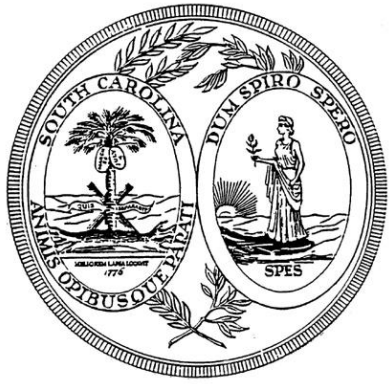
# South Carolina Academic Standards and Performance Indicators for Science 2014




## Instructional Unit Resource

## Physics

# *South Carolina Academic Standards and Performance Indicators for Science 2014*
# *Physics Instructional Unit Resource*

As support for implementing the *South Carolina Academic Standards and Performance Indicators for Science 2014*, the standards for Physics have been grouped into possible units. In the Overview of Units below, the titles for those possible units are listed in columns. Refer to the Overview document to note these unit titles and how Standards, Conceptual Understandings, Performance Indicators, Science and Engineering Practices, and Crosscutting Concepts align. Following the Overview of Units, an Instructional Unit document is provided that delivers guidance and possible resources in teaching our new *South Carolina Academic Standards and Performance Indicators for Science 2014*. The purpose of this document is to provide guidance as to how all the standards in this grade may be grouped into units and how those units might look. Since this document is merely guidance, districts should implement the standards in a manner that addresses the district curriculum and the needs of students. This document is a living document and instructional leaders from around the state will continuously update and expand these resource documents. These documents will be released throughout the 2016-2017 school year with the intentionality of staying ahead of instruction. Teachers should also note that links to the Standards document, A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, the SEP Support Document, and the Support Document 2.0 are embedded throughout the Instructional Unit format for reference.

**Acknowledgments**

Jean Baptiste Massieu, famous deaf educator, made a statement that is now considered a French proverb. “Gratitude is the memory of the heart. Indeed, appreciation comes when you feel grateful from the depths of your heart. The head keeps an account of all the benefits you received and gave. But the heart records the feelings of appreciation, humility, and generosity that one feels when someone showers you with kindness.” It is with sincere appreciation that we humbly acknowledge the dedication, hard work and generosity of time provided by teachers and instructional leaders across the state that have made and are continuing to make the Instructional Unit Resources possible.

