



SPRING GROVE AREA SCHOOL DISTRICT



PLANNED COURSE OVERVIEW

Course Title: Advanced Placement Physics 1 Grade Level(s): 10-12 Units of Credit: 1.5 credits Classification: Elective	Length of Course: 30 cycles Periods Per Cycle: 9 Length of Period: 43 minutes Total Instructional Time: 193.5 hours
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Course Description

This course is designed to prepare students for the College Board Advanced Placement Exam administered in May, therefore it is fast paced and rigorous. It is a study of matter, energy, forces, and motion. The coverage of course material will be more in depth and the pace will be faster than in Physics 1. Additional topics will include general wave motion, sound, and optics. Extensive laboratory activities are included in each unit of study. This is a laboratory science. Emphasis is placed on integrating mathematical skills into the science of physics.

Prerequisites: Successful completion of Algebra 1 Honors, with a passing grade of 85% or teacher recommendation.

Instructional Strategies, Learning Practices, Activities, and Experiences

Bell Ringers	Teacher Demonstration	Practice AP Exams & Essays
Class Discussion	Detailed Laboratory Experiments	Formal Assessments
Flexible Groups	Inquiry Laboratory Experiments	Guided Practice
APL Strategies	Textbook Reading	Online Tutorials/Resources
Posted Objectives and agenda	Homework	Critical Thinking

Assessments

Quizzes	AP Physics 1 exam by the College Board	Practice exams
Chapter exams	Lab reports	Homework problem sets

Materials/Resources

Text – Physics by Giancoli (Prentice Hall)

Adopted: 5/19/14

Revised:

Newtonian Mechanics	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
<p>Kinematics (including vectors, vector algebra, components of vectors, coordinate systems, displacement, velocity, and acceleration)</p> <ol style="list-style-type: none"> 1. Motion in one dimension 2. Motion in two dimensions, including projectile motion <p>Newton's laws of motion</p> <ol style="list-style-type: none"> 1. Static equilibrium (first law) 2. Dynamics of a single particle (second law) 3. Systems of two or more objects (third law) 	<ol style="list-style-type: none"> 1. State from memory the meaning of key terms and phrases used in kinematics. 2. List the SI unit and its abbreviation associated with displacement, velocity, acceleration, and time. 3. Describe the motion of an object relative to a particular frame of reference. 4. State from memory the meaning of the symbols used in kinematics: x, x_0, v, v_0, a, y, y_0, g, t. 5. Write from memory the equations used to describe motion at constant acceleration. 6. Complete a data table using information both given and implied in word problems. 7. Use your completed data table to solve word problems. 8. Use the method of graphical analysis to determine the instantaneous velocity at a point on a position versus time graph and the instantaneous acceleration at a point in time on a velocity versus time graph. <ol style="list-style-type: none"> 1. Differentiate between a vector quantity and a scalar quantity, and state which quantities used in kinematics are vector quantities and which are scalar quantities. 2. Use a protractor and ruler to represent the magnitude and direction of a vector. 3. Multiply or divide a vector quantity by a scalar quantity. 4. Use the methods of graphical analysis (the parallelogram method and the tail-to-tip method) to determine the magnitude and direction of the resultant vector in problems involving vector addition or subtraction of two or more vector quantities. 5. Use the trigonometric functions to resolve a vector into components in the x and y directions. 6. Use the component method to determine the resultant vector in problems involving vector addition or subtraction of two or more vector quantities. 7. State Newton's three laws of motion and give examples that illustrate each law. 8. Explain what is meant by the term net force. 9. Use the methods of vector algebra to determine the net force acting on an object. 10. Define each of the following terms: mass, inertia, weight. 11. Distinguish between mass and weight. 12. Identify the SI units of force, mass, and acceleration. 13. Draw an accurate free-body diagram locating each of the forces acting on an object or a system of objects. 14. Use free-body diagrams and Newton's laws of motion to solve word problems. 15. Use the kinematics equations along with the vector component method to solve problems involving two-dimensional projectile motion.

