

Newport-Mesa Unified School District
Office of Secondary Curriculum and Instruction
High School Course of Study

Department	Science		Course Title	AP Physics B 1AB			
Course Code			Grade Level(s)	11-12		Course Length	1 Year
Credits/Semester	5	Required for Graduation?		No	Elective Credit?	No	
Prerequisites	Concurrent enrollment in Trigonometry, teacher recommendation;						
Community College Articulation?			Name of College				
UC/CSU Articulation?			Name of University				
Meets UC/CSU “a-g” Requirement?			Meets NCAA Requirement?			Weighted Course Credit?	5.0

COURSE DESCRIPTION

AP Physics B is divided into 4 units, covered in one year before the AP Exam. Concepts and problem-solving techniques are introduced through a combination of lectures, demonstrations, lab experiments, question-answer sessions, assignments from the textbook and teacher-generated worksheets. Trigonometry is used throughout and where appropriate.

This course is equivalent to the general freshman-level Physics course for university students. The emphasis is on understanding the concepts and skills and using concepts and formulae to solve problems. Laboratory work is an integral part of this course. Students engage in inquiry-based activities to develop their understanding of the material of the course.

GOALS:

The goal in the Advanced Placement Physics course is to provide an excellent first-year college-level calculus-based physics education.

At the end of this course the student should be able to:

- Define and apply definitions of displacement, average velocity, instantaneous velocity, and average acceleration
- Demonstrate proficiency in solving problems using kinematics equations, including problems involving free fall by using the value of the acceleration due to gravity
- Analyze motion graphs qualitatively and quantitatively, including calculations of the slope of the tangent of an x -versus- t graph, the slope of the v -versus- t graph, the area under the v -versus- t graph and the area under the a -versus- t graph
- Distinguish between vectors and scalars
- Add vectors using graphical methods: parallelogram and polygon methods
- Add vectors using the component method of vector addition
- Describe the horizontal and vertical motion of a projectile
- Demonstrate proficiency in solving problems of situations involving projectiles fired horizontally and at an angle
- Apply the concepts of vectors to solve problems involving relative velocity.
- Distinguish between contact forces and field forces by identifying the agent that causes the force
- Distinguish between mass and weight, and calculate weight using the acceleration due to gravity
- Differentiate between static and kinetic friction
- State and apply Newton's first law of motion for objects in static equilibrium
- Demonstrate proficiency in accurately drawing and labeling free-body diagrams

Course Title	AP Physics B 1AB	Course Code	Code
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- State and apply Newton's second law of motion
- Demonstrate proficiency in solving problems that involve objects in motion with constant acceleration by analyzing the resultant force(s) in horizontal surfaces, inclined planes, and pulley systems (Atwood's machines)
- State and apply Newton's third law of motion
- Define and apply the concepts of work done by a constant force, potential energy, kinetic energy, and power
- Calculate the work from the area under the curve of a force-versus-displacement graph
- Distinguish between conservative and non-conservative forces
- State and apply the principle of conservation of mechanical energy
- Demonstrate proficiency in solving problems by applying the work–energy theorem to situations that involve conservative and nonconservative forces
- Define and give examples of impulse and momentum
- Restate Newton's second law of motion in terms of momentum
- Calculate the change in momentum from the area under the curve of a force versus time graph
- Derive a statement of the conservation of momentum between two objects by applying Newton's third law
- Define and recognize examples of elastic and inelastic collisions
- Explain which conservation laws apply to each type of collisions
- Demonstrate proficiency in solving problems involving conservation of momentum in collisions in one and two dimensions
- Explain the characteristics of uniform circular motion
- Derive the equation for centripetal acceleration of an object moving in a circle at constant speed
- Understand that centripetal force is not a new type of force
- Demonstrate proficiency in solving problems involving banking angles, the conical pendulum and motion in a vertical circle
- Define and calculate the torque of a given force about an axis of rotation
- State the two conditions of equilibrium (translational and rotational) and apply them to solve for unknown forces and/or distances in a variety of situations
- Define and identify the following terms on a displacement-versus-time graph: equilibrium position, amplitude, period, and frequency
- Define simple harmonic motion
- Use the reference circle to describe the displacement, velocity and acceleration
- Describe and apply Hooke's law and Newton's second law to determine the acceleration as a function of displacement
- Apply the principles of conservation of mechanical energy for an object moving with simple harmonic motion
- Derive and apply the equation to obtain the period of a mass–spring system
- Derive and apply the equation to obtain the period of a simple pendulum
- Demonstrate proficiency in solving problems involving horizontal and vertical mass–spring systems
- Define resonant frequency and give examples of resonance
- State and apply Newton's law of universal gravitation
- Describe Cavendish's experiment to determine the value of the universal gravitation constant
- Derive the acceleration due to gravity at the surface of the earth or other planets
- Explain and apply the relationship between the speed and the orbital radius of a satellite
- Demonstrate proficiency in solving problems involving apparent weightlessness in a satellite and in an elevator
- State Kepler's three laws of planetary motion
- Derive and apply Kepler's third law of planetary motion
- Define atmospheric pressure, gauge pressure, and absolute pressure, and the relationship among these terms
- Define and apply the concept of fluid pressure
- State and apply Pascal's principle in practical situations such as hydraulic lifts
- State and apply Archimedes' principle to calculate the buoyant force

