Physics Curriculum Bundle #10

Title	Suggested Dates
Electrostatics and Circuits	03/21-04/15 (20 Days)

Big Idea/Enduring Understanding	Guiding Questions
Coulomb's law allows us to predict the interactions of electrostatic charges. The configuration of conductive paths in an electric circuit determines its behavior.	How do electrostatic charges interact? What determines the flow of charge through a circuit?

The resources included here provide teaching examples and/or meaningful learning experiences to address the District Curriculum. In order to address the TEKS to the proper depth and complexity, teachers are encouraged to use resources to the degree that they are congruent with the TEKS and research-based best practices. Teaching using only the suggested resources does not guarantee student mastery of all standards. Teachers must use professional judgment to select among these and/or other resources to teach the district curriculum.

Knowledge & Skills with Student Expectations	Specificity & Examples	Suggested Resources (Read the note above)
Phy.5 Science concepts. The student knows the nature of forces in the physical world. The student is expected to: **5A** research and describe the historical development of the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces;	• Research Coulomb's law • Compare and contrast with law of gravitation	
Phy.5 Science concepts. The student knows the nature of forces in the physical world. The student is expected to: **5C** describe and calculate how the magnitude of the electrical force between two objects depends on their charges and the distance between them;	Discuss electric charge and electric force. a. Describe electrical repulsion and attraction. b. State Coulomb's Law and use it to compute electrical force. c. Describe the concept of an electric field. CCRS Including • Solve problems involving Coulomb's law. • Solve electric field intensity problems. • Describe charging by induction. • Quantify charge as integer multiple of elementary charges. • Describe the properties of electric fields. • Describe the effects of electric fields on charges. • Describe electric fields in conductors. Pre-AP: • Calculate electrical forces between objects in 2-	Types of charges & Coulomb's Law Lab – using scotch tape. (phys_9_ScotchTapeLab) Nature of Charges – using pith balls & rods. (phys_9_ChargePithBallRods) Electric Field Mapping – using equipotential lines. (phys_9_EFieldMapping) Electric Field Mapping Physlet – http://www.its.caltech.edu/~phys1/java/phys1/EField/EField.html Electric Field Hockey Physlet – http://phet.colorado.edu/simulations/sims.php?sim=Electric_Field_Hockey

	dimensions (including vectors) • Calculate electric field • Calculate electric force • Calculate electric potential • Calculate electric potential energy	
Phy.5 Science concepts. The student knows the nature of forces in the physical world. The student is expected to: **5D** identify examples of electric and magnetic forces in everyday life;	Relate electricity and magnetism to everyday life. a. Explain how an electric motor works. State which electromagnetic laws or principles govern the workings of a motor. b. Explain how an electric generator works. State which electromagnetic laws or principles govern the workings of a generator. c. Make quantitative predictions of whether or not a circuit breaker will "trip" when a variety of electrical appliances are in use. CCRS Including • Solve problems involving electric power consumption. • Compare & contrast the current and voltage in the wires in a long distance transmission line and the wires that carry electricity to a home. •	Electric Power website – http://www.glenbrook.k12.il.us/gbssci/phys/Class/circuits/u9l2d.html
Phy.5 Science concepts. The student knows the nature of forces in the physical world. The student is expected to: **5E** characterize materials as conductors or insulators based on their electrical properties;	• Students should use simple circuits to test various materials	
Phy.5 Science concepts. The student knows the nature of forces in the physical world. The student is expected to: **5F** design, construct, and calculate in terms of current through, potential difference across, resistance of, and power used by electric circuit elements connected in both series and parallel combinations;	Gain qualitative and quantitative understandings of voltage, current, and resistance. CCRS a. Describe the concept of electric potential. b. Describe the concept of electrical charge flow and what limits that flow. c. Describe the concept of electrical resistance to charge flow. CCRS Understand Ohm's Law. a. Solve for unknown quantities using Ohm's Law. b. Determine electrical resistance from graphs of voltage versus current. CCRS	Ohm's Law Lab – graph voltage vs. current for different resistors to calculate resistance. (phys_10_Ohm) Series Circuits – measure voltage and current, comparing to theoretical values. (phys_10_SeriesCircuitLab) Parallel Circuits – measure voltage and current, comparing to theoretical values. (phys_10_ParallelCircuitLab) Combination Circuits – compare brightness of bulbs in different combinations. (phys_10_CombCircuitBulbLab) Circuit Applet –