Newtonian Mechanics	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
<p>Work, energy, power</p> <ol style="list-style-type: none"> 1. Work and work–energy theorem 2. Forces and potential energy 3. Conservation of energy 4. Power 	<ol style="list-style-type: none"> 1. Distinguish between the scientific definition and the colloquial definition of work. 2. Write the definition of work in terms of force and displacement, and calculate the work done by a constant force when the force and displacement vectors are at an angle. 3. Use graphical analysis to calculate work done by a force that varies in magnitude. 4. Define types of mechanical energy and give examples of types of energy that are not mechanical. 5. State the work-energy principle and apply it to solve problems. 6. Distinguish between a conservative force and a nonconservative force, and give examples of each. 7. State the law of conservation of energy and apply it to problems involving mechanical energy. 8. Define power in the scientific sense and solve problems involving work and power.
<p>Systems of particles, linear momentum</p> <ol style="list-style-type: none"> 1. Center of mass 2. Impulse and momentum 3. Conservation of linear momentum, Collisions 	<ol style="list-style-type: none"> 1. Define linear momentum and write the mathematical formula for linear momentum from memory. 2. Distinguish between the unit of force and the unit of momentum. 3. Write Newton’s second law of motion in terms of momentum. 4. Define impulse and write the equation that connects impulse and momentum. 5. State the laws of conservation of momentum and write, in vector form, the law for a system involving two or more objects. 6. Distinguish between a perfectly elastic collision and a completely inelastic collision. 7. Apply the laws of conservation of momentum and energy to problems involving collisions between two objects. 8. Define center of mass and center of gravity, and distinguish between the two concepts.
<p>Circular motion and rotation</p> <ol style="list-style-type: none"> 1. Uniform circular motion 2. Torque and rotational statics 3. Rotational kinematics and dynamics 4. Angular momentum and its conservation 	<ol style="list-style-type: none"> 1. Calculate the centripetal acceleration of an object in uniform circular motion, given the radius of the circle and either the linear speed or the period of the motion. 2. Identify the force that is the cause of the centripetal acceleration, and determine the direction of the acceleration vector. 3. Use Newton’s laws of motion and the concept of centripetal acceleration to solve word problems. 4. Distinguish between centripetal acceleration and tangential acceleration. 5. State the relationship between the period of the motion and frequency of rotation, and use a mathematical equation to express this relationship.

Newtonian Mechanics	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
<p>Oscillations and gravitation</p> <ol style="list-style-type: none"> 1. Simple harmonic motion (dynamics and energy relationships) 2. Mass on a spring 3. Pendulum and other oscillations 4. Newton's law of gravity 5. Orbits of planets and satellites <ol style="list-style-type: none"> a) Circular b) General 	<ol style="list-style-type: none"> 1. Write the equation for Newton's universal law of gravitation, and explain the meaning of each symbol in the equation. 2. State the conditions required to produce SHM. 3. Determine the period of motion of an object of mass m attached to a spring. 4. Calculate the velocity, acceleration, potential energy, and kinetic energy at any point in the motion of an object undergoing SHM. 5. Determine the period of a simple pendulum. 6. Determine the magnitude and direction of the gravitational force (F_G) at a distance r from an object of mass m. 7. Use Newton's second law of motion, the universal law of gravitation, and the concept of centripetal acceleration to solve problems involving the orbital motion of satellites. 8. Explain the "apparent weightlessness" of an astronaut in orbit. 9. State from memory Kepler's laws of planetary motion. 10. Use Kepler's third law to solve word problems involving planetary motion. 11. Use Newton's second law of motion, the universal law of gravitation, and the concept of centripetal acceleration to derive Kepler's third law. 12. Solve word problems relating to Kepler's third law.