Course Title	AP Physics B 1AB	Course Code	Code
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- Demonstrate proficiency in accurately drawing and labeling free-body diagrams involving buoyant force and other forces
- State the characteristics of an ideal fluid
- Understand that Bernoulli's equation is a statement of conservation of energy
- Demonstrate proficiency in solving problems involving changes in depth and/or changes in pressure and/or changes in velocity
- Understand and apply the mechanical equivalent of heat
- Describe the condition for thermal equilibrium and define temperature
- Define the coefficient of linear expansion and apply the equation to calculate linear thermal expansion
- Explain the mechanisms of heat transfer: conduction, radiation, and convection
- Demonstrate proficiency in solving problems involving thermal conductivity
- State and apply the gas laws: Boyle's, Charles's and Gay Lussac's
- Apply the Ideal Gas law and the General Gas law to the solution of problems involving changes in volume, pressure, and temperature
- State the postulates of the kinetic theory
- Understand that the average translational energy of molecules in a gas is directly proportional to the absolute temperature
- State and apply the first law of thermodynamics
- Define and illustrate the four thermodynamic processes: isothermal, adiabatic, isovolumetric, isobaric process
- Calculate of the work done by graphical methods
- State and understand the implications of the second law of thermodynamics
- Describe a typical heat engine and define the efficiency of a heat engine
- Understand a Carnot engine and how its efficiency is expressed in terms of the Kelvin temperatures between which it operates
- Demonstrate proficiency in solving problems related to thermodynamic processes
- Define electrostatics and the nature of an electric charge
- State the law of electrostatics and the law of conservation of charge
- State Coulomb's law and its equation to calculate the electrostatic force between two charges
- Define the electric field and derive for a single point charge
- Describe electric field lines as means to depict the electric field
- Demonstrate proficiency in solving problems involving electric charges by applying appropriate vector addition methods
- Define and apply the concepts of electric potential energy, electric potential, and electric potential difference
- Describe and apply the relationship of the potential difference between two points to the uniform electric field existing between the points
- Understand that equipotential lines are perpendicular to electric field lines
- Demonstrate proficiency in solving problems involving the calculation of the total potential at any point in the vicinity of a number of known charges
- Demonstrate proficiency in solving problems involving the calculation of the work required to move a known charge from one point to another
- Apply a relationship between the electric field and the potential difference in a parallel plate configuration
- Explain the charging of an object by contact and by induction
- Distinguish between conductors and insulators
- Understand the distribution of charge in a conductor
- Define capacitance and apply the equation to calculate the total charge
- Understand and apply the fact that the capacitance depends on the geometry of the capacitor: area and separation between the plates
- Calculate the equivalent capacitance of capacitors connected in series and in parallel
- Determine the energy stored in a parallel plate capacitor
- Define electric current as the rate of flow of charge
- Understand some reasons for the conventional direction of electric current
- Explain the term *emf* (electromotive force) and what a source of *emf* is

