Education 432: Secondary Principles & Practices
Lesson Plan Template

Electricity Lesson 9 – Power & Efficiency	
Teachers' Name: Mr. Andrew Kroon	**Grade: 9**
Subject: Science 9	**Topic: Electricity**

A. Learning Goals & Success Criteria

Learning Goals: In this lesson we hope to…

- Solidify understanding of simple circuit calculations
- Begin to work with more complex circuit calculations
- Practice rearranging and substituting electrical formulas
- Learn how efficient devices are and what happens to excess energy

Success Criteria: Success will be demonstrated by students' ability to…

- Correctly complete simple calculations
- Identify given factors and figure out how to use them to get other useful values
- Correctly rearrange and substitute formulas using basic algebra
- Calculate percent efficiency and identify possibilities of what will occur with the excess energy
- Remember the correct units for values like resistance, current, potential difference, power, energy, charge, etc.

B. Lesson Outcomes

GCOs/Competencies:	- Knowledge, Skills, STSE
SCOs:	- Describe the flow of charge in an electrical circuit (308-16) - Explain the importance of using precise language in science and technology (109-14) - Determine quantitatively the efficiency of an electrical appliance that converts electrical energy to heat energy (308-19) - Identify potential sources of error and determine the amount of error in measurement (210-10)

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C. Lesson Phases	
Intro Time: 10 minutes	**Introduction:** - Remind me what is a conductor and what is an insulator? • Get each group of 2 or 3 to find 3 facts (left half of the room does conductors, right half of the room does insulators) • Allow them 5 minutes or so to find a definition, what type of materials they usually are (metals or non metals), some examples of each within a circuit, etc • After the 5 minutes is up I will cold call to see who was actually doing it - Are resistors conductors? (raise your hands if yes, then same for no) • Both are right, they have a conductor within them, otherwise electricity would stop all together - Do wires have resistance? (raise your hand if you think yes, then same for no) • They do! However it is so small that we don't bother calculating it because it has little to no effect on the current
Body Time: 30-35 minutes	**Body:** - Resistors and other conductors • What determines the resistance of a conductor or resistor? • The material these are made of plays a role in its conductivity (and thus resistance, strong conductors have less resistance) • As temperature increases, so does resistance. The warmer the material, the more resistant it is (Think about the ruler and other things in the static lab…when they got hot did they do what they were expected to? • The size of a conductor also affects the resistance • As length of a conductor doubles, so does resistance (direct relationship) • As cross sectional area increases, resistance decreases. When cross sectional area doubles, resistance is halved (inverse relationship) • Examples: If a resistor of 10 Ω becomes 5 times longer, what is the new resistance? 50 Ω. If a 20 Ω resistor's diameter is doubled, what is it's new resistance? If diameter is doubles, area is quadrupled, therefore 20/4=5Ω • Activity to get people moving: Get 7 volunteers. Draw a resistor on the first board, write its length and its resistance. Get the first volunteer to draw the resistor but stretched, its resistance is 4 times the first one, whats it's length? Next volunteer changes the resistor again, this time its half the resistance, whats the diameter? Do this until each volunteer has gone.

- Power
  - Power (P) is energy used over a period of time, therefore, electrical power is how much electrical energy converted to other energy per second.
  - The formula is P=E/t, where E is energy in joules (J) and t is time in seconds. One joule per second is known as a watt (W), this is what we use to measure power.
  - Its not common that look at energy and time with circuits, more commonly we look at some of the key terms from last class (current, potential difference and resistance)
  - If we are given current and potential difference, how can we calculate power? Think back to our previous equations. If P=E/t, we can replace E with Q*V (V=E/Q, rearrange for E). Now we have P = Q*V/t. Now we have P, and V in the same formula, have we seen either of the other variables in a formula with current before? I=Q/t, therefore, P=I*V
  - Most devices say how much power they require to function (how much energy they use per second), so to determine how much energy the device uses, you simply multiply the power rating provided by the time its used.

- Efficiency
  - Not every resistor is 100% efficient, that would mean that all of the energy being put into a circuit is being used, but that is never the case.
  - Since each device has a certain amount of power needed, the remaining energy is lost elsewhere. Most commonly to heat, the excess of energy can cause the apparatuse to heat up as a way to dispel unsued energy. (For example, light bulbs after they are turned on usually start to get warm, this is because the extra enery is turned into heat)
  - Percentage efficiency = Useful energy output (electrical energy used by a device)/total electrical energy input (total energy from battery source) *100%
  - For example: If a stereo has a power rating of 15 W, and its used for 5 minutes, then the total energy input is 15 W * 300s = 4500 J. Lets say that 3000J are used to make sound energy. Then the %eff = 3000J/4500J * 100% = 66.67%
  - Now you guys try, with some guidance from me. I turn on my TV to watch an episode of Heartstopper. Each episode is roughly 30 minutes long, and my TV has a power rating of 50W. The TV produces 60000J of sound and light energy. What is its % efficiency?

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Closing Time: 15-20 minutes	**Closing:** - For the remainder of the class I would encourage students to try practice problems for more practice with the math as some of it is probably a bit more complex than what they are used to. The practice problems will be projected on the screen for those who want to practice.

D. Assessment Tasks

Introduction Phase Assessment(s):

- Cold calling makes students want to learn the content so that when they are asked questions they will know how to answer because not knowing is often seen as embarrassing (even though its not)
- Asking questions about content covered at the start of the unit helps to connect previous content so that it seems more relevant and has a flow that easier to follow
- Asking critical questions allows students to think and apply what they already know

Body of Lesson Phase Assessment(s):

- Doing examples after each new topic is introduced allows the students to get a stronger grasp on the material by actually practicing applying the concepts and calculations
- Allowing students a chance to get up and move around allows them to become more engaged in the material and also wakes them up a bit to help them focus better afterwards.

Closing of Lesson Phase Assessment(s):

- Allowing students to try practice questions themselves in class gives them a chance to practice and ask for some help on the spot rather than after the fact

E. Resources

- Projector
- White board & markers
- Printer & paper (might make worksheets to follow along with the notes and examples)
- White boards around the room

F. Inclusive Practices

- Visuals are used to capture students attention and can help students that learn more visually
- Having a notesheet for students to follow along with may help them understand the material better, or atleast more more important topics

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