Teacher: CORE HON INTRO PHYS SCI Year: 2012-13

Course: HON INTRO PHYS SCI Month: All Months

September

Linear Motion

Essential Questions	Content	Skills	Assessments	Lessons	Learning Benchmarks	Standards
Consider a drag car racing down a linear track, how can one best describe its motion?	Graphical interpretation from position-, velocity-, and acceleration-vs-time graphs. One dimensional vectors of displacement, velocity, and acceleration. Problem solving with a constant linear acceleration.	Refined math skills with slope and graphing coordinate points. Correct interpretation of the basic ideas from graphs. Algebraic manipulation of linear equations. Recognizing symbolic representation of physical quantities.	Homework Problems 9/1/2012 Quiz 9/30/2012 Quiz 9/1/2012 Homework Problems - Linear acceleration 9/1/2012 Quiz - Constant Linear Acceleration 9/1/2012 Homework Problems - Freefall 9/1/2012 Quiz - Freefall 9/1/2012 Graphic Analysis of Motion Lab 9/1/2012 Acceleration Due to Gravity Lab 9/1/2012	Class discussion - Graphical analysis of position vs. time graphs. Class discussion of velocity vs. time graphs. Class discussion of acceleration vs. time graphs. Class discussion - multiple line segments on a position vs. time graph. Creating a v vs. t and a vs t graph. Class discussion - multiple line segments on acceleration vs. time graph. Creating a v vs. t	Define the following terms: position, displacement, average velocity, constant velocity, initial velocity, final velocity, change in velocity, acceleration, time and change in time. Know representative symbols to all identified terms. Describe the motion of an object with in a straight line as either: no	

			Recognizing appropriate units to all described quantities. Ability to construct appropriate graphs and draw appropriate line segments that correlate with the specific linear motion. Learns how to apply the DATASTUDIO program of graphing motion of all kinds	Test - One Dimensional Motion 9/1/2012	and x vs. t graph. Problem solving explained with the equations of a constant linear acceleration. Demonstration of freefall and differing effects.	motion, constant velocity, increasing velocity, decreasing velocity, forwards, backwards (or right-left or up-down), positive acceleration, negative acceleration, or zero acceleration. Draw appropriate line segments that describe the motion on a position vs. time graph, a velocity vs. time graph, and acceleration vs. time graph. Analyze the linear motion of an object from a position vs time graph, a velocity vs time graph and acceleration vs. time graph.	

					Solve problems using the equations of a constant acceleration when objects have linear motion in the horizontal direction and in freefall. Solve problems when two objects are described to be moving as the same time somehow.	

October

Two Dimensional Motion

Essential Questions	Content	Skills	Assessments	Lessons	Learning Benchmarks	Standards
The military often strike moving targets from stationary platforms or strike stationary targets from moving platforms. This	Relative motion in one and two dimensions. Projectile motion Centripetal Acceleration	Drawing to scale vectors, showing the "head to tail" method of adding vectors, drawing the resultant vector, and recording its magnitude and direction.	Homework Problems - Vectors and their sum 10/1/2012 What's your Vector Victor Lab 10/1/2012 Quiz - Addition of Vectors in one		Recognizes the difference between vector and scalor quantities. Recognize a one dimensional vector and a two dimensional vector.	

	involves motion in two dimensions. How is this done?		Recognizing different frames of reference, one a stationary frame and the other a moving frame. Adding relative motion velocity vectors in one and two dimensions. Before adding two dimensional relative motion velocity vectors, student should be able to draw appropriate graphic pictures of the vector sum. Algebraic manipulation of linear equations to solve for one or more unknowns. Recognition of the application of similar triangles when dealing with motion in two	and two dimensions 10/1/2012 Homework - Relative Motion in One and Two Dimensions 10/1/2012 Quiz - Relative Motion in One and Two dimensions 10/1/2012 Homework - Projectile motion 10/1/2012 Ball in Bucket Lab - Application of Projectiles 10/1/2012 Quiz - Projectile Motion 10/1/2012 Test - Two Dimensional Motion 10/1/2012		Recognize horizontal and vertical angles. Determine/calculate the components of a one- and two-dimensional vector. Calculate the magnitude and direction of vectors. Add vectors by the graphic and component methods. Recognize two different frames of reference; one stationary the other moving. Solve problems when two objects are described to be moving at the same time when they accelerate in one dimension.	

			dimensions. Application of the concepts of vectors when determining directions of velocities and accelerations. Solving problems regarding Projectile motion: Application of equations of a constant acceleration in the vertical direction and equations of a constant velocity in the horizontal direction. Graphing motion in two dimension, applying the sum of vectors. Continues to apply the DATASTUDIO graphing program for motion analysis. Recognizes appropriate			Solve problems using the equations of a constant acceleration when an object moves as a projectile. Recognize when to use the RANGE equation. Solve basic problems as objects move in a circular path.	

		accelerations as objects move in a linear path, projectile path, and circular path.				

