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|  |  | Conceptual Physics |  |  |  |
| Date Range | **Unit** | **Essential Question(s)** | **List of Labs and Activities** | **Course Content Unit/Instructional Objectives** | **Formative/**  **Summative**  **Assessment** |
| 8/15 – 8/25 | Math Review /Scientific Hypothesis | * What is scientific hypothesis? * How to do unit conversion? * How to represent a number in scientific notation? | * Marshmallow challenge | * Frame a hypothesis based on observations and scientific principles. (Science and Engineering practices) * Convert among different-sized standard measurement units within a given measurement system * Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used | Quiz 1. Physics Foundation |
| 8/25 – 9/22 | Kinematics | * 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?\* * What is projectile motion and how to predict the path of a projectile motion? | - constant acceleration lab (car in ramps) [Lab1]  Describe motion (paper programming game)  Match Graph Activity  Marble Launch Lab [Lab2] | - Vector operation  - 4.A.1 The linear motion of a system can be described by the displacement, velocity, and acceleration of its center of mass  - 4.A.2 The acceleration is equal to the rate of change of velocity with time, and velocity is equal to the rate of change of position with time | Quiz 2. Linear Motion  Test 1. Linear motion and physics foundation |
| 9/22 – 10/25 | Newton's Law | * If there is no force, what will be the motion of an object? * What are Newton’s 3 laws of motion? | Skate board Activities | * 1.C.1 Inertial mass is the property of an object or a system that determines how its motion changes when it interacts with other objects * 3.A.2 Forces are described by vectors * 3.A.3 A force exerted on an object is always due to the interaction of that object with another object * 3.A.4 If one object exerts a force on a second object, the second object always exerts a force of equal magnitude on the first object in the opposite direction * 3.B.1 If an object of interest interacts with several other objects, the net force is the vector sum of the individual forces * 3.B.2 **Free body diagrams** are useful tools in visualizing forces being exerted on a single object and writing the equations that represent a physical situation | Quiz 3. Newton’s 1st law  Quiz 4 Newton’s law  Test 2 Newton’s law |
| 10/26 – 12/ | Sound, Color and Light | * How to describe the motion of a wave? * What are some properties of waves? * How to use ray diagram to describe waves that are reflected, refracted by mirror and lenses? * Is light particle or wave? * How global warming works? | Wave and Sound Lab [Lab 3]  Color and Light Lab [Lab4]  Mirror and lenses | * HS-PS4-1, [PS4.A: Wave Properties](http://www.nap.edu/openbook.php?record_id=13165&page=131) ([The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing.](http://www.nap.edu/openbook.php?record_id=13165&page=131) * PS3.A [At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy.](http://www.nap.edu/openbook.php?record_id=13165&page=120) * MS PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. * PS 4-4 Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. | Quiz 5. Wave and Sound  Quiz 6 Light and Color  Test 3 Sound, light and color |
| 1/4 – 1/22 | Momentum | Why is a dish more easy to break if it lands on a hard floor than lands on a carpet? | Momentum lab | * Use impulse and momentum in describing motion * The change of momentum equal to the impulse * Analyze elastic and inelastic collisions of two objects * Conservation of momentum | Quiz 7 Momentum lab |
| 1/23 – 2/14 | Work, Power 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? * What are the six types of simple machine? | Roller coaster Design lab | * 4.C.1 The energy of a system includes its kinetic energy, potential energy, and microscopic internal energy. Examples should include gravitational potential energy, elastic potential energy, and kinetic energy. * 4.C.2 Mechanical energy is transferred into or out of system when an external force is exerted on a system such that a component of the force is parallel to the displacement. The process through which the energy is transferred is called work * 5.B.5 Energy can be transferred by an external force exerted on an object or system that moves the object or system through a distance; this energy transfer is called work. Energy transfer in mechanical or electrical systems may occur at different rates. Power is defined as the rate of energy transfer into, out of, or within a system. * Simple Machine includes: lever, ramps, pulley, screw, and wedge. | Quiz 8 work and power  Quiz 9 Simple Machine  Test 1 Momentum, work and power |
| 2/15 -3/9 | Circular Motion and Gravity | * What determines the gravitational force between objects? * What centripetal force is required to move an object in a circular path? | Water won't fall  Great American Worksheet | - MS ESS 1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.  - 2.B.2 The gravitational field caused by a spherically symmetric object with mass is radial and, outside the object, varies as the inverse square of the radial distance from the center of that object.  - 3.C.1 Gravitational forces describes the interaction of one object that has mass with another object | Quiz 10 Circular Motion and Gravity |
| 3/9- 3/26 | Fluid and Thermodynamics | * Is there more pressure at the bottom of a bathtub of water 30 cm deep or at the bottom of a pitcher of water 35 cm deep? * When you throw a rock in water from your boat. Can you figure out what happens to the water level? * How does the Bernoulli principle apply to lift? | Bernoulli Principle Application | - Describe what determines the pressure of a liquid at any point  Explain what causes a buoyant force on an immersed or submerged object  - Relate the buoyant force on an immersed or submerged object to the weight of the fluid it displaces  - Describe how pascal’s principle can be applied to increase the force of a fluid on a surface.  - Describe the relationship between the speed of a fluid at any point and the pressure at that point for steady flow  - Describe some applications of Bernoulli’s principle  - Define temperature in terms of KE and describe the common temperature scales.  - Give examples and applications of thermal expansion of solids  - Describe the behavior of water as it is heated from 0 Celsius degree to 15-degree Celsius | Quiz 11 Fluid and Heat |
| 3/26-5/18 | Electrostatics and Circuit | * What is the nature of charges and how do charges interact with one another? * What is Ohm’s law? * What are parallel circuits and series circuits? * What are some electrical safety rules? | Circuit Lab | -HS-PS2-4  Use mathematical representations of Coulomb's law to describe and predict the gravitational and electrostatic forces between objects.  - 1.B.1 Electric charge is conserved. The net charge of a system is equal to the sum of the charged of all the objects in the system. | Quiz 12 Electrostatics  Quiz 13 Circuits |
| 5/19-5/23 | Magnetics and Electromagnetics |  | Electromagnetic Lab | -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.  Solve problems involving the change of magnetic flux and induced current.  Understand the principle of transformers and the benefits of DC and AC power. | Exam 3 Electricity and Magnetism |
|  | Final Exam Review |  |  |  | Final Exam |