Course: Physics 1 *Course Code: 2003380*

SEMESTER 2
QUARTER 3
UNIT 7

TOPIC of STUDY: Thermal Energy
STANDARDS: 8:Matter, 10: Energy, 12: Motion
KEY LEARNING:
~Mathematically relate heat, phase change, energy, and work
~Heat added to a system affects temperature and phase change
~The First Law of Thermodynamics is a statement of the Conservation of Energy

RESOURCES COMMON CORE PACING GUIDE

VOCABULARY: internal energy, temperature scale, convection, conduction, radiation, heat, thermal equilibrium, calorimetry, heat of fusion, heat of vaporization, phase change, specific heat, entropy

SUGGESTED LABS:
1. Freezing point of Stearic Acid
2. Calorimetry /Specific Heat Capacity

NGSSS	CONTENT	TARGETS
SC.912.P.10.4 Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter SC.912.P.10.5 Relate temperature to the average molecular energy	**CONCEPT: Temperature and Heat** 1. Relate temperature to the kinetic energy of atoms in a molecule. 2. Describe the temperature changes of two objects as they reach thermal equilibrium. 3. Identify the various temperature scales and their respective units. **ESSENTIAL QUESTIONS:** A. How does temperature relate to the potential and kinetic energies of molecules? B. What are the differences between temperature and heat? C. How does heat relate to average kinetic molecular energy? D. How does a material's insulating properties affect the transfer of energy?	~State the similarities and differences between the temperature scales (Celcius, Kelvin, Farenheit, and Rankine) ~Define and describe the differences between temperature and heat. ~Discuss transfer of heat.

SC.912.P.8.1 Differentiate among the four states of matter SC.912.P.10.6 Create and interpret potential energy diagrams SC.912.P.12.11 Describe phase transitions in terms of kinetic molecular theory	**CONCEPT: Phase Changes** 1. Perform calculations with specific heat capacity. 2. Interpret the various sections of a heating curve **ESSENTIAL QUESTIONS:** A. How does the type of material affect the amount of heat required to change both the temperature and the phase? B. How do you calculate the total energy needed to change the temperature of a substance to pass through a phase change?	~Describe solid, liquid, and gas phases in terms of molecular motion. ~Solve problems involving heat and cooling curves and phase change. ~Solve problems with specific heat capacity.
SC.912.P.10.2 Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity SC.912.P.10.8 Explain entropy's role in determining the efficiency of processes that convert energy to work SC.912.P.12.10 Interpret the behavior of ideal gases in terms of kinetic molecular theory	**CONCEPT: First Law of Thermodynamics** 1. Illustrate how the First Law of thermodynamics is a statement of energy conservation. **ESSENTIAL QUESTIONS:** A. How does the First Law of thermodynamics relate heat, work, and internal energy? B. Can you compare the First Law of Thermodynamics to both an open and closed system, as related to the efficiency of an internal combustion engine?	~Identify a system as open, closed, or isolated and tell the differences among these systems. ~Define entropy. ~Solve problems involving the equation PV/T = a constant.

SEMESTER 2
QUARTER 3
UNIT 8

TOPIC of STUDY: Wave Properties
STANDARDS: 8:Matter, 10: Energy,
KEY LEARNING:
~Force, velocity, and acceleration change as an object vibrates with simple harmonic motion (SHM)
~Recognize the relationships between period, frequency, velocity, and wavelength
~All waves exhibit the properties of rectilinear propagation, reflection, refraction, diffraction, and interference
~Sound waves are mechanical, longitudinal waves

VOCABULARY: rectilinear propagation, reflection, refraction, diffraction, interference, crest, trough, longitudinal wave, transverse wave, mechanical wave, electromagnetic wave, wavelength, simple harmonic motion, Hooke's Law, restoring force,
Node, standing wave, resonance, compression, rarefaction, pitch, frequency, amplitude, Doppler Effect

SUGGESTED LABS:
1. Hooke's Law/determine the spring constant of a spring
2. Resonance/Frequency of a Tuning Fork
3. Solve for g using the Period of a Pendulum

NGSSS	CONTENT	TARGETS
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 SC.912.P.10.20 Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another	**CONCEPT: Properties of Waves** 1. Discuss that wave is a motion of energy, NOT matter. 2. Differentiate between pulse waves and periodic waves. 3. Discuss the five properties of waves 4. Compare mechanical waves and electromagnetic waves **ESSENTIAL QUESTIONS:** A. What are the fundamental measures of a wave and how are they related to one another? B. What is the behavior of a wave as it travels between media? C. Discuss Newton's Corpuscular Theory of Light, Huygen's Wave Theory of Light, and the Modern Theory of Light.	~Compare and contrast mechanical waves and electromagnetic waves. ~Compare and contrast transverse waves and longitudinal waves. ~Discuss the different parts of the electromagnetic spectrum. ~List and give examples of the five properties of waves. ~Explain how the diffraction and interference led to the acceptance of the Wave Theory of Light (Huygens) over the Corpuscular Theory of Light (Newton). ~State the Modern Theory of Light. ~Solve problems using $v = f\lambda$.
SC.912.P.10.6 Create and interpret potential energy diagrams	**CONCEPT: Simple Harmonic Motion** 1. Identify the conditions of SHM. 2. Explain how force, velocity, and acceleration change as an object vibrates with SHM. **ESSENTIAL QUESTIONS:** A. How does the Conservation of Energy play a role in SHM? B. How can the Earth's acceleration due to gravity be calculated using a Pendulum? C. How can the spring constant of a spring be determined using Hooke's Law	~Discuss the properties of SHM. ~Solve problems using the equation for the Period of a Pendulum $T = 2\pi\sqrt{\frac{l}{g}}$ ~Calculate the spring constant using Hooke's Law
SC.912.P.10.20 Describe the	**CONCEPT: Wave Interactions**	

measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another	1. Apply the Superposition Principle. 2. Differentiate between constructive and destructive interference. 3. Identify nodes and antinodes of a standing wave. **ESSENTIAL QUESTIONS:** A. How do interactions affect the properties of waves? B. How can society benefit from an understanding of wave interactions?	~Give examples of constructive and destructive interference. ~Predict when a reflected wave will be inverted.
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 the receiver SC.912.E.5.1 Site evidence to develop and verify the scientific theory of the big bang of the origin of the universe. SC.912.E.5.2 Identify patterns in the organization and distribution of matter in the universe and the forces that determine them.	**<u>CONCEPT: Properties of Sound</u>** 1. Explain how sound waves are produced. 2. Discuss the physical properties of sound vs. the physiological properties of sound (frequency vs. pitch, amplitude vs. loudness, harmonic content vs. quality) 3. Compare the speed of sound in various media. 4. Discuss the Doppler Effect and its ramifications to ALL waves. **ESSENTIAL QUESTIONS:** A. How does sound relate to the properties of waves? B. How does the frequency of a sound change as the direction or speed of the source changes? C. What is resonance? D. How are intensity, decibel level and perceived loudness related? E. What is the speed of sound at various temperatures?	~Describe how the Red Shift, explained by the Doppler Effect, indicates that the universe is expanding and is evidence for the Big Bang Theory ~Solve problems involving sound to determine the speed of sound at various temperatures, the frequency of sound, the wavelength of a sound wave, the distance a sound wave has traveled (include problems that have echoes) $v_{Sound} = 331.5 \frac{m}{s} + (0.6 \frac{m/s}{^{\circ}C})(T_{in\,^{\circ}C})$ $v = f\lambda$ $\Delta x = vt \; c = f\lambda$

SEMESTER 2
QUARTER 3
UNIT 9

TOPIC of STUDY: Light and Geometric Optics
STANDARDS: 10: Energy, 12: Motion
KEY LEARNING:
~Electromagnetic waves include visible light. The uses of the radiation of the electromagnetic spectrum depends upon the frequencies and wavelengths of the waves.
~The speed of light is a constant, 3.00×10^8 m/s
~Mirrors reflect light.
~Lens refract light.
~Intensity of light obeys an Inverse Square Law.

VOCABULARY: electromagnetic spectrum, inverse square law, speed of light, dispersion, lens, mirror, concave, convex, converging, diverging, real image, virtual image, magnification, focal length, principal axis, center of curvature, law of reflection, law of refraction, index of refraction

SUGGESTED LABS:
1. Reflection/Focal length of a Concave Mirror
2. Refraction/Focal Length of a Converging Lens

NGSSS	CONTENT	TARGETS
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 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 the receiver SC.912.P.12.7 Recognize that nothing travels faster than the speed of light in a vacuum which is the same for all observers no matter how they or the light source are moving	**CONCEPT: Light** 1. Identify the components of the electromagnetic spectrum. 2. Calculate the frequency or wavelength of electromagnetic radiation. 3. Recognize that light has a finite speed. **ESSENTIAL QUESTIONS:** A. Can you solve for the frequency or wavelength of light given the other? B. Can you describe various uses for the different bands of the electromagnetic spectrum?	~List the bands of the electromagnetic spectrum and be able to give uses for them in our society. ~Solve problems using $c = f\lambda$ ~Recognize that frequency of visible light is represented by its color.
SC.912.P.10.20 Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another SC.912.P.10.22 Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors	**CONCEPT: Reflection** 1. Apply the Law of Reflection for flat mirrors. 2. Describe the nature of images formed by flat mirrors. 3. Demonstrate the Mirror/Lens equation as used for concave and convex mirrors. 4. Illustrate how to construct ray diagrams for concave and convex mirrors and how to interpret the images formed. **ESSENTIAL QUESTIONS:**	~Describe the nature of images formed by plane, concave, and convex mirrors. ~Compare and contrast real and virtual images. ~Construct and interpret ray diagrams formed by concave and convex mirrors. ~State the Law of Reflection.

	A. What are the nature of images formed by Plane, concave, and convex mirrors? B. How are ray diagrams used to show reflection?	
SC.912.P.10.20 Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another SC.912.P.10.22 Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors	**<u>CONCEPT: Refraction</u>** 1. Identify which direction light will bend when it passes from one medium to another. 2. . Demonstrate the Mirror/Lens equation as used for converging and diverging lenses. 3. Illustrate how to construct ray diagrams for converging and diverging lenses and how to interpret the images formed. **ESSENTIAL QUESTIONS:** A. What are the nature of images formed by converging or diverging lenses? B. How are ray diagrams used to show refraction? C. How can Snell's Law be used to investigate the changing speed of light?	~Use Snell's Law to solve problems. ~Identify the density of a material based on the refraction of light as it changes media (whether the final medium is more or less dense than the initial medium) ~Calculate the magnification of lenses. ~ Construct and interpret ray diagrams formed by converging and diverging lens.