November

Newton's Laws of Motion

Essential Questions	Content	Skills	Assessments	Lessons	Learning Benchmarks	Standards
Think about the seven wonders of the ancient world; Statue of Zeus, Temple of Artemis, Great Pyramids, Hanging Gardens, Mausoleum at Halicarnassus, Colossus of Rhodes, and Lighthouse of Alexandria. How did they ever build these "wonders" so long ago?	Newton's Laws of Motion Free Body Diagrams for single and multi-mass systems. Application of Newton's second law and vector addition to solve for acceleration of systems Static and kinetic Friction Uniform circular motion	Able to state the meaning of each of Newton's Laws of motion Draws appropriate free body diagrams for each and every mass. Write appropriate equations applying Newton's second law for each direction separately. Derives an appropriate	Homework - Application of all three laws of newtion 11/1/2012 Homework - Application of Newton's Second law without friction 11/1/2012 Homework - Application of Newton's Second law with friction 11/1/2012 Quiz - Newtons Laws 11/1/2012 Quiz - Application of Newton's Laws (single and multi		States the meaning of each of Newton’s three laws Knows all the basic forces in free – body diagrams Recognize how to create free – body diagrams for all situations of an object at rest or moving in along a straight line – on a level surface or along an incline. Writes all	

	Centripetal vs. Centrifugal	equation of Newton's second law for multi-mass systems. Distinguishes when kinetic friction acts vs. static friction acts on masses. Distinguishes when kinetic friction acts vs. static friction acts on masses. Recognizes when the concepts of uniform circular motion apply to problems and can distinguish the direction of the velocity, acceleration, and net force throughout the object's motion. Continues to apply the DATASTUDIO graphing program	mass systems) with and without friction 11/1/2012 Newton's Second Law Lab - Direction and Inverse Relationships 11/1/2012 Forces Lab Practical 11/1/2012 Centripetal Motion Lab 11/1/2012 Quiz - Uniform Circular Motion (vertical and horizontal circles) 11/1/2012 Test - Forces of all kinds 11/1/2012		appropriate equations from each free – body diagram. Solves problems based on all created equations from free – body diagrams and system equations Understands the differences between static and kinetic friction and knows when to apply each in problem solving Solves problems determining whether or not a system will move based on frictional forces. Recognize the direction of an object’s velocity and acceleration when moving	

		for force analysis.			with uniform circular motion. Solves problems for an object that moves with uniform circular motion, whether the circular motion is horizontal or vertical.	

December

Conservation of Energy

Essential Questions	Content	Skills	Assessments	Lessons	Learning Benchmarks	Standards
Ever ride the Superman at Six Flags New England? From its slow start to fast finish how is energy converted from one form to another?	Work, a scalor quantity, in relationship to Force and Displacement (vector quantities) The meaning of +/- signs with energy quantities. Work Energy Theorem and how it relates to	Recognition of the product of two vectors yields a scalor quantity Utilizes the expression of work to determine whether work is done or if the work is a positive or negative quantity. Applies free body diagrams along	Homework - Work, Kinetic Energy and Power relationships 12/1/2012 Homework - Conservation of Energy 12/1/2012 Work - Kinetic Energy Theorem Lab 12/1/2012 Conservation of Energy Lab 12/1/2012		Knows the definition of Work which is a scalor quantity from the product of two vectors. Recognizes that all expressions of Work relate to some kind of change that must take place, whether it is a displacement or change in energy.	

		kinetic energy Conservation of Energy - Mechanical Energuy Heat energy and its effects Conservative and Non-conservative forces Power and its application to energy	with displacement vector to determine kinds of work done Recognizes different methods of solving for the total work done to a mass or system of masses. Relates Kinetic energy to the total work done Recognizes the difference between energies and changes in energy Understands that kinetic energy can never be a negative quantity, but potential energy can and why. Relates changes in forms of energy to the conservation of energy. Distinguishes when kinetic, potential	Quiz - Work Energy Theorem 12/1/2012 Quiz - Conservation of Energy / Power 12/1/2012 Test - Energy and Its Conservation 12/1/2012		Recognizes which forces do NO work, do a POSITIVE amount of work, do a NEGATIVE amount of work, and can express these ideas with complete sentences. Solves for all quantities of Work and expresses answers with +/- signs always. Recognizes the equations for the forms of energy of Kinetic Energy, Potential Energy, and Heat. Understands the exchange between kinetic energy and potential energy when friction is and is not	

			and heat energy is present at any point in the path of a mass. Relates the relationship of power to that of energy changes. Recognizes all the units involved with energy relationships. Continues to apply the DATASTUDIO graphing program for energy analysis. However, here students learn to manipulate functions for analysis.			present. Applies the concept of the Conservation of Energy in problem solving whether or not friction exists Knows the two relationships for Power and applies them in problem – solving. Recognizes the various acceptable units for energy and power.	

