AP Physics 1 (Master)

Teacher
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ESSENTIAL QUESTIONS & CONTENT	SKILLS	LEARNING TARGETS	Standards	ASSESSMENT	RESOURCES & TECHNOLOGY
CEQ **How do we use mathematical and graphical models to describe motion?** **What is the connection between force and motion?** **How are mathematical and physical models used to explain energy transfers and transformations.** ***UEQ*** ● *What does it mean to say motion is relative?* ● *How do we use mathematical models to describe the way things with constant velocity move?* ● *How do we use mathematical*	**Kinematics** 1) Calculate average velocity, displacement, and time for a moving object. 2) Calculate Acceleration, Displacement, Final Velocity, Initial Velocity, or time for an object moving with changing velocity. 3) Given a position time graph draw the corresponding velocity and acceleration time graphs. 4) Calculate displacement and acceleration from a segment of a velocity time graph. 5) Calculate the velocity and position	**Kinematics** 1)I can express the motion of an object using narrative, mathematical, and graphical representations. 2)I can design an experimental investigation of the motion of an object. 3)I can analyze experimental data describing the motion of an object and is able to express the results of the analysis using narrative, mathematical, and graphical representations.	**9P.1.3.4.1**	**Kinematics** 1 Constant Velocity of a Train (tape timer) 2-4 & 7 Velocity of a cart on a ramp 5 Human Reaction Time Lab 5 Freefall Lab (Motion Detector) 3,6, & 7 Graphing Packet **Outdoor Lesson=** 3 Mystery Walker Challenge	***Kinematics*** *Giancoli Physics 6th Ed.* Tape Timers Pasco Motion Sensors Data Studio Software Bucket Lids and Sinkers Graph Paper Stop Watches Meter Sticks and Stop Watches Long Metric Tape Measure CPO marble launchers, photogates Pasco Projectile Launcher Ramps Marbles Graph paper Meter sticks Stopwatches Protractors Air Pressure Rocket **"tech integration:** Pasco motion detector with *Capstone* software" **Key Vocabulary**

models to describe the way things with constant acceleration move? • *How do we change the axis of a graph from position vs. time to velocity vs. time to acceleration vs. time?* • *How does gravity affect the motion of an object?* **One Dimensional Kinematics** Constant Velocity Changing Velocity Position vs Time Graphs Velocity vs Time Graphs Acceleration vs Time Graphs Instantaneous Velocity Average Velocity Average Speed Free Fall Problem Solving ***UEQ*** • *How are vectors used to add motion in 2 directions?* • *How is 2 dimensional motion resolved*	of an object in freefall if given the time falling or being shot upward as well as the initial velocity. 6) Predict the instantaneous velocity of an accelerating object using the slope of the tangent on a d vs t graph. 7) Find the displacement of an accelerating object by calculating the area under the curve for a v vs t graph. 8) Solve problems involving accelerations and velocities in opposite directions. 9) Use trigonometry to resolve vectors into x- and y- components 10) Resolve the displacement, velocity, and acceleration of a projectile into their horizontal and vertical components			12) Blow Dart Challenge 13) Horizontal projectile Lab 13) Monkey and Hunter Challenge 9-13) Softball Toss Lab **Outdoor Lesson=**9-13) Air Rockets Lab 9-13) Ice Cream Pale Shot Group Challenge 1-13) Problems Check Quiz 1-13) Multiple Choice Test	Distance Displacement Speed Velocity Acceleration Freefall Scalar Vector Rate Terminal Velocity Slope of the Tangent Area under the curve Resultant Resolve Components Trajectory Projectile Range Equilibrium

into perpendicular vectors? • *How does projectile motion represent an application of both constant velocity and constant acceleration?* **Two Dimensional Motion** Resolving Vectors Adding Vectors Solving 2 dimensional motion problems Solving horizontal projectile problems Solving projectiles launched at angles Solving off plane target problems	11) Describe the motion of a projectile using the equations for constant velocity and constant acceleration 12) Apply kinematic equations to calculate the motion of objects in two-dimensions 13) Solve projectile problems for hang time, max height, horizontal range, and the magnitude, and direction of the velocity vector at impact.		**9P.2.1.1.1** **9P.2.2.2.1**		