# Physics Overview of Units

| Unit 1 | Unit 2 | Unit 3 | Unit 4 | Unit 5 | Unit 6 | Unit 7 |
|---|---|---|---|---|---|---|
| FORCES AND MOTION | WORK, ENERGY, AND MOMENTUM | ELECTRICITY AND MAGNETISM | WAVES | LIGHT AND OPTICS | THERMODYNAMICS | NUCLEAR AND MODERN PHYSICS |
| **Standard** | **Standard** | **Standard** | **Standard** | **Standard** | **Standard** | **Standard** |
| H.P.1 H.P.2 | H.P.1 H.P.2 H.P.3 | H.P.1 H.P.2 H.P.3 | H.P.1 H.P.3 | H.P.1 H.P.3 | H.P.1 H.P.3 | H.P.1 H.P.3 |
| **Conceptual Understanding** | **Conceptual Understanding** | **Conceptual Understanding** | **Conceptual Understanding** | **Conceptual Understanding** | **Conceptual Understanding** | **Conceptual Understanding** |
| H.P.2A<br>H.P.2B<br>H.P.2C | H.P.2B<br>H.P.3A<br>H.P.3B | H.P.2D<br>H.P.3E | H.P.3D | H.P.3F | H.P.3C | H.P.3G |
| **Performance Indicators** | **Performance Indicators** | **Performance Indicators** | **Performance Indicators** | **Performance Indicators** | **Performance Indicators** | **Performance Indicators** |
| H.P2A.1 H.P.2B.8<br>H.P.2A.2 H.P.2B.9<br>H.P.2A.3 H.P.2B.10<br>H.P.2A.4 H.P.2C.1<br>H.P.2A.5 H.P.2C.2<br>H.P.2A.6 H.P.2C.3<br>H.P.2B.1 H.P.2C.4<br>H.P.2B.2 H.P.2C.5<br>H.P.2B.3 | H.P.2B.4 H.P.3A.3<br>H.P.2B.5 H.P.3A.4<br>H.P.2B.6 H.P.3A.5<br>H.P.2B.7 H.P.3B.1<br>H.P.3A.1 H.P.3B.2<br>H.P.3A.2 H.P.3B.3 | H.P.2D.1 H.P.3E.5<br>H.P.2D.4 H.P.3E.6<br>H.P.2D.5 H.P.3E.7<br>H.P.2D.7<br>H.P.3E.1<br>H.P.3E.2<br>H.P.3E.3<br>H.P.3E.4 | H.P.3D.1<br>H.P.3D.2<br>H.P.3D.3<br>H.P.3D.4 | H.P.3F.1<br>H.P.3F.2<br>H.P.3F.3<br>H.P.3F.4<br>H.P.3F.5<br>H.P.3F.6 | H.P.3C.1<br>H.P.3C.2<br>H.P.3C.3<br>H.P.3D.1 | H.P.3G.1<br>H.P.3G.2<br>H.P.3G.3<br>H.P.3G.4<br>H.P.3G.5 |
| ***Science and Engineering Practices** | ***Science and Engineering Practices** | ***Science and Engineering Practices** | ***Science and Engineering Practices** | ***Science and Engineering Practices** | ***Science and Engineering Practices** | ***Science and Engineering Practices** |
| S.1A.2 S.1A.5<br>S.1A.3 S.1A.6<br>S.1A.4 S.1A.8 | S.1A.2 S.1A.7<br>S.1A.3 S.1A.8<br>S.1A.5 | S.1A.2 S.1A.6<br>S.1A.3 S.1A.8<br>S.1A.5 S.1B.1 | S.1A.2<br>S.1A.5<br>S.1A.6 | S.1A.1 S.1A.5<br>S.1A.2 S.1A.6<br>S.1A.3 S.1A.8 | S.1A.1 S.1A.4<br>S.1A.2<br>S.1A.3 | S.1A.2 S.1A.8<br>S.1A.5<br>S.1A.6 |
| ***Crosscutting Concepts** | ***Crosscutting Concepts** | ***Crosscutting Concepts** | ***Crosscutting Concepts** | ***Crosscutting Concepts** | ***Crosscutting Concepts** | ***Crosscutting Concepts** |
| 1, 2, 3, 4, 5, 6, 7 | 1, 2, 3, 4, 5, | 2, 3, 5, 6, 7 | 1, 2, 3, 5, 6, 7 | 1, 2, 3, 5, 6, 7 | 1,2,3,4,5,6,7 | 1,2,3,4,5,6,7 |

**Teachers have the discretion to enhance the selected SEP's and CCCs.*

| **Unit Title** |
|---|
| Electricity and Magnetism |
| **Standard**<br>http://ed.sc.gov/scdoe/assets/file/agency/ccr/Standards-Learning/documents/South_Carolina_Academic_Standards_and_Performance_Indicators_for_Science_2014.pdf |
| H.P.2 The student will demonstrate an understanding of how the interactions among objects and their subsequent motion can be explained and predicted using the concept of forces. |

| **Conceptual Understanding** |
|---|
| H.P.2D The non-contact (at a distance) interactions among objects and their subsequent motion can be explained and predicted by analyzing the gravitational, electric, and magnetic forces acting on the objects and applying Newton's laws of motion. These non- contact forces can be represented as fields. |
| **New Academic Vocabulary**<br>**Some students may need extra support with the following academic vocabulary in order to understand what they are being asked to understand and do. Teaching these terms in an instructional context is recommended rather than teaching the words in isolation. A great time to deliver explicit instruction for the terms would be during the modeling process. Ultimately, the student should be able to use the academic vocabulary in conversation with peers and teachers. These terms are pulled from the essential knowledge portion of the Support Doc 2.0 (http://ed.sc.gov/instruction/standards-learning/science/support-documents-and-resources/) and further inquiry into the terms can be found there.** |
| Law of Electrostatics — Friction — Conduction — Induction — Electroscope<br>Coulomb's Law — Coulombs — Electrical Force — Electric Field |
| **Performance Indicators**<br>**Text highlighted below in *orange* and *italicized/underlined* shows connections to SEP's** |
| H.P.2D.1 *Develop and use models* (such as computer simulations, demonstrations, diagrams, and drawings) to explain how neutral objects can become charged and how objects mutually repel or attract each other and include the concept of conservation of charge in the explanation.<br>H.P.2D.4 *Use mathematical and computational thinking* to predict the relationships among the charges of two particles, the attractive or repulsive electrical force between them, and the distance between them (Coulomb's Law. $F=kq1q2/r^2$).<br>H.P.2D.5 *Construct explanations* for how the non-contact forces of gravity, electricity, and magnetism can be modeled as fields by sketching field diagrams for two given charges, two massive objects, or a bar magnet and use these diagrams to qualitatively interpret the direction and magnitude of the force at a particular location in the field.<br>H.P.2D.7 *Use a free-body diagram* to represent the electrical force on a charge. |