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Momentum and Impulse

Essential Questions	Content	Skills	Assessments	Lessons	Learning Benchmarks	Standards
During car crashes, who really is at fault?	Newton's Laws of motion once again.	Able to apply Newton's first law of motion to	Homework - Impulse and Momentum		Understands the relationships of all three laws of	

	What is your best advice to improve the game of someone playing golf, baseball, tennis, running, karate, etc.?	Momentum and the change in momentum Impulse and the change in momentum Collisions and the conservation of momentum Kinetic energy revisited Types of collisions	momentum. Recognizes Newton's second law with impulse and the change in momentum Recognizes the application of Newton's third law during collisions Recognizes the difference and similarity between impulse and the change in momentum Applies the conservation of momentum to all types of collisions or simulations of collisions Applies the concept of impulse to all collisions Recognizes the different types of	1/7/2013 Homework - Collisions and momentum conservation 1/16/2013 Quiz - momentum and Impulse 1/20/2013 Quiz - Collisions and the conservation of momentum 1/23/2013 Impulse Lab 1/1/2013 Collisions Lab 1/1/2013 Test - Momentum and its conservation 1/1/2013		Newton with momentum and collisions Recognizes the difference between momentum and the change in momentum. Understands the meaning of impulse and its equation and recognizes what an impulse causes Understands the idea of the conservation of momentum regarding collisions in one dimension. As a result of any kind of collision solve for the following for either object: the momentum, the impulse, the	

			collisions and the methods of distinguishing one collision from another. Continues to apply the DATASTUDIO graphing program for momentum/collision analysis. However, here students learn to manipulate functions for analysis.			mass, the initial or final velocity. Recognizes that there are only two types of collisions. As a result of any kind of collision solve for the following for either object: the initial or final kinetic energy. Determines the type of collision based on kinetic energy calculations. Apply the concepts of the conservation of energy and the conservation of momentum when problems solving.	
Fe	Universal Gravitation						

bruary

Essential Questions	Content	Skills	Assessments	Lessons	Learning Benchmarks	Standards
Skylab is a satellite that partly made its fame by falling back to earth. What does it take to get a satellite into orbit, what happens when they get there, and what implications are there if they fall back to earth?	Universal gravitational force Gravitational acceleration and fields Gravitational potential energy, ... a new look. Escape velocity Velocity for liftoff and impact velocities Kepler's Laws of orbits	Knows the Universal Gravitational Constant value and its units. Recognizes that two masses and the distance between their centers are needed for a gravitational force. Practices calculating numbers in scientific notation. Recognizes the difference between fields and forces. Recognizes that fields and acceleration are the same. Can subtract negative numbers and as negative numbers approach zero the value	Big G: Forces, Fields and Energy 2/1/2013 Homework - Kepler's Laws of Orbits 2/1/2013 Orbit's Lab: The Solar System 2/1/2013 Quiz - Universal Gravitation 2/1/2013 Quiz - Kepler's Laws 2/1/2013 Test - Universal Gravitation 2/1/2013		Understands the expression of the universal gravitational force and its equivalent expression of an object's weight. Uses the Universal Gravitational force expression to derives the expression of a gravitational field/acceleration at any distance away from a large mass. Uses the Universal Gravitational force expression to derives the expression of a gravitational potential energy at any distance away from a large mass. Understands that why and how	

			increases. Applies the conservation of energy when changes in position become vast/large/enormous. Knows how to mathematically manipulate and derive for the escape velocity function and the period of orbit function. Can map out Kepler's first and second laws as well as describe their essence. Can convert meters to light years and years to seconds Can apply Kepler's Third law to calculate periods of orbit, orbital distances, and orbital speeds.			this quantity is always negative and that its maximum value is zero at infinity. Uses the Universal Gravitational force expression to derives the expression of orbital speed, period, and radius. Graphically interprets orbital data to analyze radius with period to find mass. Understands how orbital radius and speed changes with energy. Solves problems regarding masses changing positions and solving for resulting speeds and masses changes speeds and solving for	

		Apply graphing to Kepler's third law to determine the mass creating gravitational fields.			resulting positions.	