Course Title	AP Physics B 1AB	Course Code	Code
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- Define resistance and the factors affecting the resistance of a conductor
- State and apply Ohm's law
- Understand and apply the equation of electric power as the rate of energy transferred in the form of heat
- Draw schematic diagrams of circuits, including measuring devices such as ammeters and voltmeters
- Analyze series and parallel circuits and demonstrate proficiency in calculations of equivalent resistance, current, and voltage drop
- Calculate the terminal voltage, taking into account the internal resistance of a battery
- State and apply Kirchhoff's laws to solve complex networks
- Analyze circuits with resistors and capacitors (steady state) and demonstrate proficiency in calculations of equivalent resistance, current, and voltage drop
- Describe the magnetic fields created by magnets
- Calculate the magnetic force exerted on a moving charge and determine the direction of the magnetic field, the velocity of the charge, and the magnetic force by using a right-hand-rule
- Calculate the magnetic force on a current carrying wire (or loop of wire) and determine the direction of the magnetic field, the current, and the magnetic force by using a right-hand-rule
- Calculate the magnetic force on a long, straight wire and determine the direction of the magnetic field, the current, and the magnetic force by using a right-hand rule
- Determine the magnitude and direction of the magnetic force between two parallel wires
- Describe Faraday's experiments that led to the conclusion that a changing magnetic field induces an *emf*
- State Faraday's law of induction and Lenz's law
- Demonstrate proficiency in solving problems involving an induced *emf* in cases where the magnetic flux density changes and in cases where the area of a loop of wire is changed
- Apply Lenz's law to determine the direction of the induced current in a variety of situations including motional *emf*
- Define and give characteristics and examples of longitudinal, transverse, and surface waves
- Apply the equation for wave velocity in terms of its frequency and wavelength
- Describe the relationship between energy of a wave and its amplitude
- Describe the behavior of waves at a boundary: fixed-end, free-end, boundary between different media
- Demonstrate proficiency in solving problems involving transverse waves in a string
- Distinguish between constructive and destructive interference
- State and apply the principle of superposition
- Describe the formation and characteristics of standing waves
- Describe the characteristics of sound and distinguish between ultrasonic and infrasonic sound waves
- Calculate the speed of sound in air as a function of temperature
- Use boundary behavior characteristics to derive and apply relationships for calculating the characteristic frequencies for an open pipe and for a closed pipe
- Explain the interference of sound waves and the formation of beats
- Apply the Doppler effect to predict the apparent change in sound frequency
- Explain how electromagnetic waves are produced
- Describe the electromagnetic spectrum and the relationship between frequency, wavelength, and speed of electromagnetic waves
- Describe Roemer and Michelson's experiment to determine the speed of light
- Explain the dispersion of light and the visible spectrum
- State the conditions for constructive interference and destructive interference
- Describe Young's double-slit experiment and apply the results of the experiment to predict the location of bright and dark fringes
- Describe the pattern observed by the use of a diffraction grating
- Demonstrate proficiency in solving problems involving the use of a single slit, a double slit and a diffraction grating

Course Title	AP Physics B 1AB	Course Code	Code
--------------	------------------	-------------	------

