

Department: Science	Course Title: PHYSICS: MECHANICS C/AP Course Number: 249 B
Grade(s): 11-12	PRE-REQUISITES (IF ANY): SUCCESSFUL COMPLETION OF HONORS CHEMISTRY OR APPROVAL OF SCIENCE DEPARTMENT HEAD; CO-REQUISITE: CONCURRENT ENROLLMENT IN AN AP CALCULUS COURSE OR SUCCESSFUL COMPLETION OF A CALCULUS COURSE.

UNIT	LENGTH	CONTENT	Skills	METHODS OF ASSESSMENT	FRAMEWORK STRAND(S) & STANDARD(S)
UNIT 1: INTRODUCTION	1.5 WKS	What is Physics? SI system of units Unit Conversion and Dimensional Analysis Uncertainty in Measurement (precision, accuracy, significant figures) Analyzing Experimental Data: perfect graphs and tables, straightening a curve. Order of Magnitude Estimating, Fermi Problems	Students will: Demonstrate problem solving abilities. Use scientific calculator properly. Understand unit conversion. Practice lab safety. Understand Uncertainty in measurement and data collection. Calculate mean and standard deviation. Understand modeling and critical analysis. Use science graphing software to construct data tables, graphs. Conduct graphical analysis of experimental data. Work collaboratively.	6 homework sets of ~ 5 textbook problems. 3 group work sessions, ~2 problems each. 3 Lab Activities. Unit Test.	SCIENTIFIC INQUIRY SKILLS: SIS1, SIS2, SIS3, SIS4. MATH SKILLS: ALL
UNIT 2: ONE DIMENSIONAL KINEMATICS	3 WKS	Graphical Representations of Motion. Position, Distance, Displacement, Average Speed, Velocity, and Acceleration. Instantaneous Velocity and Acceleration: Derivatives and the Equations of Motion. Constant Acceleration and Free Fall. Integration and the Equations of Motion.	Students will: Create and interpret motion graphs and diagrams. Demonstrate experimental design. Demonstrate computer skills of data collection, data analysis, and modeling. Apply kinematic concepts to real world phenomena. Participate in peer discussion and evaluation of preconceptions. Make inferences. Demonstrate problem solving abilities.	10 homework sets of ~5 textbook problems each 5 group work sessions, ~2 problems each. 4 Lab Activities. 1 Formal Lab Report. Unit Test.	CONTENT STANDARDS: 1.1, 1.2, 1.3 SCIENTIFIC INQUIRY SKILLS: SIS1, SIS2, SIS3, SIS4. MATH SKILLS: ALL

UNIT	LENGTH	CONTENT	Skills	METHODS OF ASSESSMENT	FRAMEWORK STRAND(S) & STANDARD(S)
UNIT 3: 2-DIMENSIONAL MOTION	3 WKS	Vectors: Notion, unit vectors, arithmetic. Rectangular Vector Components. Position, velocity and acceleration vectors. Relative Motion Projectile Motion Circular Motion	Students will: Participate in peer discussion and evaluation. Make inferences. Use unit vector notation to describe motion Apply concept of components of motion to real world Phenomenon. Formulate and test hypotheses. Draw and interpret scale diagrams and maps. Use vector applications in navigation problems. Navigate using a compass. Identify variables in word problems. Practice lab safety. Use a computer for modeling with simulations. Work collaboratively.	10 homework sets of ~5 textbook problems each. 5 group work sessions, ~2 problems each. 5 Lab Activities. Unit Test.	CONTENT STANDARDS: 1.1, 1.2 SCIENTIFIC INQUIRY SKILLS: SIS1, SIS2, SIS3, SIS4. MATH SKILLS: ALL
UNIT 4: NEWTON'S LAWS	2.5 WKS	Forces: contact forces and the 4 fundamental forces, units of force. Static Equilibrium: 1st Law and inertia Dynamics of a single particle: 2nd Law and cause and effect. Systems of two objects: 3rd Law and interaction forces. Net force and Free-body diagrams. Mass, weight, and apparent weight. Tension and pulleys Springs and Hooke's Law	Students will: Understand measurement, data collection and analysis. Make inferences from observations Participate in peer discussion and evaluation. Identify forces in common situations. Use a computer for collection and analysis of data. Decode word problems. Practice lab safety. Work collaboratively	9 homework sets of ~5 textbook problems each plus additional tension problems. 5 group work sessions, ~2 problems each. 5 Lab Activities. Unit Test.	CONTENT SKILLS: 1.4, 1.5, 1.6, 1.7 SCIENTIFIC INQUIRY SKILLS: SIS1, SIS2, SIS3, SIS4. MATH SKILLS: ALL

