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| AP Physics 1 | | | | | |
| ***Date Range*** | ***Unit*** | ***Essential Question(s)*** | ***List of Labs and Activities*** | ***Course Content Unit/Instructional Objectives*** | ***Summative Assessment*** |
| 8/15 – 9/28 | Kinematics | 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 observers description of an object’s motion? | Car Speed Lab  Reaction Time Lab  Velocity and Acceleration Lab  Car Race Project  Match the Graph Activity  Cannons Project  Marble Launch Lab | * 3.A.1 An observer in a particular reference frame can describe the motion of an object using such quantities as position, displacement, distance, velocity, speed, and acceleration * 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 | Chapter 2 Reading Quiz  Chapter 2 Test  Chapter 3 Reading Quiz  Chapter 3 Test |
| 10/10 – 11/2 | Dynamics | How is force related to the motion of an object?  What are Newton’s 3 laws of motion? | Newtons 2nd Law Lab  Friction Lab | * 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 * 3.C.4 contact forces result from the interaction of one object touching another object and they arise from interatomic electric forces. These forces include tension, friction, normal, and spring * 4.A.3 Forces that systems exert on each other are due to interactions between objects in the systems. If the interacting objects are part of the same system, there will be no change in the center of mass velocity of that system | Chapter 4 Reading Quiz  Chapter 4 Test |
| 11/13 – 11/30 | Gravity and Circular Motion | What determines the gravitational force between objects?  What centripetal force is required to move an object in a circular path? | Circular Motion Lab  Flying Pig Lab | * 1.C.2Gravitational mass is the property of an object or a system that determines the strength of the gravitational interaction with other objects, systems, or gravitational fields * 1.C.3 Objects and systems have properties of inertial mass and gravitational mass that are experimentally verified to be the same and that satisfy conservation principles * 2.A.1 A vector field gives, as a function of position (and perhaps time), the value of a physical quantity that is described by a vector. * 2.B.1 A gravitational field g at the location of an object with mass m causes a gravitational force of magnitude mg to be exerted on the object in the direction of the field * 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 that has mass | Chapter 5 Reading Quiz  Chapter 5 Test |
| 12/5 – 1/18 | 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 is the relationship between work, power, and energy? | Conservation of Energy Lab | * 3.E.1 The change in the kinetic energy of an object depends on the force exerted on the object and on the displacement of the object during the interval that the force is exerted * 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.A.2 For all systems under all circumstances, energy, charge, linear momentum, and angular momentum are conserved. For an isolated or a closed system, conserved quantities are constant. An open system is one that exchanges any conserved quantity with its surroundings. * 5.B.1 Classically, an object can only have kinetic energy since potential energy requires an interaction between two or more objects * 5.B.3 A system with internal structure can have potential energy. Potential energy exists within a system if the objects within that system interact with conservative forces. * 5.B.4 The internal energy of a system includes the kinetic energy of the objects that make up the system and the potential energy of the configuration of the objects that make up the system. * 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. | Chapter 6 Reading Quiz  Chapter 6 Test |
| 1/22 – 2/5 | Linear Momentum | What is the relationship between force and momentum?  What are the properties and characteristics of elastic and inelastic collisions? | Egg Drop Lab  Collisions and Momentum Lab  Mechanical Advantage Activity | * 3.D.1 The change in momentum of an object is a vector in the direction of the net force exerted on the object * 3.D.2 The change in momentum of an object occurs over a time interval * 4.B.1 The change in linear momentum for a constant mass system is the product of the mass of the system and the change in velocity of the center of mass * 4.B.2 The change in linear momentum of the system is given by the product of the average force on that system and the time interval during which the force is exerted * 5.A.2 For all systems under all circumstances, energy, charge, linear momentum, and angular momentum are conserved. For an isolated or a closed system, conserved quantities are constant. An open system is one that exchanges any conserved quantity with its surroundings. * 5.D.1 In a collision between objects, linear momentum is conserved. In an elastic collision, kinetic energy is the same before and after * 5.D.2 In an inelastic collision, kinetic energy is not the same before and after the collision * 5.D.3 The velocity of the center of mass of the system cannot be changed by an interaction within the system | Chapter 7 Reading Quiz  Chapter 7 Test |