- Explain and apply the characteristics of thin-film interference using the concepts of boundary behavior
- Calculate the thickness of a film
- Discuss the evidence supporting the ray model of light
- State and apply the law of reflection
- Define the following terms for spherical mirrors: principal axis, focal point, and focal length
- Demonstrate proficiency in the use of ray diagrams to find the image of an object using a converging and a diverging mirror
- Understand how mirrors form real and virtual images
- Demonstrate proficiency in solving problems that use the mirror equation to calculate the focal length of a mirror, image distance, image height, and the magnification
- Explain what is meant by spherical aberration
- Define the index of refraction and describe the behavior of refracted light
- Apply Snell's law to the solution of problems
- Explain the concepts of critical angle and total internal reflection
- Demonstrate proficiency in the use of ray diagrams to find the image of an object using a converging and a diverging lens and a combination of lenses
- Understand how lenses form real and virtual images
- Demonstrate proficiency in solving problems that use the lens equation to calculate the focal length of a lens, image distance, image height, and the magnification
- Describe Thomson and Millikan's experiments related to the electron
- Discuss the basics of Planck's hypothesis
- Define a photon and relate its energy to its frequency and/or wavelength
- Convert energy units: joules to electronvolts and vice versa
- Demonstrate proficiency in solving problems involving the energy of a photon and the conservation of momentum in photon interactions
- Explain the characteristics of the photoelectric effect and define the terms "work function" and "threshold frequency"
- Given a graph of energy versus frequency, understand the meaning of the slope, the x -intercept, and the y -intercept
- Demonstrate proficiency in solving problems involving the calculation of the maximum kinetic energy of photoelectrons
- Understand the nature and production of X-rays
- Describe the results of the collision of an X-ray photon with an electron (Compton effect) and the results of the scattering of X-rays from a crystal (Davisson–Germer experiment)
- Understand the dual nature of light and matter, and apply de Broglie's equation to calculate the wavelength of a particle
- Describe how atomic spectra are produced
- Demonstrate proficiency in drawing and interpreting energy-level diagrams
- Calculate the energy absorbed or emitted by an atom when an electron moves to a higher or lower energy level
- Describe the structure and properties of the nucleus
- Apply Einstein's equation of mass energy equivalence
- Calculate the mass defect and the total binding energy of the nucleus
- Understand the origin of the strong and weak nuclear forces
- Describe three types of radiation emitted in radioactivity: alpha decay, beta radiation and gamma radiation
- Understand how nuclear reactions are produced
- Define the following terms: threshold energy, chain reaction, and critical mass
- Explain the process of nuclear fission and the basic operation of a nuclear reactor
- Describe a chain reaction
- Explain the process of nuclear fusion and how magnetic and inertial confinements can provide thermonuclear power

Course Title	AP Physics B 1AB	Course Code	Code
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California Content Standards

Motion and Forces

1. Newton's laws predict the motion of most objects. As a basis for understanding this concept:
 - a. Students know how to solve problems that involve constant speed and average speed.
 - b. Students know that when forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest (Newton's first law).
 - c. Students know how to apply the law $F=ma$ to solve one-dimensional motion problems that involve constant forces (Newton's second law).
 - d. Students know that when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (Newton's third law).
 - e. Students know the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of Earth.
 - f. Students know applying a force to an object perpendicular to the direction of its motion causes the object to change direction but not speed (e.g., Earth's gravitational force causes a satellite in a circular orbit to change direction but not speed).
 - g. Students know circular motion requires the application of a constant force directed toward the center of the circle.
 - h.* Students know Newton's laws are not exact but provide very good approximations unless an object is moving close to the speed of light or is small enough that quantum effects are important.
 - i.* Students know how to solve two-dimensional trajectory problems.
 - j.* Students know how to resolve two-dimensional vectors into their components and calculate the magnitude and direction of a vector from its components.
 - k.* Students know how to solve two-dimensional problems involving balanced forces (statics).
 - l.* Students know how to solve problems in circular motion by using the formula for centripetal acceleration in the following form: $a=v^2/r$.