December

ESSENTIAL QUESTIONS & CONTENT	SKILLS	LEARNING TARGETS	Standards	ASSESSMENT	RESOURCES & TECHNOLOGY
UEQ • *How are Free Body Diagrams used to express the interaction of forces?* • *How do Newton's laws of motion allow us to make*	**Statics and Dynamics** 1) Draw free body diagrams for a mass acted on by several forces 2) Solve for net force acting on an object 3) Resolve force vectors to find net force in each dimension 4) Use Newtons 2nd law to solve for the	**Statics and Dynamics** 1) I can draw free body diagrams for a mass acted on by several forces 2) I can solve for net force acting on an object 3) I can resolve force vectors to find net force in each dimension 4) I can use Newtons 2nd law to solve for the	**9P.2.2.1.1** **9P.2.2.1.2** **9P.2.2.1.3**	**Statics and Dynamics** 1,2, 4-6) Newtons 2nd Law Lab 1,2,4-6) Attwoods challenge 1,2,4-6)	**Statics and Dynamics** Giancoli 6th Ed. Pulleys Ramps String Newtons Scales

predictions about the acceleration of masses acted on by forces? • *How are vectors used to resolve 2-D forces into perpendicular components?* • *How is the force of weight resolved for objects on inclined planes?* • *How do frictional forces affect the motion of an object?* **Static and Dynamic vector mechanics** Newtons Laws Free Body Diagrams Net Force 2D Forces Inclined Planes Weight Mass Normal Force Frictions Tension **UEQ** • *What is the magnitude and direction of velocity and acceleration when moving at a*	acceleration of a mass acted on by a net force. 5) Use accelerations of objects to solve for individual forces acting on the object such as friction, weight, normal force or tension. 6) Calculate the coefficient of friction between surfaces for static and kinetic friction. 7) Resolve the force of weight on inclined planes. **Circular Motion & Gravitation** 1) Calculate centripetal accleration of an object revolving with a constant speed. 2) Calculate centripetal force of an object revolving with a constant speed. 3) Calculate centripetal force as the horizontal component of tension for an object being whirled by a rope. 4) Calculate centripetal force as friction for an object traveling	acceleration of a mass acted on by a net force. 5) I can use accelerations of objects to solve for individual forces acting on the object such as friction, weight, normal force or tension. 6) I can calculate the coefficient of friction between surfaces for static and kinetic friction. 7) I can resolve the force of weight on inclined planes into parallel and normal force. **Circular Motion & Gravitation** 1) I can calculate centripetal accleration and force of an object revolving with a constant speed. 2) I can calculate centripetal force as the horizontal component of tension for an object being whirled by a rope (like tetherball). 4) I can calculate centripetal force as friction for an object traveling around an unbanked corner	**9P.2.2.1.3**	Tibometer challenge 1-7) Double Incline Problem 1-7) Coin and book cover challenge 1-7) Problem Check Quiz 1-7) Test **Circular Motion & Gravitation** 3) Circular Motion Lab 1-8) Chapter 5 Prob Check quiz 3) Turning Pt Challenge 4) Coin on LP Challenge 1-8) Chapter 5 Test	Tension Protractors Dynamics Track Pasco Cars Pasco Motion Sensors CPO Energy Cars CPO Energy Tracks Photogates **Key Terms** Force Mass Weight Net Force FBD Inertia F=ma Newtons 3rd Law Tension Normal Force Friction Coefficient of Friction Equilibrant Inclined Plane Force Parallel Force Perpendicular Attwoods Machine Tibometer Statics Dynamics **Circular Motion & Gravitation** Rubber Stoppers Plastic Tubes String Mass Set