| 2/12 – 2/22 | Rotational Motion | How do the concepts of kinematics and dynamics relate to rotating objects?  What are inertia, kinetic energy, and momentum in regards to rotating objects? | Moment of Inertia Activity  Torque Lab | * 4.D.3 The change in angular momentum is given by the product of the average torque and the time interval during which the torque is exerted * 5.A.2 For all systems under all circumstances, energy, charge, linear momentum, and angular momentum are conserved. For an isolated or a closed system, conserved quantities are constant. An open system is one that exchanges any conserved quantity with its surroundings. * 5.E.1 If the net external torque exerted on the system is zero, the angular momentum of the system does not change * The angular momentum of a system is determined by the locations and velocities of the objects that make up the system. The rotational inertia of an object or system depends upon the distribution of mass within the object or system. Changes in the radius of a system or in the distribution of mass within the system result in changes in the system’s rotational inertia, and hence in its angular velocity and linear speed for a given angular momentum * 4.D.1 Torque, angular velocity, angular acceleration, and angular momentum are vectors and can be characterized as positive or negative depending upon whether they give rise to or correspond to counterclockwise or clockwise rotation with respect to an axis | Chapter 8 Reading Quiz  Chapter 8 Test |
| 2/27 – 3/16 | Waves and Oscillations | What is simple harmonic motion, and how does one find the energy, velocity, and period of an object undergoing simple harmonic motion?  What are the different types of waves, how can on describe waves, and how do waves interact?  How can the concepts about waves be applied to sound? | Pendulum Lab  Waves Lab  Sound Lab | * 3.B.3 Restoring forces can result in oscillatory motion. When a linear restoring force is exerted on an object displaced from an equilibrium position, the object will undergo a special type of motion called simple harmonic motion * 5.B.2 A system with internal structure can have internal energy, and changes in a system’s internal structure can result in changes internal energy * 6.A.1 Waves can propagate via different oscillation modes such as transverse and longitudinal * 6.A.2 For propagation, mechanical waves require a medium, while electromagnetic waves do not require a physical medium * 6.A.3 The amplitude is the maximum displacement of a wave from its equilibrium value * 6.A.4 Classically, the energy carried by a wave depends upon and increases with amplitude. Examples should include sound waves. * 6.B.1 For a periodic wave, the period is the repeat time of the wave. The frequency is the number of repetitions of the wave per unit time * 6.B.2 For a periodic wave, the wavelength is the repeat distance of the wave * 6.B.4 For a periodic wave, wavelength is the ration of speed over frequency * 6.B.5 The observed frequency of a wave depends on the relative motion of source and observer. This is a qualitative treatment only * 6.D.1 Two or more wave pulses can interact in such a way as to produce amplitude variations in the resultant wave. When two pulses cross, they travel through each other, they do not bounce off each other. Where the pulses overlap, the resulting displacement can be determined by adding the displacements of the two pulses. This is called superposition. * 6.D.2 Two or more travelling waves can interact in such a way as to produce amplitude variations in the resultant wave * 6.D.3 Standing waves are the result of the addition of incident and reflected waves that are confined to a region and have nodes and antinodes. Examples should include waves on a fixed length of string, and sound waves in both closed and open tubes * 6.D.4 The possible wavelengths of a standing wave are determined by the size of the region to which it is confined * 6.D.5 Beats arise from the addition of waves of slightly different frequency | Chapters 11-12 Test |
| 3/20 – 4/12 | Electrostatics and Circuits | What is the nature of charge and how do charges interact with one another?  What is Ohm’s law?  What are different types of circuits and how does the circuit affect the power output of the circuit components? | Circuits Lab | * 1.A.1 A collection of particles in which internal interactions change little or not at all, or in which changes in these interactions are irrelevant to the question addressed, can be treated as an object. * 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 * 1.B.2 There are only two kinds of electric charge. Neutral objects or systems contain equal quantities of positive and negative charge, with the exception of some fundamental particles that have no electric charge * 1.B.3 The smallest observed unit of chare that can be isolated is the electron charge, also known as the elementary charge * 3.C.2 Electric force results from the interaction of one object that has an electric charge with another object that has an electric charge * 5.A.2 For all systems under all circumstances, energy, charge, linear momentum, and angular momentum are conserved. For an isolated or a closed system, conserved quantities are constant. An open system is one that exchanges any conserved quantity with its surroundings * 5.B.3 The change in potential in a circuit is the change in potential energy per unit charge * 5.B.9 Kirchhoff’s loop rule describes conservation of energy in electrical circuits * 5.C.3 Kirchhoff’s junction rules describes the conservation of electric charge in electrical circuits. Since charge is conserved, current must be conserved at each junction in the circuit | Chapters 16, 18, 19 Test |