Conservation of Energy and Momentum

2. The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects. As a basis for understanding this concept:
 - a. Students know how to calculate kinetic energy by using the formula $E=(1/2)mv^2$.
 - b. Students know how to calculate changes in gravitational potential energy near Earth by using the formula (change in potential energy) = mgh (h is the change in the elevation).
 - c. Students know how to solve problems involving conservation of energy in simple systems, such as falling objects.
 - d. Students know how to calculate momentum as the product mv .
 - e. Students know momentum is a separately conserved quantity different from energy.
 - f. Students know an unbalanced force on an object produces a change in its momentum.
 - g. Students know how to solve problems involving elastic and inelastic collisions in one dimension by using the principles of conservation of momentum and energy.
 - h.* Students know how to solve problems involving conservation of energy in simple systems with various sources of potential energy, such as capacitors and springs

Heat and Thermodynamics

3. Energy cannot be created or destroyed, although in many processes energy is transferred to the environment as heat. As a basis for understanding this concept:
 - a. Students know heat flow and work are two forms of energy transfer between systems.
 - b. Students know that the work done by a heat engine that is working in a cycle is the difference between the heat flow into the engine at high temperature and the heat flow out at a lower temperature (first law of thermodynamics) and that this is an example of the law of conservation of energy.
 - c. Students know the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. The greater the temperature of the object, the greater the energy of motion of the atoms and molecules that make up the object.
 - d. Students know that most processes tend to decrease the order of a system over time and that energy levels are eventually distributed uniformly.
 - e. Students know that entropy is a quantity that measures the order or disorder of a system and that this quantity is larger for a more disordered system.
 - f.* Students know the statement "Entropy tends to increase" is a law of statistical probability that governs all closed systems (second law of thermodynamics).
 - g.* Students know how to solve problems involving heat flow, work, and efficiency in a heat engine and know that all real engines lose some heat to their surroundings.

Waves

4. Waves have characteristic properties that do not depend on the type of wave. As a basis for understanding this concept:
 - a. Students know waves carry energy from one place to another.
 - b. Students know how to identify transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves).
 - c. Students know how to solve problems involving wavelength, frequency, and wave speed.
 - d. Students know sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.
 - e. Students know radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately 3×10^8 m/s (186,000 miles/second).
 - f. Students know how to identify the characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.

Course Title	AP Physics B 1AB	Course Code	Code
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Electric and Magnetic Phenomena

5. Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept:
- Students know how to predict the voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors.
 - Students know how to solve problems involving Ohm's law.
 - Students know any resistive element in a DC circuit dissipates energy, which heats the resistor. Students can calculate the power (rate of energy dissipation) in any resistive circuit element by using the formula $\text{Power} = IR$ (potential difference) $\times I$ (current) $= I^2R$.
 - Students know the properties of transistors and the role of transistors in electric circuits.
 - Students know charged particles are sources of electric fields and are subject to the forces of the electric fields from other charges.
 - Students know magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arising from the magnetic fields of other sources.
 - Students know how to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.
 - Students know changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.
 - Students know plasmas, the fourth state of matter, contain ions or free electrons or both and conduct electricity.
 - * Students know electric and magnetic fields contain energy and act as vector force fields.
 - * Students know the force on a charged particle in an electric field is qE , where E is the electric field at the position of the particle and q is the charge of the particle.
 - * Students know how to calculate the electric field resulting from a point charge.
 - * Students know static electric fields have as their source some arrangement of electric charges.
 - * Students know the magnitude of the force on a moving particle (with charge q) in a magnetic field is $qvB \sin(a)$, where a is the angle between $\mathbf{v}$ and $\mathbf{B}$ (v and B are the magnitudes of vectors $\mathbf{v}$ and $\mathbf{B}$, respectively), and students use the right-hand rule to find the direction of this force.
 - * Students know how to apply the concepts of electrical and gravitational potential energy to solve problems involving conservation of energy.