constant speed in a circular path? • *How do mass, radius, and velocity relate to the force on an object moving in a circular path?* • *How may Newton's laws be utilized to analyze real and perceived phenomena for a body in circular motion?* • *What variables affect the force of Gravity on an object?* • *How does the universal law of gravity provide a theoretical basis for Kepler's Laws of Planetary motion?* **Circular Motion & Gravitation** Centripetal Accelerations Intertia vs Centrip. Forces Revlotions vs Rotations Coponents of weight as F_c Components of T as F_c Universal Gravitation Satelite Motion	around an unbanked corner 5) Calculate centripetal force as a component of weight for an object going around a banked corner 6) Use the law of universal gravtiation to calculate the force of attraction between 2 masses. 7) Calculate centripetal force as gravitational force to describe satelite motion. 8) Use Keplers laws to calculate the periods and radii of planetary motion as well as describe changes in velocity during a planets orbit.	5) I can calculate centripetal force as a component of weight for an object going around a banked corner 6) I can use the law of universal gravtiation to calculate the force of attraction between 2 masses. 7) I can calculate centripetal force as gravitational force to describe satelite motion. 8) I can use Keplers laws to calculate the periods and radii of planetary motion as well as describe changes in velocity during a planets orbit.			Flying Pig Demo Record player Graph Paper CPO Pendulum kit Stop Watches **Key Terms** Linear Velocity Angular Velocity Radius Period Centripetal Acceleration (radial) Centripetal Force Gravitational Force G Field Force Satelite Geosynchronous Keplers 1st Law Keplers 2nd Law Keplers 3rd Law

Planetary Motion and Keplers Laws					

February

ESSENTIAL QUESTIONS & CONTENT	SKILLS	LEARNING TARGETS	Standards	ASSESSMENT	RESOURCES & TECHNOLOGY
UEQ • *What characteristics define simple harmonic motion?* • *How does conservation of energy apply to simple harmonic motion?* • *What factors change/remain constant for all waves in a given medium or a single wave moving from medium to medium?* • *What causes standing waves and how do they differ from traveling waves?* • *What causes resonance?* **Simple Harmonic Motion** Frequency period amplitude (max displacement) max velocity Restoring force	**Simple Harmonic Motion** Students should understand simple harmonic motion, so they can: 1)Sketch or identify a graph of displacement as a function of time, and determine from such a graph the amplitude, period and frequency of the motion. 2) Find an expression for velocity as a function of time. 3) State the relations between acceleration, velocity, and displacement, and identify points in the motion where these quantities are zero or achieve their greatest	**Simple Harmonic Motion** 1)I can sketch or identify a graph of displacement as a function of time, and determine from such a graph the amplitude, period and frequency of the motion. 2) I can find an expression for velocity as a function of time. 3) I can state the relations between acceleration, velocity, and displacement, and identify points in the motion where these quantities are zero or achieve their greatest positive and negative values. 4) I can state and apply the relationship between	**9P.2.3.1.1**	**Simple Harmonic Motion** 12-13 Pendulum lab 8 mass on spring lab 1-13 chapter problem check quiz 1-13 unit test **Momentum** 1,3, 4 Elastic Momentum Lab 1,3,4 Inelastic Momentum Lab 5 Nickel Collisions 1-6 Chapter 7 Problem Quiz **Energy** 1-3) Rubberband Car Lab 4,6, 7) Marble Roll Lab II	**Simple Harmonic Motion** *Giancoli 6th Ed* *Pendulum kits from CPO* *Masses* *Springs* *Data Studio Capstone software* **Key Vocabulary** Frequency period amplitude (max displacement) max velocity Restoring force springs pendulums resonance Oscillator phase angular velocity **Momentum** CPO Energy Track CPO Photogates Pasco Cars Meter Sticks

springs pendulums **UEQ** • *How is impulse momentum theorem related to Newton's 2nd law?* • *How do we use conservation of momentum to interpret interactions between objects?* • *How do we distinguish between elastic and inelastic collisions?* • *What is meant by center of mass and why is it important in analyzing the motion of an object or system?* **Momentum** Impact vs Impulse Momentum Impulse=change in momentum Elastic and Inelastic Collisions Collisions in 2 dimensions	positive and negative values. 4) State and apply the relationship between frequency and period. 5) Calculate the kinetic and potential energies of an oscillating system as functions of time. 6) Calculate the maximum displacement or velocity of a particle that moves in simple harmonic motion with specified initial position and velocity. 7) Develop a qualitative understanding of resonance so they can identify situations in which a system will resonate in response to a sinusoidal external force <u>Mass on a spring</u>	frequency and period. 5) I can calculate the kinetic and potential energies of an oscillating system as functions of time. 6) I can calculate the maximum displacement or velocity of a particle that moves in simple harmonic motion with specified initial position and velocity. 7) I can develop a qualitative understanding of resonance so they can identify situations in which a system will resonate in response to a sinusoidal external force 8) I can derive the expression for the period of oscillation of a mass on a spring. 9) I can apply the expression for the	**9P.2.2.1.2** **9P.2.2.2.3**	2) Vertical Loop Challenge 4-7) Bungee Jumper Lab 1-9) Chapter 6 Problem Check Quiz 1-9) Test	Stop Watches Balistic Pendulum **Key Vocabulary** Impulse Momentum Elastic Collision Inelastic Collision Perfectly Elastic Collision Center of Mass **Energy** CPO Energy Track Marble tracking and loop Pasco Cars Stop Watches Balistic Pendulum Spring Sets Rubberbands Mass Sets Marbles

