El Monte Union High School District

Course Outline

High School District

Title: AP Physics C Mechanics
Transitional*_____(Eng. Dept. Only)

Sheltered (SDAIE)*____Bilingual*___

AP**__X____Honors**_____

Department:___Science_____

Grade Level (s):_____10-12_____

Semester_____X_____Year_____

Year of State Framework Adoption_____

This course meets graduation requirements:

( ) English
( ) Fine Arts
( ) Foreign Language
( ) Health & Safety
( ) Math
( ) Physical Education
(X) Science
( ) Social Science
( ) Elective

Department/Cluster Approval	Date

*Instructional materials appropriate for English Language Learners are required.

**For AP/Honors course attach a page describing how this course is above and beyond a regular course. Also, explain why this course is the equivalent of a college level class.

1. Prerequisite(s):
    - Pass the AP Calculus BC exam with a 3 or better or concurrently taking AP Calculus BC.
    - All students will be required to take the AP Physics C Mechanics exam in May.

2. Short description of course which may also be used in the registration manual:

This course ordinarily forms the first part of the college sequence that serves as the foundation in physics for students majoring in the physical sciences, engineering, or math. The sequence is parallel to or proceeded by mathematics courses that include calculus. Methods of calculus are used whenever appropriate in formulating physical principles and in applying them to physical problems. The sequence is more intensive and analytic than that in the B course. Strong emphasis is placed on solving a variety of challenging problems, some requiring calculus. The subject matter is principally mechanics, electricity, and magnetism. First semester is devoted to mechanics. Use of calculus in problem solving and in derivations is expected to increase as the course progresses. In the second semester, the primary emphasis is on classical electricity and magnetism. Calculus is used freely in formulating principles and in solving problems. Students will be expected to take the Advanced Placement Physics Exam in May.

3. Describe how this course integrates the schools ESLRs (Expected School-wide Learning Results):
    - Academic achievers
        - Students will participate in classroom discussions and on classroom projects.
        - Students will complete classroom and homework assignments.
        - Students will conduct lab investigations.

    - Critical thinkers:
        - Students will understand the process of goal setting and develop a personal plan for high school and beyond.
        - Students will conduct lab investigations that present problems to solve and use critical thinking skills.
        - Students will apply theoretical and practical knowledge acquired to everyday situations.

    - Competent users of technology:
        - Students will use word processing and presentation programs to present their work.
        - Students will use computers for research and development of projects.
        - Students will receive supervised Internet instruction and utilize the net as a tool to assist them in their class work.

    - Ethical and respectful individuals:
        - Students will be made aware of ethical behavior and the consequences for unethical behavior (cheating, copying, and plagiarizing).
        - Students will work cooperatively in diverse groups.
        - Students will be expected to assume personal responsibility for their actions and spoken words when working with other students.

    - Active community participants:
        - Students will be encouraged to respect diverse cultures within the classroom setting.
        - Students will be given opportunities to participate in school clubs and activities that respect cultural diversity.
        - Student will learn to work cooperatively with each other in groups when doing labs and projects.
        - Students will develop working relationships across gender and cultural groups.

4. Describe the additional efforts/teaching techniques/methodology to be used to meet the needs of English Language Learners:
    - SDAIE (Specially Designed Academic Instruction in English) strategies will be incorporated into lessons
    - Vocabulary development will be emphasize
    - Visuals/manipulatives will be used

5. Describe the interdepartmental articulation process for this course:

When applicable, the science department works with other departments to coordinate student work on course projects. All students take a course to introduce them to computer applications. The individual departments then build computer skills though assigning various projects requiring Power Point presentation, word processing, spreadsheet, and graphing. This course will work hand in hand with AP Calculus AB & BC classes. Projects will be assigned that will correlate with math intensively.

6. Describe how this course will integrate academic and vocational concepts, possibly through connecting activities. Describe how this course will address work-based learning/school to career concepts:

Students will be exposed to a variety of career pathways by attending field trips to colleges and corporations, such as JPL, having guest speakers come to inform students about their field, and evaluating current topics by analyzing case studies. A House Building project will consists of a floor plan, building of the house, wiring the house the lights, switches, and batteries, and also a presentation to sell the house to potential buyers. This project will teach students about architecture, planning, cost of materials, electrical planning and wiring, and the cost of building a real home and ways to sell the home.

7. Materials of Instruction (Note: Materials of instruction for English Language Learners are required and should be listed below.)

A. Textbook(s) and Core Reading(s):
Text: Halliday, D., Resnick, R., & Walker, J. (2010). *Fundamentals of physics*. (9th ed.). New Jersey: John Wiley & Sons, Inc.

B. Supplemental Materials and Resources:
- Supplementary materials provided by the publisher of the text.
- Standard supply lab materials, as necessary.

C. Tools, Equipment, Technology, Manipulative, Audio-Visual:
Visual presentations will be made using demonstrations, videos, models and/or presentations with an LCD projector. A variety of lab equipment will be utilized, such as lasers, mirrors, lenses, and rollercoaster sets.

8.