Nuclear Processes (Chemistry)

11. Nuclear processes are those in which an atomic nucleus changes, including radioactive decay of naturally occurring and human-made isotopes, nuclear fission, and nuclear fusion. As a basis for understanding this concept:
- Students know protons and neutrons in the nucleus are held together by nuclear forces that overcome the electromagnetic repulsion between the protons.
 - Students know the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions. The change in mass (calculated by $E=mc^2$) is small but significant in nuclear reactions.
 - Students know some naturally occurring isotopes of elements are radioactive, as are isotopes formed in nuclear reactions.
 - Students know the three most common forms of radioactive decay (alpha, beta, and gamma) and know how the nucleus changes in each type of decay.
 - Students know alpha, beta, and gamma radiation produce different amounts and kinds of damage in matter and have different penetrations.
 - * Students know how to calculate the amount of a radioactive substance remaining after an integral number of half-lives have passed.
 - * Students know protons and neutrons have substructures and consist of particles called quarks.

Investigation and Experimentation

1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will:
- Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
 - Identify and communicate sources of unavoidable experimental error.
 - Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
 - Formulate explanations by using logic and evidence.
 - Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.
 - Distinguish between hypothesis and theory as scientific terms.
 - Recognize the usefulness and limitations of models and theories as scientific representations of reality.

Evaluation

Student achievement will be measured using multiple assessment tools, included but not limited to benchmark test results, final exams, end-of-unit tests, quizzes, homework, classwork, notebooks, portfolios, authentic performance assessments, and written assessments using the district's rubric. District-wide benchmark assessments will be assessed using the following chart:

Performance Standards - Benchmark Assessments				
Far Below Basic = F	Below Basic = D	Basic = C	Proficient = B	Advanced Proficient = A

Course Title	AP Physics B 1AB	Course Code	Code
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Unit 1	Length of Unit (5 weeks)				
	Key Terms	Standards*	Model Tasks**		Tools & Text
<u>Newtonian Mechanics:</u> <i>Kinematics and Dynamics</i>	Displacement Velocity Acceleration Vector Components Centripetal Newton’s Laws Inertia Friction Air Resistance Normal Force Coefficient of friction	1a. Students know how to solve problems that involve constant speed and average speed. 1b. Students know that when forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest (Newton’s first law). 1c. Students know how to apply the law $F=ma$ to solve one-dimensional motion problems that involve constant forces (Newton’s second law). 1d. Students know that when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (Newton’s third law).	1. Students will analyze the motion of objects moving at constant speed and at uniform accelerated motion. Data should be collected to produce a graph of x versus t and use the graph to plot a v - versus t -graph for each object. 2. Students will determine the initial velocity of a projectile and the angle at which the maximum range can be attained. 3. Students will Determine static and kinetic coefficients of friction using two different methods.	D C B A	Teacher resource book Student textbook Mechanical Universe video series AP Released exams
Differentiation	Support -- for students who are struggling with the content	Meet with instructor during Prep periods to help with understanding, Up to date website communications to facilitate understanding.			
	Extension – for high achieving students. Required activities for all honors courses.	This course is designed as an advanced course to earn College Credit. The course itself is designed as an extension of the regular HS curriculum.			
Evaluation	<i>Formative Assessments: Students will be assessed through weekly quizzes, homework review, chapter tests.</i> <i>Summative Assessments: Unit exams, Complete AP exams</i>				

* Standards are to be identified by frequency on California Standards Tests. A high frequency standard will be labeled with an "H", a medium frequency standard will be labeled "M", and a low frequency standard will be labeled "L".

** Tasks are to be identified by the Application Taxonomy Quadrant designed by the International Center for Leadership in Education.

