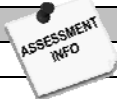



Physics Curriculum Bundle #7

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| Title |   | Suggested Dates |
| Thermodynamics and Simple Harmonic Motion | | 01/04-01/28 (10 Days) |

| Big Idea/Enduring Understanding | Guiding Questions |
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| Macroscopic properties are related to molecular phenomena. Thermodynamics allows us to predict and regulate the flow of heat energy. The motion of objects undergoing simple oscillation can be characterized and generalized. | How does heat energy flow in a system? What are the characteristics of simple harmonic motion? |

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) |
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| <p>Phy.6 Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to:</p> <p>6E describe how the macroscopic properties of a thermodynamic system such as temperature, specific heat, and pressure are related to the molecular level of matter, including kinetic or potential energy of atoms;</p> | <p>Understand pressure in a fluid and its applications.</p> <p><i>a. Define pressure and make basic pressure computations using $pressure = force/area$ in appropriate units.</i></p> <p><i>b. Describe qualitatively and quantitatively how the pressure in a fluid changes with depth and explain the physical basis for the relationship.</i></p> <p><i>c. Describe the cause of atmospheric pressure and its variations. CCRS</i></p> <p>Understand states of matter and their characteristics.</p> <p><i>a. Describe the states of matter in terms of volume, shape, and cohesive strength.</i></p> <p><i>b. State the physical changes associated with a change in phase. CCRS</i></p> <p>Including</p> <ul style="list-style-type: none"> • Kinetic theory of gas • Relationship between <ul style="list-style-type: none"> ○ Average kinetic energy and temperature ○ Average speed and temperature ○ Internal energy and temperature | |

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| | <ul style="list-style-type: none"> • Specific Heat <p>Pre-AP</p> <ul style="list-style-type: none"> • Ideal Gas Law | |
| <p>Phy.6 Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to:</p> <p>6F contrast and give examples of different processes of thermal energy transfer, including conduction, convection, and radiation; and</p> | <p>Including.</p> <ul style="list-style-type: none"> • Methods of heat transfer <ul style="list-style-type: none"> ○ Conduction ○ Convection ○ Radiation • Compare and contrast alternative heating methods <ul style="list-style-type: none"> Such as <ul style="list-style-type: none"> ○ Heat pumps ○ Air conditioning ○ Radiant heating ○ Solar ○ Geothermal <p>Pre-AP</p> <ul style="list-style-type: none"> • Explain thermal expansion in examples such as bridges, metallic structures of buildings, railroad tracks. | <p>Thermodynamics Applet – http://www.mhhe.com/physsci/physical/giambattista/thermo/thermodynamics.html</p> <p>Thermodynamics Simulations – http://phet.colorado.edu/new/simulations/index.php?cat=Heat at and Thermo</p> <p>Heat engine simulation – http://www.uwsp.edu/physastr/kmenning/flash/AF_2202.swf</p> <p>Suggested Equipment – calorimeter, thermometer, specific heat specimens</p> |
| <p>Phy.6 Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to:</p> <p>6G analyze and explain everyday examples that illustrate the laws of thermodynamics, including the law of conservation of energy and the law of entropy.</p> | <p>Understand the gain and loss of heat energy in matter.</p> <p><i>a. Describe, qualitatively and quantitatively, the relationship between heat and change in temperature, including the effects of mass and specific heat.</i></p> <p><i>b. Identify and compute the energy involved in changes of state.</i></p> <p><i>c. Explain the relationships among evaporation, condensation, cooling, and warming.</i></p> <p><i>d. Describe the transfer of heat by conduction, convection, and radiation. CCRS</i></p> <p>Understand the basic laws of thermodynamics.</p> <p><i>a. State and describe the laws of thermodynamics.</i></p> <p><i>b. Describe qualitative applications of the laws of thermodynamics and relate each to the concept of conservation of energy. CCRS</i></p> <p>Including</p> | <p>Calorimetry Lab – using the method of mixtures to measure the specific heat of an unknown substance. (phys_6_SpecificHeat)</p> <p>Convection simulation – http://www.kangwon.ac.kr/~sericc/sci_lab/physics/conduction/convection.html</p> <p>Conduction simulation – http://www.kangwon.ac.kr/~sericc/sci_lab/physics/conduction/conduction.html</p> |

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| | <ul style="list-style-type: none"> • Describe entropy as a measure of the degree of order/disorder • Explain the relationship between internal energy, heat, and work. • Describe the concept of thermal equilibrium. • Describe the relationship between heat energy and entropy as it relates to a system and its surroundings. | |
| <p>Phy.7 Science concepts. The student knows the characteristics and behavior of waves. The student is expected to:</p> <p>7A examine and describe oscillatory motion and wave propagation in various types of media;</p> | <p>Understand basic oscillatory motion and simple harmonic motion.</p> <p><i>a. Identify examples of oscillatory motion.</i></p> <p><i>b. Recognize examples of simple harmonic motion. CCRS</i></p> <p>Such as</p> <ul style="list-style-type: none"> • Describe the properties of oscillation / simple harmonic motion • Describe factors that affect the period of a simple pendulum and spring-mass system | <p>Simple harmonic motion lab – comparing period of spring and pendulum to theoretical value. (phys_7_SHMBoth)</p> <p>Simple pendulum lab – measuring period and compare to theoretical value. (phys_7_PendulumLab)</p> <p>Oscillating spring-mass lab – measuring period and compare to theoretical value. Compare position, velocity, acceleration with motion detector. (phys_7_SpringLab)</p> |
| <p>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.</p> <p>1A demonstrate safe practices during laboratory and field investigations</p> | | |
| <p>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.</p> | | |

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| <p>1B demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.</p> | | |
| <p>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> <p>2A know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;</p> | | |
| <p>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> <p>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;</p> | | |
| <p>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> <p>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;</p> | | |
| <p>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> | | |

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| <p>2D distinguish between scientific hypotheses and scientific theories</p> | | |
| <p>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> <p>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</p> | | |
| <p>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> <p>2F demonstrate the use of course apparatus, equipment, techniques, and procedures, including, triple beam balances, clamps, data acquisition probes, hot plates, slotted and hooked lab masses, pendulum supports, power supply, stopwatches, graph paper, protractors, metric rulers, Celsius thermometer, meter sticks, scientific calculators, graphing technology, computers, spools of nylon thread or string.² The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> | | |
| <p>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> <p>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,</p> | | |

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| <p>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;</p> | | |
| <p>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> <p>2H make measurements with accuracy and precision and record data using scientific notation and International System (SI) units;</p> | | |
| <p>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> <p>2I identify and quantify causes and effects of uncertainties in measured data;</p> | | |
| <p>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> <p>2J organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs;</p> | | |
| <p>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</p> <p>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;</p> | | |
| <p>2 The student uses a systematic approach to</p> | | |

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| <p>answer scientific laboratory and field investigative questions.</p> <p>2L express and manipulate relationships among physical variables quantitatively, including the use of graphs, charts, and equations.</p> | | |
| <p>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</p> <p>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</p> | | |
| <p>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</p> <p>3B communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials</p> | | |
| <p>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</p> <p>3C draw inferences based on data related to promotional materials for products and services</p> | | |
| <p>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</p> <p>3D explain the impacts of the scientific contributions of a variety of historical and</p> | | |

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| contemporary scientists on scientific thought and society | | |
| <p>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</p> <p>3E research and describe the connections between physics and future careers</p> | | |
| <p>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</p> <p>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</p> | | |