St. Lucie County Science Scope and Sequence 2012-2013

Course: Physical Science
Course Code: 2003310

Quarter: 4

Topic(s) of Study: Electrostatics and Circuits

Bodies of Knowledge: Nature of Science; Physical Science

Standards: Energy

Essential Questions: How do the use of conductors, semiconductors, and insulators affect our daily lives? How does the flow of electrical charges impact our daily lives; internally and externally? How are work and power quantitatively and qualitatively alike and different? How do scientists design an investigation to answer a scientific question and communicate their findings?

RESOURCES | COMMON CORE | PACING GUIDE

Next Generation Sunshine State Standards	Outline of Content/Concept	Targets
SC.912.P.10.14 Differentiate among conductors, semiconductors, and insulators Cognitive Complexity: Moderate **SC.912.P.10.15** Investigate and explain the relationships among current, voltage, resistance, and power. Cognitive Complexity: High **SC.912.P.10.3** Compare and contrast work and power qualitatively and quantitatively. Cognitive Complexity: Moderate	**I. Conductors, Semiconductors, and Insulators:** A. Conductors – materials through which electrical charges can flow. B. Insulators – materials that are poor conductors of electricity. C. Semiconductors – Materials that can behave as a conductor or insulator depending on conditions. **II. Current** – The rate at which charge flows past a point in a conductor. **III. Voltage** – Defined as the electric potential difference between two points. **IV. Resistance** – The resistance of a material is the slope of a voltage vs. current graph. **V. Power** – Power is the rate at which work is done or energy is used. In electrical circuits, P=VI. **VI. Ohm's Law** is used to relate Voltage, Current, and Resistance in a circuit: V=IR **VII. Mechanical Energy** A. Mechanical Energy is considered to be the Kinetic Energy, Gravitational Potential	• Classify materials as conductors, insulators, and semiconductors • Explain the relationship between current, voltage, resistance and power using data from an investigation • Analyze graphs to calculate resistance • Apply Ohm's Law to simple circuits • Calculate energy used and power in circuits • Calculate the work done on an object • Use the Work/Energy principle and the Conservational of Mechanical Energy to solve motion problems • Compare and contrast work and power • Calculate Mechanical Power when given problems

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	Energy and Elastic Potential Energy of an object. B. Work is defined to be the force acting on an object over a distance. C. Work can be positive or negative, but work is a scalar quantity. D. The net work done on an object changes its Kinetic Energy (Work/Energy Principle) E. In a situation where there is no NET work done on an object; its Mechanical Energy is conserved or constant. F. The conservation of Mechanical Energy and the Work/Energy Principle can be used to solve problems regarding an object's motion.	

Topic(s) of Study: Waves and Optics

Bodies of Knowledge: Nature of Science**;** Physical Science

Essential Questions: Why do the unique characteristics of the electromagnetic field produce distinct phenomenon? How is the motion of an object related to its velocity, acceleration and frame of reference? How do scientists design an investigation to answer a scientific question and communicate their findings?

SC.912.P.10.18 Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications. Cognitive Complexity: High **SC.912.P.10.21** Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver. Cognitive Complexity: Moderate	**I. Electromagnetic Waves (EM) (aka Light)** A. The EM spectrum is a continuous range of waves extending from radio waves (low frequency/high wavelength) to gamma rays (high frequency/low wavelength). B. All EM waves move with the same speed, c, through a vacuum. C. The energy of each EM wave is proportional to the frequency and give by, E=hf where h=Planck's constant. **II. Waves - Overview**	**Mechanical Waves:** • Identify and calculate wavelength, frequency, period, and amplitude of a transverse wave using a sinusoidal wave diagram • Solve problems using the equation v= fλ and E=hf • Explain the behavior of waves as they travel between media • Demonstrate constructive and destructive interference of transverse waves by drawing the result of two

	A. A wave is a motion of energy, NOT matter. B. There are several types of waves but the two types focused on here are transverse and longitudinal (compression). C. In a transverse wave the vibration of the medium is perpendicular to the motion of the energy and in a longitudinal wave the vibration of the medium is parallel to the motion of the energy. D. Light moves as a transverse wave and sound moves as a longitudinal wave. Water waves are more complicated, but with small amplitudes they can be modeled as transverse waves. E. Wave quantities of speed, wavelength, frequency, and amplitude can be defined by examining wave diagrams. • The speed, wavelength and frequency are related by the equation, $v=f\lambda$. F. Frequency can be observed as the pitch of a sound wave or the color of a light wave. G. Amplitude can be observed by the loudness of a sound wave or the intensity of a light wave. **III. Waves – Properties and Phenomena** A. Reflection – The bouncing back of a wave that strikes a boundary between two	interfering waves using superposition • Explain how diffraction and interference relate to the formation of Young's Double Slit pattern **Electromagnetic Waves**: • Construct the electromagnetic spectrum with the relationships of frequency and wavelength illustrated • Validate the relationship between wavelength, frequency, and energy of different waves in the electromagnetic spectrum • Discuss the relationships among electromagnetic quantities and technological practical applications involving them

	media. B. Refraction – When a wave crosses from one medium into another AND its speed changes, the wavelength MUST change and the wave MAY change direction. C. Diffraction – The bending of a wave around a barrier such as an obstacle or the edges of an opening. D. Interference – When two waves occupy the same place at the same time the principle of superposition states that the resulting wave's amplitude will be the sum of the two interfering waves' amplitudes. This can lead to constructive interference(two crests make a larger crest or two troughs make a larger trough) or destructive interference (a crest and a trough partially or fully cancel each other). E. Doppler Effect – The APPARENT change in the frequency of a wave due to motion of the source and/or observer. • Examples include the change in pitch of a race car engine as it approaches/recedes from a microphone and the red shift/blue shift of stars and distant galaxies as they move relative to us. F. The red shift of every distant galaxy was part of the evidence used to theorize that the universe is constantly expanding and thus must have originated as a singularity that exploded in a big bang. G. Advances in Astrophysics have been	

	made by the use of electromagnetic observations throughout the spectrum including the observation of the microwave background radiation from the original big bang.	