Course Title	AP Physics B 1AB	Course Code	Code
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Unit 2	Length of Unit (5 weeks)				
	Key Terms	Standards*	Model Tasks**		Tools & Text
<u>Newtonian Mechanics:</u> Energy, Momentum, Rotation and Gravitation	Energy Kinetic Potential Work Power Momentum Impulse Elastic/Inelastic Orbital Velocity Escape Velocity SHM Spring Constant	2a. Students know how to calculate kinetic energy by using the formula $E = (1/2)mv^2$. 2b. Students know how to calculate changes in gravitational potential energy near Earth by using the formula (change in potential energy) $= mgh$ (h is the change in the elevation). 2c. Students know how to solve problems involving conservation of energy in simple systems, such as falling objects. 2d. Students know how to calculate momentum as the product mv .	1. Students will determine the velocity of each glider before and after a collision. 2. Students will determine the velocity of a flying toy and the tension in the string. 3. Students will plot a planetary orbit and apply Kepler's Laws 4. Students will determine the spring constant of the spring, the evaluation of the extent to which the change in gravitational potential energy of the mass is equal to the change in the spring potential energy.	D C B A	Teacher resource book Student textbook Mechanical Universe video series AP Released exams
Differentiation	Support -- for students who are struggling with the content	Meet with instructor during Prep periods to help with understanding, Up to date website communications to facilitate understanding.			
	Extension – for high achieving students. Required activities for all honors courses.	This course is designed as an advanced course to earn College Credit. The course itself is designed as an extension of the regular HS curriculum.			
Evaluation	Formative Assessments: Students will be assessed through weekly quizzes, homework review, chapter tests. Summative Assessments: Unit exams, Complete AP exams				

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Unit 3	Length of Unit (4 Weeks)				
	Key Terms	Standards*	Model Tasks**		Tools & Text
<i>Fluid Dynamics and Thermal Physics</i>	Pressure Buoyancy Bernoulli's Principle Heat Temperature Thermodynamics Carnot Cycle	3a. Students know heat flow and work are two forms of energy transfer between systems. 3b. Students know that the work done by a heat engine that is working in a cycle is the difference between the heat flow into the engine at high temperature and the heat flow out at a lower temperature (first law of thermodynamics) and that this is an example of the law of conservation of energy. 3c. Students know the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. The greater the temperature of the object, the greater the energy of motion of the atoms and molecules that make up the object.	1. Students will determine the density of two unknown materials. Using a triple-beam balance, overflow can, beaker, various metal objects and string. 2. Students will determine the exit velocity of a liquid and to investigate the range attained with holes at varying heights. 3. Students will determine the coefficient of linear expansion of two metal rods.	D C B A	Teacher resource book Student textbook Mechanical Universe video series AP Released exams
Differentiation	Support -- for students who are struggling with the content	Meet with instructor during Prep periods to help with understanding, Up to date website communications to facilitate understanding.			
	Extension – for high achieving students. Required activities for all honors courses.	This course is designed as an advanced course to earn College Credit. The course itself is designed as an extension of the regular HS curriculum.			
Evaluation	<i>Formative Assessments: Students will be assessed through weekly quizzes, homework review, chapter tests.</i> <i>Summative Assessments: Unit exams, Complete AP exams</i>				

* Standards are to be identified by frequency on California Standards Tests. A high frequency standard will be labeled with an “H”, a medium frequency standard will be labeled “M”, and a low frequency standard will be labeled “L”.

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Unit 4	Length of Unit (8 Weeks)				
	Key Terms	Standards*	Model Tasks**		Tools & Text
<i>Electricity and Magnetism</i>	Coulomb’s Law Electric Field Electric Potential Capacitors Induction Ohm’s Law Resistors Current Circuits Magnetic Field	5a. Students know how to predict the voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors. 5b. Students know how to solve problems involving Ohm’s law. 5c. Students know any resistive element in a DC circuit dissipates energy, which heats the resistor. Students can calculate the power (rate of energy dissipation) in any resistive circuit element by using the formula $Power = IR$ (potential difference) $\times I$ (current) $= I^2R$. 5e. Students know charged particles are sources of electric fields and are subject to the forces of the electric fields from other charges.	1. Students will map both the potentials and the electric fields around a system of two-dimensional, charged conductors. 2. Students will make qualitative observations of the behavior of an electroscope when it is charged by conduction and by induction. 3. Students will investigate the behavior of resistors in series, parallel, and series-parallel circuits. The lab should include measurements of voltage and current. 4. Students will qualitatively examine the effects of changing magnetic field by observing currents induced in a solenoid and to determine whether your observations agree with the theory of electromagnetic induction and Lenz’s law.	D C B A	Teacher resource book Student textbook Mechanical Universe video series AP Released exams
Differentiation	Support -- for students who are struggling with the content	Meet with instructor during Prep periods to help with understanding, Up to date website communications to facilitate understanding.			
	Extension – for high achieving students. Required activities for all honors courses.	This course is designed as an advanced course to earn College Credit. The course itself is designed as an extension of the regular HS curriculum.			
Evaluation	<i>Formative Assessments: Students will be assessed through weekly quizzes, homework review, chapter tests.</i> <i>Summative Assessments: Unit exams, Complete AP exams</i>				