March

Electrostatics

Essential Questions	Content	Skills	Assessments	Lessons	Learning Benchmarks	Standards
What is up with getting a shock? Have you ever seen lightning strike? What conditions are necessary for such an event, what is happening as the strike takes place, and what can result from lightning strikes?	Arrangement of charges Conservation of charge and the quantization of charge Insulators and conductors Charge by induction, conduction, and polarization Coulomb's law for forces and fields Electric field	Recognizes that charge is a fundamental property of matter and its unit. Recognizes the structure of an atom, the concept of valence electrons, differences between metals and non metals, and electron affinity and electronegativity. Recognizes the charge of protons and electrons and how objects become charged	Electrostatics Lab 3/1/2013 Electrostatics Quiz 3/1/2013 Homework - Electrostatics - Forces and Fields 4/30/2013 Homework - Electrostatic voltages and energies 4/1/2013 Electric Fields and Potentials Lab 3/1/2013 Test - Electrostatics 3/1/2013		Explains electrostatic charge distributions on conductors and insulators under various static conditions. Solves for net forces and fields related to various arrangements of point charges and oppositely charged parallel plates Solves for net potentials and energies related	

		diagrams Voltages and potential energy. Equipotential surfaces Net Fields and Voltages from arrangements of point charges and oppositely charged parallel plates and their effects on point charges	through induction, conduction, and polarization. Recognizes the difference between insulators and conductors, the "sea of electrons" for conductors, and grounding. Understands that two charges and the distance between them are needed to create and calculate electrostatic forces through Coulomb's Law. Understands that the sign of the charge does not dictate the direction of the electrostatic force or field in using Coulomb's Law, but the arrangement of the specific point charges and			to various arrangements of point charges and oppositely charged parallel plates. Explain the effects of forces and energies as charges move from one position to another. Draws appropriate electric field diagrams around point charges of various arrangements as well as between oppositely charged parallel plates and draw appropriate equipotential surfaces and indicating resulting areas of high and low potentials.	

		knowledge of their sign in the picture does dictate direction. Understands how to draw electric field diagrams and the equipotential surfaces that result. Distinguishes the difference between forces and fields and voltages and energies. Can solve for fields, forces, energies, voltages, accelerations, speeds, times and distances using electrostatic relationships as well as knowing all the varied units for each quantity. Can solve for the varies electrostatic				

			quantities for any arrangement of point charges and for oppositely charged parallel plates. Understands that the sign of the charge does matter in determining voltages and energies.				

April

Electricity - Circuits

Essential Questions	Content	Skills	Assessments	Lessons	Learning Benchmarks	Standards
Could you build your own flashlight and make it work? Open up and look at the circuitry inside any calculator. What does all that mean?	Basics of batteries and circuit meters both analog and digital Circuit diagrams Voltages, current, Resistance Ohm's Law Resistors -	Able to draw circuits using appropriate diagrams Able to construct a series, parallel and complex circuit of resistors/capacitors. Calculate total resistance values, current values and voltage values of series, parallel, and	Ohm's Law Lab 4/1/2013 Resistors - Series Lab 4/1/2013 Resistors - Parallel Lab 4/1/2013 Resistors - Complex Circuit 4/1/2013 Lab Practical - Resistors - Determine Circuits		Understands the concepts of current, resistance, change in voltage, and capacitance at the molecular level. Relates the concepts of current, resistance, voltage, and capacitance through Ohm's law and Capacitance.	

	Series/Parallel Capacitors - series/parallel - dielectrics RC Circuits Power or brightness of light bulbs in circuits and energy consumption	complex circuit of resistors. Determine brightness of lightbulbs if act like resistors. Graphically analyze circuit relationships Calculate total capacitance values, charge values and voltage values of series, parallel, and complex circuit of capacitors. Construct and analyze resistor/capacitor circuits. Analyzing basic RC circuits	Diagrams based on brightness of bulbs 4/1/2013 Lab - RC Circuit 4/1/2013 Quiz - Basic circuitry (Ohm, Series, Parallel) 4/1/2013 Quiz - Complex Circuit 4/1/2013 Quiz - RC Circuit 4/1/2013 Test - Circuits 4/1/2013		Analyzes graphically the relationships between voltage and current and voltage/charge/current and time. Understands how to draw various schematic diagrams including resistors, batteries, ammeters, voltmeters, switches, and capacitors. Understands the results from various changes to existing diagrams. Problem solves for values of voltage, resistance, current, and capacitance based on existing circuit and possible changes to the circuit. Recognizes all the possible units to all electrical quantities.	