Perfectly Elastic Collisions Balistic Pendulums Center of Mass calculations **UEQ** • *What is energy?* • *How do we use conservation of mechanical energy to interpret interactions between objects?* • *What are some forms of potential energy and how is potential energy gained?* • *How does power fit into the energy accounting system?* **Energy** Calculating Work Calculating gravitational potential energy Spring Potential Energy Calculating Kinetic Energy Work Energy Theorem	Students should be able to apply their knowledge of simple harmonic motion to the case of a mass on a spring, so they can: 8) Derive the expression for the period of oscillation of a mass on a spring. 9)Apply the expression for the period of oscillation of a mass on a spring. 10) Analyze problems in which a mass hangs from a spring and oscillates vertically. 11) Analyze problems in which a mass attach ed to a spring oscillates horizontally. 12) Determine the period of oscillation for systems involving series or parallel	period of oscillation of a mass on a spring. 10) I can analyze problems in which a mass hangs from a spring and oscillates vertically. 11) I can analyze problems in which a mass attach ed to a spring oscillates horizontally. 12) I can determine the period of oscillation for systems involving series or parallel combinations of identical springs, or springs of differing lengths. 13) I can derive and apply the expression for the period of a simple pendulum. **Momentum** 1) I can use the impulse momentum theorem to calcuate the change in velocity of an object acted on by a force for a given amount of time.	**9P.2.2.2.1** **9P.2.2.2.3**		**Key Vocabulary** Work Conservative Forces Work-Energy-Theorem Potential Energy Kinetic Energy Mechanical Energy Conservation of Energy Power

Conservative and Nonconservative Forces Energy Conservation Power Calculations	combinations of identical springs, or springs of differing lengths. <u>Pendulum and other oscillations</u> Students should be able to apply their knowledge of simple harmonic motion to the case of a pendulum, so they can: 13) Derive and apply the expression for the period of a simple pendulum. **Momentum** 1) Use the impulse momentum theorem to calcuate the change in velocity of an object acted on by a force for a given amount of time. 2) Calculate impulse as the area under the curve of a graph of force vs. time. 3) Use conservation of momentum to solve velocities of masses before or after elastic and inelastic collisions. 4) Use conservation of energy and conservation of momentum to make calculations of velocities of multiple objects in	2) I can calculate impulse as the area under the curve of a graph of force vs. time. 3) I can use conservation of momentum to solve velocities of masses before or after elastic and inelastic collisions. 4) I can use conservation of energy and conservation of momentum to make calculations of velocities of multiple objects in perfectly elastic collisions. 5) I can use conservation of momentum to solve for velocities of objects before or after collisions in 2 dimensions. 6) I can calculate the center of mass of a system of particles. **Energy** 1) I can calculate work done by a force as well as net work done by all forces acting on a system. 2) I can calculate work done by a variable force as area under the curve of force vs. distance. 3) I can show that work done on an object is equal to changes in its potential and or kinetic energy 4) I can calculate gravitation potential energy 5) I can calculate spring potential energy 6) I can calculate kinetic energy 7) I can use consevation of			

	perfectly elastic collisions. 5) Use conservation of momentum to solve for velocities of objects before or after collisions in 2 dimensions. 6) Calculate the center of mass of a system of particles. **Energy** 1) Calculate work done by a force as well as net work done by all forces acting on a system. 2) Calculate work done by a variable force as area under the curve of force vs. distance. 3) Use the work energy theorem to calculate changes in potential and kinetic energy 4) Calculate gravitation potential energy 5) Calculate spring potential energy 6) Calculate kinetic energy 7) Use consevation of mechanical energy to solve physics problems involving work done by consevative forces. 8) Explain how energy is conserved as it is transformed. 9) Calculate power.	mechanical energy to solve physics problems involving work done by consevative forces. 8) I can explain how energy is conserved as it is transformed. 9) I can calculate power.			