Fluid Mechanics and Thermal Physics	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
<p>Fluid Mechanics</p> <ol style="list-style-type: none"> 1. Hydrostatic pressure 2. Buoyancy 3. Fluid flow continuity 4. Bernoulli's equation <p>Temperature and heat</p> <ol style="list-style-type: none"> 1. Mechanical equivalent of heat 2. Heat transfer and thermal expansion <p>Kinetic theory and thermodynamics</p> <ol style="list-style-type: none"> 1. Ideal gases <ol style="list-style-type: none"> a) Kinetic model b) Ideal gas law 2. Laws of thermodynamics <ol style="list-style-type: none"> a) First law (including processes on pV diagrams) b) Second law (including heat engines) 	<ol style="list-style-type: none"> 1. Distinguish between density and specific gravity and, given an object's mass and volume, calculate the object's density and specific gravity. 2. Define pressure and calculate the pressure that an object of known weight exerts on a surface of known area. 3. Calculate the pressure acting at a depth below the surface of a liquid. 4. Distinguish between absolute pressure and gauge pressure and solve problems involving both types of pressure. 5. State Pascal's Principle and apply this principle to basic hydraulic systems. 6. State Archimedes' Principle and use this principle to solve problems related to buoyancy. 7. Use Bernoulli's equation and the concept of streamline flow to solve for the velocity of a fluid and/or the pressure exerted by a fluid at a particular point in a closed pipe. <ol style="list-style-type: none"> 1. Convert from joules to calories and kilocalories. 2. Distinguish between the concepts of temperature and heat. 3. Explain what is meant by specific heat, latent heat of fusion and latent heat of vaporization. 4. Apply the law of conservation of energy to problems involving calorimetry. 5. Distinguish the three ways that heat transfer occurs: conduction, convection and radiation. 6. Solve problems involving the rate of heat transfer by convection and radiation. <ol style="list-style-type: none"> 1. Convert between all temperature scales. 2. Use the combined gas law to solve for pressure, volume or temperature. 3. State the postulates of the kinetic theory of gases. 4. Rewrite the ideal gas law in terms of the motion of the molecules of an ideal gas. 5. Explain what is meant by the term rms velocity. 6. Define sublimation and describe the three phases of matter. 7. Explain what is meant by vapor pressure of a liquid. 8. Explain what is meant by diffusion and why diffusion is slower through a liquid than through a gas. 9. Explain what is meant by a physical system and distinguish between an open and closed system. 10. State the first law of thermodynamics and use this law to solve problems. 11. Distinguish between isothermal process, an isobaric process and an isovolumetric process, and an adiabatic process. 12. Use a PV diagram to calculate the work done by a gas. 13. Calculate the amount of heat that must be added or removed to change the temperature of an object. 14. Use the first and second laws of thermodynamics to solve problems involving a Carnot engine.

Waves and Optics	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
<p>Wave motion (including sound)</p> <ol style="list-style-type: none"> 1. Traveling waves 2. Wave propagation 3. Standing waves 4. Superposition <p>Physical optics</p> <ol style="list-style-type: none"> 1. Interference and diffraction 2. Dispersion of light and the electromagnetic Spectrum <p>Geometric optics</p> <ol style="list-style-type: none"> 1. Reflection and refraction 2. Mirrors 3. Lenses 	<ol style="list-style-type: none"> 1. Distinguish between a longitudinal wave and a transverse wave and give examples of both types of waves. 2. Calculate the speed of longitudinal waves through liquids and solids. 3. Describe wave reflection from a barrier, refraction as a wave travels from one medium into another, constructive and destructive interference as waves overlap and diffraction of waves as they pass through a barrier. 4. Explain how a standing wave can be produced in a string or rope and calculate the harmonic frequencies. <ol style="list-style-type: none"> 1. Distinguish between specular reflection and diffuse reflection. 2. Draw a ray diagram and locate the position of the image produced by an object placed a specified distance from a plane mirror and state the characteristics of the image. 3. Distinguish between a convex and a concave mirror. 4. Draw a ray diagram and locate the position of the image produced by an object placed a specified distance from a convex and concave mirror and state the characteristics of the image. <ol style="list-style-type: none"> 1. Use the mirror equations and the sign conventions to determine the position, magnification, and size of the image produced by an object in front of a spherical mirror. 2. State and use Snell's Law to predict the path of a light ray as it travels from one medium into another. 3. Explain what is meant by index of refraction and total internal reflection. 4. Distinguish between a concave and convex lens. 5. Draw a ray diagram and locate the position of the image produced by an object placed a specified distance from a convex and concave lens and state the characteristics of the image. 6. Use the thin lens equation and the sign conventions to determine the position, magnification, and size of the image. 7. Use the wave model to explain reflection of light from mirrors and refraction of light as it passes from one medium into another. 8. Use the conditions for constructive and destructive interference of waves to explain the Young's double slit experiment. 9. Solve problems involving single slit, double slit and diffraction grating. 10. Solve problems involving thin film interference. 11. Explain how the Michelson interferometer can be used to determine the wavelength. 12. Use the wave model to explain plane polarization of light and polarization by reflection. 13. Calculate the angle for maximum polarization for reflected light.