| **Planned Course: Honors Physics**<br>**Unit # 7: Simple Harmonic Motion, Mechanical Waves and Sound**<br>**Estimated Time: 4 weeks** | **Course Number: 403H**<br><br>**Grade Level: 11/12**<br><br>**Level/Track: Honors/AP** | **Department: Science**<br><br><br><br>**Board Approval Date: August 27, 2018** | |
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| **Big Ideas /**<br>**PA Academic Standards** | ➢ **Core Concepts (in question format)**<br>● **Skills/Knowledge** | **Activities/Strategies/Study Skills (identify some activities as remedial or enrichment activities)** | **Assessments (include types and topics)** |
| **Big Ideas**<br><br>**Big Idea 3:** The interactions of an object with other objects can be described by forces.<br><br>**Big Idea 5**: Changes that occur as a result of interactions are constrained by conservation laws.<br><br>**Big Ideas 6:** Waves can transfer energy and momentum from one location to another without the permanent transfer of mass and serve as a mathematical model for the description of other phenomena.<br><br>**PA Academic Standards**<br><br>**3.2.10.B5:**<br><br>Understand that waves transfer energy without transferring matter. | ➢ What is simple harmonic motion?<br>● Identify the conditions of simple harmonic motion.<br>● Explain how force, velocity and acceleration change as an object vibrated with simple harmonic motion.<br>● Calculate the spring force using Hooke's Law.<br>➢ Is the motion of a pendulum considered simple harmonic motion?<br>● Discuss how for small angles, a pendulum's motion is simple harmonic.<br>➢ How is simple harmonic motion measured?<br>● Identify the amplitude of vibration.<br>● Recognize the | Hooke's Law Lab<br>● Students must determine both the spring constant k of a spring and the mass of three unknown masses. Students must also investigate the conservation of mechanical energy of the system.<br><br>Pendulum Lab<br>● Students will explore the relationship between period and frequency with a pendulum undergoing simple harmonic motion.<br><br>Sound Waves Lab (Pan Pipes)<br>● Students will vary the frequency or sound by cutting pipes to various lengths to create a pan pipe instrument.<br><br>Fire Tube Demonstration<br>● Students will observe standing sound waves using a fire tube. | Hands on laboratory assessments (Intro to Circular Motion Lab, Circular Motion Station Lab)<br><br>Lab Simulations (Jupiter's Moons Virtual Lab, Portions of Circular Motion Station Lab).<br><br>Quizzes on major concepts.<br><br>Homework to reinforce major concepts.<br><br>Unit Test. |

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| Compare and contrast the wave nature of light and sound.<br><br>Describe the components of the electromagnetic spectrum.<br><br>Describe the difference between sound and light waves.<br><br>**3.2.P.B5:**<br><br>Explain how waves transfer energy without transferring matter.<br><br>Explain how waves carry information from remote sources that can be detected and interpreted.<br><br>Describe the causes of wave frequency, speed, and wave length. | relationship between period and frequency.<br>● Calculate the period and frequency of an object vibrating with simple harmonic motion.<br>➢ What are properties of waves?<br>● Distinguish local particle vibrations from overall wave motion.<br>● Differentiate between pulse waves and periodic waves.<br>● Interpret waveforms of transverse and longitudinal waves.<br>● Apply the relationship among wave speed, frequency, and wavelength to solve problems.<br>● Relate energy and amplitude.<br>➢ What is wave interference?<br>● Apply the superposition principle.<br>● Differentiate between constructive and destructive interference.<br>● Predict when a reflected wave will be inverted.<br>● Predict whether specific traveling waves | Doppler Shift Virtual Lab (Gizmo)<br>● Observe sound waves emitted from a moving vehicle. Measure the frequency of sound waves in front of and behind the vehicle as it moves, illustrating the Doppler effect.<br><br>Problem Solving Examples and Guided Practice<br><br>Class discussion and guided note taking | |

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| | will produce a standing wave.<br>● Identify notes and antinodes of a standing wave.<br>➢ What are sound waves?<br>● Explain how sound waves are produced.<br>● Relate frequency to pitch.<br>● Compare the speed of sound in various media.<br>● Relate plane waves to spherical waves.<br>● Recognize the Doppler Effect, and determine the direction of a frequency shift when there is relative motion between a source and an observer.<br>➢ What are sound intensity and resonance?<br>● Calculate the intensity of sound waves.<br>● Relate intensity, decibel level, and perceived loudness.<br>● Explain why resonance occurs.<br>➢ What are harmonics?<br>● Differentiate between the harmonic series of open and closed pipes.<br>● Calculate the harmonics of a | | |

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| | vibrating string and of open and closed pipes.<br>● Relate harmonics and timbre.<br>● Relate the frequency difference between two waves to the number of beats heard per second. | | |