May	Magnetism					
Essential Questions	Content	Skills	Assessments	Lessons	Learning Benchmarks	Standards
What is going on when I plug a charger in to a wall socket and how does my electrical device work?	Magnetism: Magnets to Unpaired electron spins Diamagnetism, paramagnetism, ferromagnetism Electromagnetism: Free Moving Charges to Current Bearing Wires Electromagnetism - Magnetic fields from long straight wire to loops of wires (solenoid) - Ampere's Law Electromagnetic Induction: Faraday's Law and Lenz's Law Magnetic Flux Inductors Right Hand Rules and periodic Left hand rule	Drawing magnetic field lines inside and outside specific kinds of magnets Recognizing direction of B fields: out of N, into S Recognizing the presence of B fields with regard to unpaired electron spins from quantum numbers. Recognizing that everything is magnetic but does not always show magnetic properties; and those that do are either permanent	Lab - Magnetic Fields and the earth 5/1/2013 Homework - Electromagnetism 5/1/2013 Lab - Electromagnetism - Solenoids 5/1/2013 Homework - Electromagnetic Induction and circuits 5/1/2013 Homework - Circuits with inductors 5/1/2013 Quiz - Electromagnetism 5/1/2013 Quiz - Electromagnetic Induction 5/1/2013 Quiz - RL circuits 5/1/2013 Test - Magnetism		Understands the meaning of diamagnetism, paramagnetism, and ferromagnetism on an atomic level. Draw magnetic field diagrams for various conditions as well and applies the RHR in determining various vector directions of current, force, velocity and B fields. Problem solves for magnetic force, velocity, current, length of wire, charge, magnetic field,	

		Maxwell's Equations and the concept of Light	or temporary. Recognizing that temporary magnetic properties can be enhanced or diminished or made permanent Utilizes the RHR in determining directions of Force, B field, velocity, and current given all appropriate initial conditions. Applies centripetal motion to magnetic forces on free moving charges Applies linear acceleration concepts to magnetic forces on wires	to Maxwell's equations 5/1/2013		electric field, voltage, capacitance, and inductance. Understands the meaning of each of the four equations of Maxwell. Describes the make up of all forms of light.	

		Draws appropriate diagrams showing currents flowing through loops of wire and the resulting Magnetic fields. Recognizes that solenoids are no different from bar magnets, however they are more easily manipulated to make stronger and better magnetism Analyzes the effects of magnetic fields from wires on objects such as moving charges and other current bearing wires. Problem solves for induced currents and induced EMF's.				

		Determines direction of induced currents and resulting forces from various changes in magnetic flux. Analyze circuit responses to RL circuits Explains Maxwell's equations Understands the make up of light				

June

EM Wave Propogation

Essential Questions	Content	Skills	Assessments	Lessons	Learning Benchmarks	Standards
The Hubble Space Telescope captures great images in all ranges of light, how is that accomplished?	Characteristics of EM waves (speed, wavelength, frequency, energy level)	Recall facts about EM waves Recognizes what type of EM waves have high/low frequencies, long/short	Quiz EM Wave 6/30/2013 Lab Colors of light - Blending of colors 6/30/2013 Lab - Reflection of light 6/30/2013		Recognizes more than seven EM waves in in order of increasing frequency, wavelength, and energy level.	

	Visible Light Colors of visible light and effects Reflection of light (Law of Reflection) Refraction of light, index of refraction, opitcal density of media Snell's Law of Refraction between two media boundries. The critical angle and TIR (total internal reflection); fiber optics	wavelengths, and high/low energies. Manipulate formulas involving speed, wavelength, and frequency of EM waves Recognizes the acronym to remember the colors of light. Recognizes the primary colors of light. Predict colors of light from blending certain colors of light. Resolve the images of reflected light. Resolve images of refracted light. Calculates angles of refraction as light rays enter	Lab - Refraction of Light 6/30/2013 Quiz - Reflection and Refraction 6/30/2013 Test - Light 6/30/2013		Describe at least seven EM waves and how they are used in technology. Understands the nature of the colors of visible light and blending of visible colors. Be able to solve mathematically for speed, frequency, and wavelength for a light wave Understand what happens when light travels into, around, or through a new medium (refraction and reflection). Problem solves for appropriate angles, incident, reflected, and refracted, as light strikes surfaces	

			new optical media. Calculates critical angles and recognizes when TIR will occur.			and boundaries of media. Problem solves for indices of refraction, speed of light, and determines types of media as light crosses boundaries of media. Predicts correct paths of light through various media.	