* Standards are to be identified by frequency on California Standards Tests. A high frequency standard will be labeled with an "H", a medium frequency standard will be labeled "M", and a low frequency standard will be labeled "L".

** Tasks are to be identified by the Application Taxonomy Quadrant designed by the International Center for Leadership in Education.

Course Title	AP Physics B 1AB	Course Code	Code
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Unit 5	Length of Unit (4 Weeks)					
	Key Terms	Standards*		Model Tasks**		Tools & Text
<i>Waves and Optics</i>	Amplitude Frequency Wavelength Standing Waves Interference Reflection Refraction Diffraction Dispersion Lenses	4a. Students know waves carry energy from one place to another. 4b. Students know how to identify transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). 4c. Students know how to solve problems involving wavelength, frequency, and wave speed. 4d. Students know sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.		1. Students will determine the experimental value of the frequency of standing waves in a string by means of a graph of collected data. 2. Students will determine the wavelength of a source of light by using a double slit and a diffraction grating of known spacing. 3. Students will determine the index of refraction of an acrylic block	D C B A	Teacher resource book Student textbook Mechanical Universe video series AP Released exams
Differentiation	Support -- for students who are struggling with the content	Meet with instructor during Prep periods to help with understanding, Up to date website communications to facilitate understanding.				
	Extension – for high achieving students. Required activities for all honors courses.	This course is designed as an advanced course to earn College Credit. The course itself is designed as an extension of the regular HS curriculum.				
Evaluation	<i>Formative Assessments: Students will be assessed through weekly quizzes, homework review, chapter tests.</i> <i>Summative Assessments: Unit exams, Complete AP exams</i>					

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Course Title	AP Physics B 1AB	Course Code	Code
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Unit 6	Length of Unit (2 Weeks)				
	Key Terms	Standards*		Model Tasks**	Tools & Text
<i>Atomic and Nuclear Physics</i>	Photons Photoelectric Compton Scattering Energy Levels Nuclear reaction	11b. Students know the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions. The change in mass (calculated by $E=mc^2$) is small but significant in nuclear reactions. 11c. Students know some naturally occurring isotopes of elements are radioactive, as are isotopes formed in nuclear reactions. 11d. Students know the three most common forms of radioactive decay (alpha, beta, and gamma) and know how the nucleus changes in each type of decay.		1. Students will, using a simulation, collect data to create a graph that will allow you to find the value of Planck’s constant for three different metals.	D C B A Teacher resource book Student textbook Mechanical Universe video series AP Released exams
Differentiation	Support -- for students who are struggling with the content	Meet with instructor during Prep periods to help with understanding, Up to date website communications to facilitate understanding.			
	Extension – for high achieving students. Required activities for all honors courses.	This course is designed as an advanced course to earn College Credit. The course itself is designed as an extension of the regular HS curriculum.			
Evaluation	<i>Formative Assessments: Students will be assessed through weekly quizzes, homework review, chapter tests.</i> <i>Summative Assessments: Unit exams, Complete AP exams</i>				

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