|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Conceptual Physics 2019 – 2020 | | | | | |
| ***Date Range*** | ***Unit*** | ***Essential Question(s)*** | ***List of Labs and Activities*** | ***Course Content Unit/Instructional Objectives*** | ***Summative Assessment*** |
| August 13 –Aug 23 | Unit 0.  Lab Safety,  Scientific Hypothesis and  Problem solving | What is a scientific hypothesis?  What are the steps for problem solving?  What determined the Significant Figure | * Measure the length of a table (lab 0) * Marshmallow challenge | * Distinguish between a hypothesis that is scientific and one that is not. * Distinguish between independent variables, dependent variables, and control variables. * Distinguish the difference between accuracy and precision and different types of error during experimentation. * Evaluate merits and limitations of two different models. (Atomic models, Earth Shape models, particle and wave models of light) * Describe circumstances under which a hypothesis or law must be changed or abandoned. * Analyze the limitation of models | Daily Quiz  Unit Test on all lessons at the end of the unit. |
| Aug 26 – Sept 13 | Unit 1.  Oscillation, Wave, Sound,  Electromagnetic waves | How can one describe the motion of a wave?    What are some properties of waves? | * Basic Wave properties (lab1) * String Sound Lab (lab2) | * Explain the relationship between wavelength, frequency, and the speed of travel of a wave. * Demonstrate knowledge of the properties of waves and energy by measuring wavelength and amplitude in a lab. * Describe, distinguish, and solve problems involving interference, diffraction, refraction, reflection, Doppler effect, and polarization. * Analyze a system where standing waves are present. * Define and use scientific terminology for invisible light: *Radio wave, Microwave, Infrared light, visible light, Ultraviolet light, x-ray, gamma ray, black body radiation* | Daily Quiz  Unit Test on all lessons at the end of the unit. |
| Sept 16 – Oct 8 | Unit 2  Kinematics  Free Fall | What is the difference between vector and scalar?  How can one describe the motion of an object?    How can one describe the motion of an object through a graph?    How does reference frame affect an observer’s description of an object’s motion? | * Linear Motion (lab 3 with handout) * Inertia (lab 4 – no handout) | * Define position, displacement, distance, and distance traveled in a particular frame of reference. ​ * Explain the relationship between position and displacement. ​ * Distinguish between displacement and distance traveled. ​Calculate displacement and distance given initial position, final position, and the path between the two. ​ * Define and distinguish between scalar and vector quantities. * Assign a coordinate system for a scenario involving one-dimensional motion. * Explain the relationships between instantaneous velocity, average velocity, instantaneous speed, average speed, displacement, and time. ​ * Calculate velocity and speed given initial position, initial time, final position, and final time. ​ * Derive a graph of velocity vs. time given a graph of position vs. time. ​ * Interpret a graph of velocity vs. time and Position vs. time. * Define and distinguish between instantaneous acceleration and average acceleration​ * Calculate acceleration given initial time, initial velocity, final time and final velocity * Describe the effects of gravity on objects in motion​. * Describe the motion of objects that are in free fall and calculate the position and velocity of objects in free fall. ​ | Daily Quiz  Unit Test on all lessons at the end of the unit. |
| Oct 14 – Nov 4 | Unit 3  Kinematic 2D  Projectile Motion | What is projectile motion and how does one predict the path of a projectile motion? | * Projectile Motion (lab 5 with handout) | * Observe that motion in two dimensions consists of horizontal and vertical components. * Understand the independence of horizontal and vertical vectors in two-dimensional motion. ​ * Understand the rules of vector addition, subtraction, and multiplication. ​ * Apply graphical methods of vector addition and subtraction to determine the displacement of moving objects. ​ * Understand the rules of vector addition and subtraction using analytical methods. ​ * Apply analytical methods to determine vertical and horizontal component vectors. ​ * Identify and explain the properties of a projectile, such as acceleration due to gravity, range, maximum height, and trajectory. ​ * Determine the location and velocity of a projectile at different points in its trajectory. ​ * Apply the principle of independence of motion to solve projectile motion problems. ​ | Daily Quiz  Unit Test on all lessons at the end of the unit. |