	Apply the concept of power to electricity. a. Define electrical power as the product of current and voltage; perform simple calculations of power consumption. CCRS Discuss basic DC circuits that include voltage sources and combinations of resistors. a. Summarize the electrical characteristics (current, voltage, total resistance) of a circuit consisting of two or more resistors wired in series. b. Summarize the electrical characteristics (e.g., current, voltage) of a circuit consisting of two or more resistors wired in parallel. c. Compare the electrical characteristics (e.g., current, voltage) of a circuit consisting of two or more resistors wired in parallel with those of the same components wired in series. CCRS Discuss basic DC circuits that include voltage sources and combinations of capacitors. a. Describe what a capacitor is and how it works. b. Summarize the electrical characteristics (e.g., current, voltage) of a DC circuit consisting of a battery and a capacitor. c. Summarize the electrical characteristics (e.g., current, voltage) of a DC circuit consisting of a capacitor and a resistor wired in series. CCRS Including • Build and diagram series and parallel circuits • Define electric current, resistance and electric potential difference • Use Ohm's law to solve and simplify (reduce) circuits Pre-AP: • Include combinations of series and parallel circuits • Calculate equivalent resistance in complex circuits	http://www.mhhe.com/physsci/physical/giambattista/circuits/circuits.html Electric Power website –

1 The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. **1A** demonstrate safe practices during laboratory and field investigations		
1 The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. **1B** demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.		
2 The student uses a systematic approach to answer scientific laboratory and field investigative questions. **2A** know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;		
2 The student uses a systematic approach to answer scientific laboratory and field investigative questions. **2B** know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;		
2 The student uses a systematic approach to answer scientific laboratory and field investigative		

questions. **2C** know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but may be subject to change as new areas of science and new technologies are developed;		
2 The student uses a systematic approach to answer scientific laboratory and field investigative questions. **2D** distinguish between scientific hypotheses and scientific theories		
2 The student uses a systematic approach to answer scientific laboratory and field investigative questions. **2E** design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness		
2 The student uses a systematic approach to answer scientific laboratory and field investigative questions. **2F** demonstrate the use of course apparatus, equipment, techniques, and procedures, including multimeters (current, voltage, resistance), triple beam balances, batteries, clamps, power supply, ring clamps, ring stands, graph paper, protractors, resistors, mini lamps bulbs and sockets, electrostatics kits, 90-degree rod clamps, metric rulers, knife blade switches, meter sticks, scientific calculators, graphing technology, computers, spools of nylon thread or string, rolls of white craft paper, copper wire,		
2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.		

2G use a wide variety of additional course apparatus, equipment, techniques, materials, and procedures as appropriate such as ripple tank with wave generator, wave motion rope, micrometer, caliper, radiation monitor, computer, ballistic pendulum, electroscope, inclined plane, optics bench, optics kit, pulley with table clamp, resonance tube, ring stand screen, four inch ring, stroboscope, graduated cylinders, and ticker timer;		
2 The student uses a systematic approach to answer scientific laboratory and field investigative questions. **2H** make measurements with accuracy and precision and record data using scientific notation and International System (SI) units;		
2 The student uses a systematic approach to answer scientific laboratory and field investigative questions. **2I** identify and quantify causes and effects of uncertainties in measured data;		
2 The student uses a systematic approach to answer scientific laboratory and field investigative questions. **2J** organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs;		
2 The student uses a systematic approach to answer scientific laboratory and field investigative questions. **2K** communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports;		
2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.		

2L express and manipulate relationships among physical variables quantitatively, including the use of graphs, charts, and equations.		
3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. **3A** in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student		
3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. **3B** communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials		
3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. **3C** draw inferences based on data related to promotional materials for products and services		
3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. **3D** explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society		
3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. **3E** research and describe the connections between physics and future careers		
3 The student uses critical thinking, scientific reasoning, and problem solving to make informed		

decisions within and outside the classroom. **3F** express and interpret relationships symbolically in accordance with accepted theories to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition		