|  |  |  |  |
| --- | --- | --- | --- |
| **WCSD High School Conceptual Physics Unit Overview**  This unit guide arranges the Performance Expectations (PEs) for HS Conceptual Physics into different units with guiding questions.  NOTE: This course does not align to all the Physical Science PEs—only those specific to physics.  The Engineering Standards HS-ETS1-1, HS-ETS1-2, HS-ETS1-3 and HS-ETS1-4 are to be integrated throughout the school year. | | | |
| **1st Semester Conceptual Physics** | | | |
| **Unit Title: Mechanical Equilibrium & Newton’s Laws**  **Guiding Questions:**  What is mechanical equilibrium and how does it relate to Newton’s Laws?  What is a force and how do force interactions influence an object’s state of motion? | **Unit Title: Momentum & Energy Principles**  **Guiding Questions:**  What is momentum and how is it measured?  What is energy and how is it measured?  How can energy & momentum principles be applied to analyze the state of motion of an entire system of objects? | **Unit Title: Projectile, Circular & Rotational Motion**  **Guiding Questions:**  How do force interactions cause objects to move in parabolic and circular paths?  How can the law of conservation of angular momentum be used to describe the fact that the earth’s rotation is slowing down due to the moon moving farther away over time? | **Unit Title: Gravity, Satellites & Einstein’s Theory of Relativity**  **Guiding Questions:**  What is the Universal Gravitational Constant and how was it discovered?  Why do satellites orbiting the earth, including the moon, have to maintain a particular speed based on their orbital altitude?  What are the postulates of Einstein’s theory of Relativity and why are they necessary for GPS technology? |
| **HS-PS2-1.** Analyze data to support the claim that Newton’s second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. | **HS-PS3-1.** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.  **HS-PS2-2.** Use mathematical representations to support the claim that the total momentum of a system of objects is  conserved when there is no net force on the system.  **HS-PS3-3.** Design, build, and refine a device that works within given constraints to convert one form of energy into  another form of energy.\* | **HS-PS2-1.** Analyze data to support the claim that Newton’s second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.  **HS-PS2-4.** Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict  the gravitational and electrostatic forces between objects. | **HS-PS2-4.** Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict  the gravitational and electrostatic forces between objects.  **HS-PS3-2.** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a  combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects). |

|  |  |  |  |
| --- | --- | --- | --- |
| **2nd Semester Conceptual Physics** | | | |
| **Unit Title: Mechanical Vibrations, Waves & Sound**  **Guiding Questions:**  What is a natural frequency and why do all objects have their own?  Where do all sounds originate? What is resonance and how does it show up in nature? | **Unit Title: Light & Electromagnetic Waves**  **Guiding Questions:**  How do atoms interact over astronomically large distances?  Why does the sky appear to be blue? How do glasses improve vision? | **Unit Title: Electricity & Magnetism**  **Guiding Questions:**  What is charge and how is it different from mass?  Where does lightning come from? How do you design a circuit?  What causes magnetism? | **Unit Title: Atoms & Quantum Physics**  **Guiding Questions:**  If protons are positively charged, then why don’t they repel each other in the nucleus of an atom?  Why is it so hard to locate the electron in a Hydrogen atom?  What is the photoelectric effect? What are quarks? |
| **HS-PS3-2.** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a  combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).  **HS-PS4-1.** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength,  and speed of waves traveling in various media. | **HS-PS3-5.** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces  between objects and the changes in energy of the objects due to the interaction.  **HS-PS4-3.** Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.  **HS-PS4-4.** Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of  electromagnetic radiation have when absorbed by matter. | **HS-PS2-5.** Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and  that a changing magnetic field can produce an electric current.  **HS-PS3-5.** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. | **HS-PS1-8.** Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.  **HS-PS4-3.** Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.  **HS-PS4-4.** Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of  electromagnetic radiation have when absorbed by matter. |