RAMPED – Summer 2016

Basic Electrical Circuits

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P = Pretest (think essential questions)
O = Objectives (measurable - see Bloom's taxonomy)
C = Catch (hook, anticipatory set, etc... use different senses, not a question)
A = Activity (procedure of what the students should do)
R = Review (how will students go over what they've learned?)
A = Assessment (formative and/or summative)
P = Posttest (same as pretest for comparison purposes)
S = Standards (Wyoming, NGSS, etc...) showcasing crosscutting concepts†

Pretest Questions	• What are some components of a simple circuit? • What is the symbol used for a: battery, switch, light, diode? • What is a “short” in a circuit? • What instrument and units are used to measure voltage, resistance and amperage? • What is an Arduino and what can it do?
Objectives	• Model the flow of electrons in a circuit. • Build and distinguish between parallel and series electric circuits. • Explain how to tell when the path of an electric circuit is complete. • Build and test a circuits with a switch, source, resistor, diode, speaker and potentiometer. • Calculate voltage, amperage and resistance using Ohm’s law. • Use Arduino /breadboard and programing to build tools to study circuits. (follow circuit diagram practice and basic programing)
Catch	• Demonstrate various obnoxious noise creating circuits using simple programs in conjunction with the Arduino board. •
Activity	• Create a simple circuit using a battery, wires, and LED • Add components in a sequential manner using a breadboard to investigate the effect on the circuit (light brighter, dimmer, no light, LED burned, etc.) • Create, using a circuit diagram and Arduino, a voltmeter, ohm meter and ammeter. • Create a circuit and program using the Arduino to make a simple telegraph key/sound.
Review	• Build and explain to classmates a circuit of your own design, • Demonstrate, as a formative assessment, a parallel and series circuit involving the lighting and control of a two LED circuit. • Calculate total resistance in the circuit and voltage drop at each component.
Assessments	• Follow a circuit diagram to build a device of the instructor’s choice. • Calculate voltage and resistance at various places on the circuit using Ohm’s law. • Use the Arduino Ohm meter and Volt meter to confirm calculations
Posttest Questions (same as pretest questions)	• What are some components of a simple circuit? • What is the symbol used for a: battery, switch, light, diode? • What is a “short” in a circuit? • What instrument and units are used to measure voltage, resistance and amperage?

† http://ngss.nsta.org/CrosscuttingConceptsFull.aspx

	• What is an Arduino and what can it do?
Standards – NextGen Standards	**4-PS3-4.** Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.* [Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [*Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound*.]
Crosscutting Concepts from NGSS	There is nothing that I have been able to find specifically addressing electricity and circuits. However I found this comment in the NextGen website: The NGSS do not include specific examples of circuits, such as parallel and series circuits, because the focus is on understanding the core concept of energy transfer. Examples of circuits can be included for instructional purposes when appropriate. I would consider a short unit in Physical Science on the functions of Arduinos and the associated programing in the above lesson/unit plan appropriate.

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Environmental Science – Monitoring Abiotic Factors Affecting Plant Growth

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Pretest Questions	• What natural abiotic resources to plants require? • Do all plants have the same requirements? • Can an automated greenhouse produce healthier plants than those grown outdoors? • Why is it important to maintain a "stasis" in abiotic factors? • Is there an optimal temperature range, water supply and soil chemistry for plants?
Objectives	• Compare plant growth and health between those grown outdoors using human monitoring of light, heat, soil and water with plants grown in a greenhouse with an Arduino microcontroller monitoring and adjusting growth factors • Determine if automation can really save time, energy and produce plants of the same quality as "naturally" grown • Use programming and microcontrollers to monitor and adjust plant growth factors
Catch	• Purchase greenhouse grown veggies and naturally grown veggies. Do a blind taste/appearance evaluation using students as tasters. Let them try to determine which are which. Keep actual information for the end of the experiment
Activity	• Start seeds for a variety of vegetables (tomatoes, radish, beans, etc.). No more than three different varieties to keep data manageable • Place ½ of each type in a school garden when weather is appropriate • Place the other ½ in a greenhouse (cheap Harbor Freight) that has been automated using sensors, servos and an Arduino microcontroller. Students can be broken into two groups: greenhouse owners and natural farmers • Each team will record observations of plant appearance, growth rate, time spent directly providing and monitoring each variety of plant • At "Harvest time", evaluate produce quality, quantity, and labor investment of produce from both teams. • Formal Lab write-up to follow
Assessments	• Presentation from each team to a panel of peers using a criteria rubric (TBD) • Presentation of formal write-up for assessment

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Posttest Questions (same as pretest questions)	
Standards	**MS-LS2-3.** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [*Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.*]
Crosscutting Concepts from NGSS (from NGSS Website) Wyoming Department of Ed has not yet adopted a Draft version for the state.	**Patterns** • Patterns can be used to identify cause and effect relationships. (MS-LS2-2) **Stability and Change** • Small changes in one part of a system might cause large changes in another part. (MS-LS2-5) - **Connections to Engineering, Technology, and Applications of Science** **Influence of Science, Engineering, and Technology on Society and the Natural World** • The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5) - **Connections to Nature of Science** **Science Addresses Questions About the Natural and Material World** • Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)