***Science and Engineering Practices**

**Support for the guidance, overviews of learning progressions, and explicit details of each SEP can found in the Science and Engineering Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf). It is important that teachers realize that the nine science and engineering practices are not intended to be used in isolation. Even if a performance indicator for a given standard only lists one of the practices as a performance expectation, scientists and engineers do not use these practices in isolation, but rather as part of an overall sequence of practice. When educators design the learning for their students, it is important that they see how a given performance expectation fits into the broader context of the other science and engineering practices. This will allow teachers to provide comprehensive, authentic learning experiences through which students will develop and demonstrate a deep understanding of scientific concepts.**

H.P.1A.2 Develop and Use Models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.

H.P.1A.3 Plan and Carry Out Investigations to answer questions, test hypotheses, and develop explanations: (1) formulate scientific questions and testable hypotheses based on credible scientific information, (2) identify materials, procedures, and variables, (3) use appropriate laboratory equipment, technology, and techniques to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.

H.P.1A.5 Use Mathematics and Computational Thinking to (1) use and manipulate appropriate metric units, (2) express relationships between variables for models and investigations, or (3) use grade-level appropriate statistics to analyze data.

H.P.1A.6 Construct Explanations of phenomena using (1) primary or secondary scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.

***Cross Cutting Concepts (http://www.nap.edu/read/13165/chapter/8)**

**The link above provides support from the Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2012) The text in blue and *italicized/underlined* below provides a brief explanation of how the specific content ties to the CCC's.**

2. Cause and effect: The National Research Council (2012) states "events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts" (p. 84). *If a charged object comes in contact with an object that does not have charge (neutral charge), then the electrons are transferred to the neutral object. It receives the same charge.*

3. Scale, proportion, and quantity: The National Research Council (2012) states that "in considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance" (p. 84). *When the distance between two charges doubles, the force is cut in half.*

5. Energy and matter: Flows, cycles, and conservation: The National Research Council (2012) states "Fully develop energy transfers. Introduce

nuclear substructure and conservation laws for nuclear processes" (p. 84). *Charge is conserved.*

6. Structure and function: The National Research Council (2012) states that "the way in which an object or living thing is shaped and its substructure determine many of its properties and functions " (p. 84). *An object that has a negative charge has a surplus of electrons. An object that has a positive charge is lacking electrons.*

7. Stability and change: The National Research Council (2012) states that "For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study" (p. 84). *Positive-charge objects have electric force field lines and they end in a negative-charge objects.*

**Teachers have the discretion to enhance the selected SEP's and CCC's.*

| **Prior Knowledge** |
|---|
| ● 7.P.2 Parts of the Atom<br>● H.C.2 Structure of the Atom<br>● 2.P.4 Forces<br>● 5.P.5 Forces |
| **Subsequent Knowledge** |
| ● N/A |

**Possible Instructional Strategies/Lessons**
**Strategies and lessons that will enable students to master the standard and/or indicator.**

- Electrostatics and Coulomb's Law This activity allows students to use computational and mathematical thinking to determine the force acting between a balloon and another object. Activity is available at http://www.myips.org/cms/lib8/IN01906626/Centricity/Domain/8123/Coulombs%20Law%20E1.pdf

- Newton's Law of Gravitation This activity allows students to use computational and mathematical thinking to predict the relationship between the masses of two tangible objects. This activity is available at http://swift.sonoma.edu/education/newton/newton_4/nlawpost406ptb508a.pdf

- Visualizing Gravity This activity will assist students in being able to communicate about long-term gravitational interactions. This activity can be found at http://www.cpalms.org/uploads/resources/152051/Visualizing%20Gravity%20Investigation%20Sheet.pdf