March

ESSENTIAL QUESTIONS & CONTENT	SKILLS	LEARNING TARGETS	Standards	ASSESSMENT	RESOURCES & TECHNOLOGY
UEQ • *What factors affect the rotational inertia of a rigid object?* • *How do we distinguish between linear and angular velocity, acceleration, and momentum?* • *What is the difference between torque and work?* **Rotational Motion** Diplacement in Radians Angular Velocity Angular Acceleration Rolling without slipping Torque Torque and Rotational Inertia Rotational Kinetic Energy Consevation of Angular Momentum Vector nature of angular momentum	**Rotational Motion** 1) Calculate the angular displacement, velocity, and acceleration of a rotating object. 2) Balance Torques about a fixed point. 3) Calculate the net torque on an object. 4) Find the net acceleration on a rotating object by adding radial and angular acceleration as vectors. 5) Make predictions about the motion of rotating objects based on their rotational inertia. 6) Calculate the rotational kinetic energy of a rotating object, 7) Explain the effects and applications of conservation of angular momentum as a rotating object changes its rotational inertia or axis of rotation. **Electrostatics** 1. Explain how an object becomes charged 2. Calculate the force of attraction or	**Rotational Motion** 1) I can calculate the angular displacement, velocity, and acceleration of a rotating object. 2) I can balance Torques about a fixed point. 3) I can calculate the net torque on an object. 4) I can find the net acceleration on a rotating object by adding radial and angular acceleration as vectors. 5) I can use rotational inertia to predict whether an object will be easy or difficult to start or stop rotating. 6) I can calculate the rotational kinetic energy of a rotating object, 7) I can explain the effects and applications of conservation of angular momentum as a rotating object changes its rotational inertia or axis of rotation. **Electrostatics** 1) I can make predictions, using the conservation of electric charge,	**9P2.2.2.2**	**Rotational Motion** 2) Balancing torques challenge 6-7) Marble Roll Lab 1-7) Chapter 8 & 9 Problem check quiz 2) Rotational statics worksheet 1-7) Momentum, energy, and rotational motion take home test **Electrostatics** **DC Circuits**	**Rotational Motion** Rot Inertia Wands Balancing Torques Mobile Rot Inertia Spheres hoops and cylinders Record Player Protractors **Key Vocabulary** radian angular velocity angular acceleration torque rotational inertia rotational kinetic energy angular momentum **Electrostatics** Insulators Fur Plastic and rubber rods Aluminum pans eletroscopes van de graf generator **Key Vocabulary** Proton Neutron Electron Positive Charge Negative Charge Coulomb's Law Electric Field Voltage Electric Potential

UEQ • ***How do we calculate the electric field and electric potential surrounding point charges?*** **Electrostatics** Charge Proton Electron Neutron Coulomb's Law Electric Potential Voltage **UEQ** • ***How is Ohm's Law used to calculate the equivalent resistance of series and parallel circuits as well as the current in and voltage across its various components?*** **DC Circuits** Voltage Resistance Current	repulsion between 2 point charges 3. Calculate the fields surrounding 1 or more point charges 4. Calculate the voltage surrounding point charges. 5. Calculate the work needed to bring a charge to a specific potential **DC Circuits** 1. Draw schematic diagrams for series and parallel circuits 2. Use Ohms law to analyze current in a device and voltage across a device	about the sign and relative quantity of net charge of objects or systems after various charging processes, including conservation of charge in simple circuits. 2) I can use Coulomb's law qualitatively and quantitatively to make predictions about the interaction between two electric point charges. **DC Circuits** 1) I can apply conservation of energy (Kirchhoff's loop rule) in calculations involving the total	**9P.2.3.2.1** **9P.2.3.2.3** **9P.2.3.2.2**		**DC Circuits** circuit boards resistors switches bulbs batteries multimeters **Key Vocabulary** Ohm's Law Kirchoffs Rules EMF Battery Resistance Current Series Circuit Parallel Circuit Circuit Breaker Fuse Switch Power Power Dissipated Electrical Energy Kilowatt-Hour

