pushing a box makes it easier for students to understand and getting students to explain things back to you in this way allows you to see if they are understanding not only the analogy but the material itself.

Closing of Lesson Phase Assessment(s):

- Doing examples with students on the board allows the students to see your thought process when working through problems so that they can understand or develop a stepwise process for solving certain types of questions
- Giving students questions to work on on their own allows them to try the strategies they just learned from the examples and see how well they remember the process of solving the same types of problems

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E. Resources

- Projector/Smart board
- White board & markers
- Printer (for exit slip sheets)
- Textbook (McGraw-Hill & Ryerson SCIENCEPOWER 9)

F. Inclusive Practices

- The powerpoint and white board provides a visual for students that struggle to learn auditorily