UNIT	LENGTH	CONTENT	Skills	METHODS OF ASSESSMENT	FRAMEWORK STRAND(S) & STANDARD(S)
UNIT 5: APPLICATIONS OF NEWTON'S LAWS	2.5 WKS	Normal forces and friction, (coefficient of friction). Slipping and static friction. Motion w/ friction (horizontal and inclined planes). Motion of stacked objects. Circular motion and centripetal force. Drag forces and terminal velocity. 2nd Law as a differential equation for velocity.	Students will: Make inferences from observations Participate in peer discussion and evaluation. Identify forces in common situations. Use free-body diagrams to analyse real world situations. Use unit vector notation to describe forces and resulting motion. Use a computer for collection and analysis of data. Work collaboratively. Decode word problems.	9 homework sets of ~5 textbook problems each plus additional friction problems. 5 group work sessions, ~2 problems each. 3 Lab Activities. Unit Test.	CONTENT SKILLS: 1.4, 1.5, 1.6, 1.7, 1.8 SCIENTIFIC INQUIRY SKILLS: SIS1, SIS2, SiS3, SIS4. MATH SKILLS: ALL
UNIT 6: WORK, POWER AND ENERGY	3 WKS	Work- average force x distance and by integration. Kinetic Energy Scalar Products Vector definition of Work: 2 and 3-D. The Work-Kinetic Energy Theorem and Newton's 2nd. Power Potential Energy Function and Conservative Forces. Gravitational & Spring PE. Stable and unstable equilibrium. Conservation of Energy. Problem solving using energy conservation as an alternative to Newton's Laws.	Students will: Make inferences from observations. Understand measurement, data collection and analysis. Apply energy concepts to real world situations. Participate in peer discussion and evaluation. Use a computer for modeling with simulations. Understand application of conservation laws. Decode word problems. Work collaboratively. Practice lab safety.	9 homework sets of ~5 textbook problems each. 5 group work sessions, ~2 problems each. 5 Lab Activities. 1 Formal Lab Report. Unit Test.	CONTENT STANDARDS: 2.1, 2.2, 2.3, 2.4 SCIENTIFIC INQUIRY SKILLS: SIS1, SIS2, SiS3, SIS4. MATH SKILLS: ALL

UNIT	LENGTH	CONTENT	Skills	METHODS OF ASSESSMENT	FRAMEWORK STRAND(S) & STANDARD(S)
UNIT 7: SYSTEMS OF PARTICLES AND CENTER OF MASS	3 WKS	Center of mass- systems of particles and symmetrical continuous objects. CM of non-uniform objects by integration. Balance and equilibrium-Center of Gravity & Potential Energy. CM velocity and linear momentum. CM acceleration and Newton's 2nd Law. Conservation of Linear Momentum and external forces. Kinetic Energy of a system. Impulse-Momentum theorem (impulse by average force and integration). Collisions: 1-D elastic and inelastic. 2-D perfectly inelastic. 2-D elastic collisions & special case equal masses. Explosions: momentum and energy considerations.	Students will: Make inferences from observations. Understand measurement, data collection and analysis. Apply center of mass concepts to real world phenomena. Participate in peer discussion and evaluation. Use unit vector notation in solving 2-D collision problems. Use a computer for modeling with simulations. Understand application of conservation laws. Work collaboratively. Practice lab safety.	10 homework sets of ~5 textbook problems each. 5 group work sessions, ~2 problems each. 5 Lab Activities. Unit Test.	CONTENT STANDARDS: 2.5 SCIENTIFIC INQUIRY SKILLS: SIS1, SIS2, SIS3, SIS4. MATH SKILLS: ALL
UNIT 8: ROTATION AND ANGULAR MOMENTUM	3 WKS	Rotational Kinematics: Angular displacement, velocity and acceleration. Kinematic equations for constant acceleration. Rotational Kinetic Energy and Moment of Inertia of discrete objects. Calculating Moment of continuous objects. Parallel Axis Theorem. Torque and Newton's 2nd Law for rotation. Rotational Equilibrium. Rolling without Slipping. Rolling and energy conservation. Cross Product (right hand rule and unit vector notation). Vector nature of angular velocity, acceleration and torque. Angular Momentum and Newton's 2nd Law. Gyroscopes and Precession Conservation of Angular Momentum	Students will: Make inferences from observations. Understand measurement, data collection and analysis. Participate in peer discussion and evaluation of preconceptions. Understand application of conservation laws. Apply angular momentum concepts to real world situations. Understand mathematical modeling. Demonstrate experimental design. Work collaboratively. Practice lab safety.	10 homework sets of ~5 textbook problems each. 5 group work sessions, ~2 problems each. 3 Lab Activities. Unit Test.	CONTENT STANDARDS: 1.8 2.5 SCIENTIFIC INQUIRY SKILLS: SIS1, SIS2, SIS3, SIS4. MATH SKILLS: ALL

UNIT	LENGTH	CONTENT	Skills	METHODS OF ASSESSMENT	FRAMEWORK STRAND(S) & STANDARD(S)
UNIT 9: GRAVITATION AND OSCILLATIONS	2.5 WKS	Interaction of masses, “masslet” concept. Inverse square laws. Newton’s Law of Universal Gravitation. “g” and “G”. Gravitational and inertial mass. Coulomb’s Law. Kepler’s Laws 2nd Law and Conservation of Angular Momentum. 3rd Law derived (circular). Gravitational Potential Energy, escape velocity and classification of orbits. Gravitational fields inside and outside uniform sphere. Simple Harmonic Motion: differential equation for spring-like restoring forces. SHM: displacement, velocity and acceleration. SHM: Energy Mass on a spring: vertical Pendulum: small amplitude. Physical Pendulums. Resonance: over, under and critically damped. Forced oscillations and Q.	Student Will: Make inferences from observations. Understand measurement, data collection and analysis. Apply concepts to real world phenomena. Participate in peer discussion and evaluation. Use a computer for modeling with simulations. Understand mathematical modeling. Identify and use proportionality relationships. Work collaboratively. Practice lab safety.	Universal gravitation worksheet. 10 homework sets of ~5 textbook problems each. 5 group work sessions, ~2 problems each. 4 Lab Activities. Unit Test.	CONTENT STANDARDS: 1.7 SCIENTIFIC INQUIRY SKILLS: SIS1, SIS2, SiS3, SIS4. MATH SKILLS: ALL