- Electric Field Drawing Practice Students will diagram electric fields to interpret the direction and magnitude of the force at a particular location in the field. Link available athttp://physics.info/electric-field/practice.shtml

- The Electric Force: Concepts and Principles In this activity, students will use a free-body diagram to represent the magnitude and direction of the electric force. In addition, this activity will allow students to model the non-contact forces as fields, given two charges. The activity is contained in p. 6-24 with some analogies to gravity prior to the activity. This activity can be found at http://web.monroecc.edu/manila/webfiles/spiral/2.ElectricForceNC.pdf

**Resources**

- Virtual Investigations: Universal Gravitation These investigations allow students to use computational and mathematical thinking to determine the force acting between two masses. There are three investigations: lab, conceptual activity, and quantitative activity. These investigations can be found at http://www.mhhe.com/biosci/genbio/virtual_labs/universal_gravitation/main.html

- Gravity Force Lab This activity forces students to use computational and mathematical thinking to determine the force acting between two masses. Activity is available at https://phet.colorado.edu/sims/html/gravity-force-lab/latest/gravity-force-lab_en.html

- Balloons and Static Electricity PhET Students will use this interactive to develop a model to explain how a neutral object becomes charged. This interactive is available at https://phet.colorado.edu/en/simulation/balloons

**Sample Formative Assessment Tasks/Questions**

**Additional sample formative assessment tasks/questions for grade bands are located at the end of each of the SEP Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf)**

- Whiteboard Drawings - Students can draw the field lines to help determine the direction of a force at a particular location in a field.

- Whiteboard Drawings - Students can practice drawing free-body diagrams of the gravitational force acting on an object and electric force on a charge.

- Electric Stations - Students are able to study induction by using a new comb and inducing charge to tissue paper squares, stream of water, etc. Students will write an explanation for what is happening using the terms charge, force, and induction.

- Practice Problems with the Universal Law of Gravitation and Coulomb's Law - Coulomb's Law Practice Problems can be found at http://images.pcmac.org/SiSFiles/Schools/TX/DesotoISD/DHS/Uploads/DocumentsCategories/Documents/coulomb-law-practice-with-

answers.pdf. Law of Universal Gravitation problems can be found at http://www.acschools.org/cms/lib07/PA01916405/Centricity/Domain/362/8.1%20Math%20Problems%20Answers.pdf

- Using a Venn Diagram, Double Bubble, T chart (mechanism to compare and contrast), enumerate the similarities and differences between the Universal Law of Gravitation and Coulomb's Law. Make sure to include units, formula, components of the formula, etc.

| **Unit Title** |
|---|
| Electricity and Magnetism |
| **Standard**<br>http://ed.sc.gov/scdoe/assets/file/agency/ccr/Standards-Learning/documents/South_Carolina_Academic_Standards_and_Performance_Indicators_for_Science_2014.pdf |
| H.P.3 The student will demonstrate an understanding of how the interactions among objects can be explained and predicted using the concept of the conservation of energy. |

| **Conceptual Understanding** |
|---|
| H.P.3E During electric circuit interactions, electrical energy (energy stored in a battery or energy transmitted by a current) is transformed into other forms of energy and transferred to circuit devices and the surroundings. Charged particles and magnets create fields that store energy. Magnetic fields exert forces on moving charged particles. Changing magnetic fields cause electrons in wires to move, creating current. |
| **New Academic Vocabulary**<br>**Some students may need extra support with the following academic vocabulary in order to understand what they are being asked to understand and do. Teaching these terms in an instructional context is recommended rather than teaching the words in isolation. A great time to deliver explicit instruction for the terms would be during the modeling process. Ultimately, the student should be able to use the academic vocabulary in conversation with peers and teachers. These terms are pulled from the essential knowledge portion of the Support Doc 2.0 (http://ed.sc.gov/instruction/standards-learning/science/support-documents-and-resources/) and further inquiry into the terms can be found there.** |

| | | | | |
|---|---|---|---|---|
| Electric Current | Amperes | Electric Resistance | Ohms | Voltage |
| Volts | Resistor | Conductor | Electric Circuit | Voltage Source |
| Switch | Load | Circuit Diagram | Series Circuit | Parallel Circuit |
| Electric Charge | Electric Potential Energy | Electric Potential | Power | Watts |
| Chemical Cells | Magnetic Field | Electromagnet | Electric Motor | Armature |

| **Performance Indicators** |
|---|
| **Text highlighted below in *orange* and *italicized/underlined* shows connections to SEP's** |

