Physics Curriculum Bundle #8

Title	Suggested Dates
Waves	01/31-02/18 (15 Days)

Big Idea/Enduring Understanding	Guiding Questions
Many phenomena may be described as waves.	How are wave characteristics applied to natural phenomena?

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.7 Science concepts. The student knows the characteristics and behavior of waves. The student is expected to: **7A** examine and describe oscillatory motion and wave propagation in various types of media;	Understand basic oscillatory motion and simple harmonic motion. *a. Identify examples of oscillatory motion.* *b. Recognize examples of simple harmonic motion. CCRS* • Describe pulses and periodic waves	
Phy.7 Science concepts. The student knows the characteristics and behavior of waves. The student is expected to: **7B investigate and analyze characteristics of waves, including velocity, frequency, amplitude, and wavelength, and calculate using the relationship between wave speed, frequency, and wavelength;**	Understand wave terminology: wavelength, period, frequency, amplitude. *a. Perform computations using the formula (wave speed) = (wavelength) * (frequency).* *b. Describe wavelength, frequency, amplitude, and period, and identify each from various wave graphs. CCRS* Including • Given a diagram label parts of waves • Calculations using $v=f\lambda$ Pre-AP: Conceptual knowledge of wave equation	Standing wave lab – slinky or string finding velocity of wave by measuring wavelength and period of a wave. (phys_7_SlinkyLab) Demonstration that harmonics are integer multiples of fundamental frequency. Dan Russell's acoustics website – http://www.kettering.edu/~drussell/demos.html Suggested Equipment – springs, slinky, pendulum, stopwatch, meter stick, motion detector, wave generator.

Phy.7 Science concepts. The student knows the characteristics and behavior of waves. The student is expected to: 7C **compare characteristics and behaviors of transverse waves, including electromagnetic waves and the electromagnetic spectrum, and characteristics and behaviors of longitudinal waves, including sound waves;**	Understand the difference between transverse and longitudinal waves. *a. Describe the motion of the medium as compared to the wave motion for both transverse and longitudinal waves. CCRS* Understand the properties and behavior of sound waves. *a. Describe the properties and behavior of sound including compressions, rarefactions, and travel through various media.* *b. Compare and contrast sound and electromagnetic waves in terms of wave speed, wave type, wavelength, frequency, and medium.* *c. Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler Effect). CCRS* Know the electromagnetic spectrum. *a. Discuss the regions of the electromagnetic spectrum, including radio waves, microwaves, infrared, visible, ultraviolet, x-rays, and gamma rays.* *b. Discuss visible light as part of the electromagnetic spectrum. Emphasize that light is an electromagnetic wave.* *c. Recognize that electromagnetic waves are transverse waves and travel at the speed of light through a vacuum.* *d. Compare and contrast transmission, reflection, and absorption of radiation. CCRS* Including • Explain how sound waves are produced • Describe properties of sound waves Including o Frequency & pitch (including beats) o Harmonics – quality & timbre (including	Speed of sound lab – measure speed of sound with 2 microphones (phys_7_speedofsound) Resonance Lab – closed end tube in graduated cylinder. (phys_7_ResonanceLab) Suggested Equipment – springs, slinky, wave generator, tuning forks, large graduated cylinder & pipes, musical instruments, oscilloscope, frequency generator, sound meter.

	standing waves w/ stringed and pipe instruments) o Resonance • Describe the two types of waves Including o Transverse o Longitudinal Pre-AP • Intensity and relative intensity	
Phy.7 Science concepts. The student knows the characteristics and behavior of waves. The student is expected to: 7D **investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, and the Doppler effect;**	• Describe in words or illustrate o Reflection (fixed & loose end) • Standing waves o Harmonics vs. frequency o String vs. closed and open pipes • The Doppler effect o Explain in words o Illustrate o Give examples Pre-AP: Calculate Doppler shift	
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 clamps, slotted and hooked lab masses, power supply, ring clamps, ring stands, stopwatches,		

tuning forks, graph paper, protractors, 90-degree rod clamps, metric rulers, spring scales, knife blade switches, Celsius thermometers, meter sticks, scientific calculators, graphing technology, computers, resonance tubes, spools of nylon thread or string, rolls of white craft paper, slinky springs, wave motion ropes, and laser pointers		
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		