Ohm's Law Kirchoffs Rules Power Cost of Electricity and Energy	3. Use Kirchoffs rules to analyze complex circuits 4. Calculate Power dissipated by a resistor 5. Calculate energy use in kwh	electric potential difference for complete circuit loops with only a single battery and resistors in series and/or in, at most, one parallel branch. 2) I can apply conservation of electric charge (Kirchhoff's junction rule) to the comparison of electric current in various segments of an electrical circuit with a single battery and resistors in series and in, at most, one parallel branch and predict how those values would change if configurations of the circuit are changed.			

		3) I can design an investigation of an electrical circuit with one or more resistors in which evidence of conservation of electric charge can be collected and analyzed. 4) I can use a description or schematic diagram of an electrical circuit to calculate unknown values of current in various segments or branches of the circuit.			

April

ESSENTIAL QUESTIONS & CONTENT	SKILLS	LEARNING TARGETS	Standards	ASSESSMENT	RESOURCES & TECHNOLOGY
UEQ • *What characteristics define simple harmonic motion?* • *How does conservation of energy apply to simple harmonic motion?* • *What factors change/remain constant for all waves in a given medium or a single wave moving from medium to medium?* • *What causes standing waves and how do they differ*	**Waves** 1. Identify the parts of a transverse and longitudinal wave 2. Identify the parts of a standing wave 3. Use the wave speed equation to calculate speed frequency and wavelength in various mediums 4. Find resonance points for open and closed tubes	**Waves** 1. II can identify the parts of a transverse and longitudinal wave 2. I can identify the parts of a standing wave 3. I can use the wave speed equation to calculate speed frequency and wavelength in various mediums 4. I can find resonance points for open and closed tubes	**9P.2.3.1.3**	**Waves** 5-6 Speed of Sound Lab 5-6 Sound Presentations 5-10 Sound Quiz 10 Standing waves in string challenge 5-10 Sound problem check quiz 1-11 Sound Test	**Waves** Boom Wacker Sound Tubes Resonance Tubes Tuning Forks Waves demonstratros Sine Wave Generator Waveport Software Elastic String and wiggler Piano wire AC power source and magnet Laser Decibel Meter **Key Vocabulary** Transverse waves Longitudinal waves Mechanical waves Sound Waves Ultrasound Infrasound Frequency/Pitch Amplitude Decibels Standing Waves

from traveling waves? • *What causes resonance?* • *How do wave properties explain the production and transfer of sound and music?* • *What causes the Doppler Effect and what is it used for?* • *How do wave properties of energy transfer apply to electromagnetic waves?* • *How has optical technology applied reflection and refraction of light?* • *How are interference patterns of diffracted em waves affected by wavelength?* • *How does refraction cause dispersion?* ***Waves*** *Transverse waves* *Longitudinal waves* *Mechanical waves* *Sound Waves*	5. Find the beat frequency from 2 similar frequencies 6. Find the shift in frequency from the doppler effect 7. Find adjacent maxima for constructive interference of speakers 8. Find wave freqency in a vibrating string for various harmonics. 9. Explain the difference between light and sound waves	5. I can find the beat frequency from 2 similar frequencies 6. I can find the shift in frequency from the doppler effect 7. I can find adjacent maxima for constructive interference of speakers 8. I can find wave freqency in a vibrating string for various harmonics. 9. I can explain the difference between light and sound waves			Resonance Interference Doppler Effect

Ultrasound *Infrasound* *Frequency/Pitch* *Amplitude/Volume* *Standing Waves* *Resonance* *Interference* *The Doppler Effect* *Bow Waves, Shock waves* *Electromagnetic waves* *Electromagnetic Spectrum* *Reflection* *Absorption* *Transmission* *Law of Reflection* *Snells Law* *Ray Diagrams* *Total Internal Reflection* *Diffraction* *Polarization* *Dispersion*					