H.P.3E.1 *Plan and conduct controlled scientific investigations* to determine the relationship between the current and potential drop (voltage) across an Ohmic resistor. Analyze and interpret data to verify Ohm's law, including constructing an appropriate graph in order to draw a line-of-best-fit whose calculated slope will yield R, the resistance of the resistor.
H.P.3E.2 *Develop and use models* (such as circuit drawings and mathematical representations) to explain how an electric circuit works by tracing the path of the electrons and including concepts of energy transformation, transfer, and the conservation of energy and electric charge.
H.P.3E.3 *Use mathematical and computational thinking* to analyze problems dealing with current, electric potential, resistance, and electric charge.
H.P.3E.4 *Use mathematical and computational thinking* to analyze problems dealing with the power output of electric devices.
H.P.3E.5 *Plan and conduct controlled scientific investigations* to determine how connecting resistors in series and in parallel affects the power (brightness) of light bulbs.
H.P.3E.6 *Obtain and communicate information* about the relationship between magnetism and electric currents to explain the role of magnets and coils of wire in microphones, speakers, generators, and motors.
H.P.3E.7 *Design* a simple motor *and construct* an explanation of how this motor transforms electrical energy into mechanical energy and work.

***Science and Engineering Practices**

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H.P.1A.2 Develop and Use Models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
H.P.1A.3 Plan and Carry Out Investigations to answer questions, test hypotheses, and develop explanations: (1) formulate scientific questions and testable hypotheses based on credible scientific information, (2) identify materials, procedures, and variables, (3) use appropriate laboratory equipment, technology, and techniques to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.
H.P.1A.5 Use Mathematics and Computational Thinking to (1) use and manipulate appropriate metric units, (2) express relationships between variables for models and investigations, or (3) use grade-level appropriate statistics to analyze data.
H.P.1A.8 Obtain, Evaluate, and Communicate Information to (1) answer questions, (2) explain or describe phenomena, (3) develop models, (4) evaluate hypotheses, explanations, claims, or designs or (5) identify and/or fill gaps in knowledge. Communicate using the conventions and expectations of scientific writing or oral presentations by (1) evaluating grade-appropriate primary or secondary scientific literature, or (2) reporting

the results of student experimental investigations.
H.P.1B.1 Construct Devices or Design Solutions using scientific knowledge to solve specific problems or needs: (1) ask questions to identify problems or needs, (2) ask questions about the criteria and constraints of the device or solutions, (3) generate and communicate ideas for possible devices or solutions, (4) build and test devices or solutions, (5) determine if the devices or solutions solved the problem and refine the design if needed, and (6) communicate the results.

***Cross Cutting Concepts** **(http://www.nap.edu/read/13165/chapter/8)**

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2. Cause and effect: The National Research Council (2012) states "events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts" (p. 84). *If the resistance is high, then the flow of electrons (current) will be low.*

3. Scale, proportion, and quantity: The National Research Council (2012) states that "in considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance" (p. 84). *If the current doubles, then the resistance is divided in half.*

5. Energy and matter: Flows, cycles, and conservation - The National Research Council (2012) states "Fully develop energy transfers. Introduce nuclear substructure and conservation laws for nuclear processes" (p. 84). *Energy transformations can occur in circuits. Electric energy can be converted to thermal energy, chemical energy, light energy, etc.*

6. Structure and function: The National Research Council (2012) states that "the way in which an object or living thing is shaped and its substructure determine many of its properties and functions " (p. 84). *The components of circuits can be arranged in series or parallel.*

7. Stability and change: The National Research Council (2012) states that "For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study" (p. 84). *If resistors parallel to one another, then the equivalent resistance is less than the resistance of any one resistor.*