| Nov 5 – Dec 11 | Unit 4  Dynamics | If there is no force, what will be the motion of an object?    What is Newton’s 3 laws of motion? | * Newton 2nd law (lab 6 with handout) * Rocket lab (lab 7 no handout) | * Understand the definition of force * Distinguish the difference between mass and weight * Identify the effect of inertia on both moving and stationary objects * Describe the relationship between force, mass, and acceleration when a force is applied to an object * Distinguish between static and kinetic friction and determine the effects on the motion of objects. * Create free body diagrams and analyze the interactions between objects and forces * Understand Newton’s third law of motion * Integrate concepts from kinematics to solve problems using Newton’s laws of motion | Daily Quiz  Unit Test on all lessons at the end of the unit. |
| Start to use CK 12 physics textbook | | | | | |
| Jan 6 – Jan 23 | Unit 5  Circular Motion and Gravity | Why study physics?  What is uniform Circular Motion? ​  The moon is attracted to the Earth by the force of gravity. Why doesn’t the moon fall into the Earth?  what is the third law of Kepler's law? | * No lab available | * Discusses circular motion and centripetal acceleration. * Explains centripetal force. * Describes Isaac Newton's universal law of gravitational attraction. * Describes orbital motion and weightlessness. * Discusses Kepler’s three laws of planetary motion. * Einstein's theory of gravity and the warping of space-time. | Daily Warm Up  Unit Test on all lessons at the end of the unit. |
| Feb 12 – March 5 | Unit 6  Momentum and Energy | How does one  determine the  mechanical  (kinetic and  potential) energy  of an object or  system of objects?  How can the law  of conservation of  energy be used to  determine the  motion of an  object? | * Design Helmet (lab 8) * Conservation of momentum (lab 9) * Potential Energy (lab 10) * Simple Machine (lab 11) | * Differentiate between kinetic energy and potential energy use scientific terms and mathematical equations. * Analyze kinetic-potential energy systems such as projectile motion, and roller coasters in terms of conservation of energy, including analyzing graphs. * Analyze elastic and inelastic collisions and solve problems involving collision for unknown values. * Recognize the relationship between momentum and impulse and predict the impacts they have on each other. * Apply the principle of the conservation of momentum two colliding objects. * Recognize the relationship between work and energy and apply the principle of the conservation of energy to falling objects | Daily Warm Up  Unit Test on all lessons at the end of the unit. |
| March 6 – March 31 | Unit 7  Thermal Physics | What does temperature relate to, kinetic energy or average kinetic energy? ​  what are the three ways of heat transfer?  How does energy transfer during phase change?  What is specific heat? | * Thermal Physics (lab 12) | * Define *temperature, heat, thermal energy* and distinguish their scientific definitions from their meaning in everyday use. * Explain the reason of thermal expansion in microscopic level and use the principle to explain real-world designs, such as the breaks between railroad tracks. * Define and identify phase change of matter in real life, including *vaporization, condensation, melting, sublimation, freezing, deposition*. * Define and distinguish different types of heat transfer including conduction, convection, and radiation. * Describes specific heat and its use in the calculation of heat transfer. * Apply knowledge of the laws of thermodynamics using the relationships among work, heat, energy, and entropy | Daily Warm Up  Unit Test on all lessons at the end of the unit. |
| April 1– April 28 | Unit 8  Fluid | What is Archimedes’ law?  What is Pascal Law?  What is Bernoulli’s law? | * Fluid (lab 13) * Buoyant Virtual Lab (lab 14) | * Discusses pressure, Pascals, the method of calculating pressure in a fluid, and the fact that the fluid pressure at a particular point in a fluid is the same in all directions. * Discusses Archimedes’ Principle and the concept of buoyancy. * Presents Pascal’s Principle and the calculations based on Pascal’s Principle for hydraulic systems. * Understand Bernoulli’s principle and be able to discuss its implications. | Daily Warm Up  Unit Test on all lessons at the end of the unit. |
| April 28 – May 15 | Unit 9  Electricity and Magnetism | What is the nature of changes and how do charges interact with one another?    What are some  electrical  safety rules? | * Virtual lab magnetic field, electric field. (lab 15)      * Circuit (no time | * Define an electric current and describe how voltage and resistance affect it (Ohm’s Law) * Define a circuit and how different circuit elements would fit in it * Analyze series & parallel circuits in terms of total resistance, voltage across resistance, and current * Familiarize self with magnetic materials * Explain magnetic fields are, how they are created, and how they affect objects * Recognize that Earth has a magnetic field that affects life on Earth * Describe how changing electric fields produce changing magnetic fields and different phenomena related to this | Daily Warm Up  Unit Test on all lessons at the end of the unit. |