**Teachers have the discretion to enhance the selected SEP's and CCC's.*

**Prior Knowledge**

- 3.P.3 Basic Circuits and Electricity

- 6.P.3 Electrical Circuits and Current

**Subsequent Knowledge**

- N/A

**Possible Instructional Strategies/Lessons**

**Strategies and lessons that will enable students to master the standard and/or indicator.**

- Electricity Dream House Students will use computational and mathematical thinking as well as research to calculate the electric power produced by their student created "dream house." This activity requires students to create a blueprint drawing with schematic diagrams of their electrical loads. Students must build two rooms of the dream house and provide the circuitry for the rooms. They will also select the appliances, lighting, and amenities with which to calculate the electricity bill. In December, students can build a Gingerbread House. The guidelines for the Dream House can be found at http://pleasanton.k12.ca.us/avhsweb/barnettDreyfuss/Physics/Documents/Electric%20House%20Project%2011.pdf

- Electric Circuits and Current Students will conduct this investigative inquiry activity to determine how the battery strength can affect the electric current. This activity can be found at http://homepage.smc.edu/kocharian_armen/Physics14/03_C5Act3-%20STRAW%20LAB.pdf

- Series and Parallel Resistors Activity This activity will allow students to conduct an investigation to determine how resistors in series and resistors in parallel affect voltage and current. This activity can be extended by using different types of resistors. This activity is available at http://www.auburn.edu/cosam//departments/physics/intro-courses/ugrad-lab/physics1500/activities/files/Series%20and%20Parallel%20Resistors%20Activity.pdf

- Circuit Construction Kit (DC Only), Virtual Lab PhET simulation in which students can plan and conduct controlled scientific investigations to determine how connecting resistors in series and in parallel affects the power (brightness) of light bulbs. This simulation can be found at https://phet.colorado.edu/en/simulation/legacy/circuit-construction-kit-dc-virtual-lab.

- Hand-made manipulatives In order to help students analyze current, electric potential, resistance, and charge, teachers can create their own manipulatives for charge, voltage source, conductors, electric load, etc. and arrange them into a circuit. The manipulatives can be symbols for the components of the circuit, i.e. clipart fuzzy monsters for charge, clipart battery for voltage source, clipart light bulb for the load. Each charge is "carrying" a beaker of energy from the battery, through the light, and completing the circuit back to the battery.

**Resources**

- Electric Current Interactive - Students will use the interactive to determine the relationship between voltage, current, and resistance. This interactive can be found at https://concord.org/stem-resources/electric-current

- Electric Current and Potential Difference Video - This video explains electric current and potential difference in an effort to prepare students to investigate the relationship between the two. This video can be found at http://www.bbc.co.uk/education/guides/zsfgr82/activity

- The Physics Classroom- This website is an excellent resource to use for mathematical thinking between electric current, potential, resistance, and charge. This link is found at http://www.physicsclassroom.com/

- Ohm's Law Simulation - PhET simulation in which students can manipulate voltage and resistance to see the effect on current. This simulation can be found at https://phet.colorado.edu/en/simulation/ohms-law.

**Sample Formative Assessment Tasks/Questions**

**Additional sample formative assessment tasks/questions for grade bands are located at the end of each of the SEP Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf)**

- Practice Problems with Ohm's Law, Electric Power, Series/Parallel/Complex Circuits
- Circuits website found at http://camillasenior.homestead.com/middle_school_science_-_basic_circuits.pdf
- Ohm's Law worksheet found at http://www.edu.pe.ca/queencharlotte/homework/mmorrison/9science/electricity/Ohms_Law_Worksheet.pdf
- Electric Power worksheet found at http://moodle.isl.edu.lv/pluginfile.php/9426/mod_resource/content/1/Electric%20Power%20Worksheet.pdf
- Students put problems on the board for discussion.
- Whiteboard sketches - schematic diagrams with simple, series, and parallel circuits
- Make a circuit (simple, series, parallel) lab practical - Students will select appropriate components to make a simple, series, and parallel circuit. Teacher will monitor students as they are working. Teacher will check off whether the students have completed a task.
- Exit Slips:
- What is the relationship between current and resistance?
- What is the difference between an ohmic appliance and a non-ohmic appliance?
- Compare and Contrast series and parallel circuits in terms of structure, current, voltage, resistance, and brightness.

References

Coulomb's Law Practice Problems [PDF document]. (n.d.). Retrieved September 7, 2016 from http://images.pcmac.org/SiSFiles/Schools/TX/DesotoISD/DHS/Uploads/DocumentsCategories/Documents/coulomb-law-practice-with-answers.pdf

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