- **Objectives of Course**
  1. Learn Physics (both conceptually and analytically)
  2. Develop Problem Solving Skills
  3. Learn to Think Critically and Methodically as a physicist / engineer

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- **Unit detail including projects and activities including duration of units (pacing plan)**

Pacing Plan

1st Semester

1st 6 weeks

- **Math & Data Review**

Algebra Review, Data Collection & Analysis, and Vector Addition

- **Kinematics**

Motion in One Dimension and Two Dimension

- **Newton's Laws Math & Data Review**

Static Equilibrium (1st Law), Dynamics of a Single Body (2nd Law), Systems of Two/More Bodies (3rd Law). Gravitation, and Application

2nd 6 weeks

- **Work, Energy, & Momentum**

Work, Work-Kinetic Energy, Conservative Forces & Potential Energy, Conservation of Energy, and Power

- **Systems of Particles, Linear Momentum**

Center of Mass, Impulse & Momentum, Conservation of Linear Momentum & Collisions

3rd 6 weeks

- **Oscillations & Gravitation**

Simple Harmonic Motion, Pendulum, Newton's Law of Gravity, and Kepler's Laws

Indicate references to state framework(s)/standards (If state standard is not applicable then national standard should be used): The College Board Standards are addressed and implemented within the curriculum.

- **Course Outline**

1st Semester

Days	**Course Outline (Ch. In Fundamentals)**	**Lab Activities**
1	*Class Introductions/Policies*	
2	**Ch. 1: Unit & Measurement**	**Density lab** Finding the density of regular and irregular objects; Error Analysis
4	**Ch. 3: Vectors**	
	vector notation	
	vector addition and multiplication	Phet Simulation: Vector Addition
	1D motion using the kinematic equs.	
	2D motion, including projectile motion	.
	Error Analysis	
	Slopes of Motion Graphs	**Motion with uniform acceleration lab** Measure and graph position vs. time of a ball on a ramp and determine velocity and acceleration graphs using calculus.
	Graphing Data Review	Phet Simulation: Curve Fitting
5	**Ch. 2: Kinematics**	
	Displacement, Speed, Vel., Accel.	
	Kinematic Equations	
	Freefall	**Egg and golf ball drop Lab** Introduce the kinematics of free-fall and the role of air resistance
	Graphical Analysis of Vel. and Accel.	
5	**Ch. 4: 2D & 3D Motion**	
	Kinematics in Two Dimensions	
	Projectiles	**Projectile lab** Determine landing point on the floor of a projectile
	Relative Velocity	
5	**Ch. 5: Forces**	
	Limits and Derivatives	Phet Simulation: Calculus Grapher
	Newton's 1st Law	
	Newton's 2nd Law	Phet Simulation: Force in 1D

	Newton's 3rd Law	
6	**Ch. 6: Friction**	
	Applications of Newton's Laws	
	Friction	**Coefficient of friction lab** Determine the coefficient of static and kinetic friction.
	Dynamics of Circular Motion	**Whirligig Lab** Circular motion in a horizontal plane is investigated by whirling a rubber stopper.
	Drag Forces	**Coffee Filters Lab** Students investigate air resistance and terminal velocity with coffee filters. Students either use stopwatches or video cameras to capture time data.
12	**Ch. 7 & 8: Work & Conservation of Energy**	
	Work , Energy, and the Integral	
	Work - Energy Theorem	
	Conservative & Non-cons. Forces	**Rollercoaster lab** Build a model rollercoaster and measure key values (such as PE, KE, impulse, centripetal force).
	Conservation of Mechanical Energy	
	Power	**Your Power Lab** Measuring human power output walking stairs (watts & HP) and comparing w/power usage of common appliances
	Work Done by a Variable Force	
9	**Ch. 9: Center of Mass, Impulse, & Mom.**	
	Impulse-Momentum Theorem	**Falling Chain Lab** Students determine the force that a falling chain has on a table as a function of distance that the chain has fallen. Analysis requires use of calculus and interpretation of Force versus time graphs.
	Conservation of Momentum	
	Collisions	**Ballistic Pendulum Lab** Calculate velocity of an object fired into a block of wood.
	One and Two Dimensional	**2D Collisions Lab** Using an air table, students investigate 2D collisions and conservation of momentum
	Center of Mass	**Center of mass lab** Determine the center of mass for a four particle system using masses hanging from a meter stick balance.
13	**Ch. 10: Rotational Kinematics & Dynamics**	
	Rotational Motion and Angular Disp.	
	Angular Velocity and Acceleration	
	Moment of Inertia	**Moment of Inertia Lab** Students determine the moment of inertia of wheels of various sizes.
	Newton's second law for Rotation	
	Rotational Kinetic Energy	**Roller Derby with Different Types of Cylinders and Spheres Lab** Students investigate how the type of cylinder or sphere impacts the acceleration experienced by the shape as it rolls down an incline.
	Rolling Motion	
5	**Ch. 11: Cons. of Angular Momentum**	
	Torque & Angular Momentum	Phet Simulation: Torque
	Conservation of Angular Momentum	
4	**Ch.12: Torque & Static Equilibrium**	
	Conditions for Equilibrium	
	Static Equilibrium	

5	**Ch. 15: Oscillations**	
	Simple Harmonic Motion	
	Simple Spring and SHM	**Harmonic Motion Lab** Students obtain the spring force constant for a given spring using two methods
	Reference Circle and SHM	
	Energy and SHM	
	The Pendulum	**Pendulum Lab** Determine which variables affect the period of a simple pendulum.
	Stress, Strain, and Hooke's Law	
5	**Ch. 13: Gravitation**	
	Kepler's Laws	**Orbit of Mars Lab** Students plot the orbit of Mars (or other orbital simulation activity).
	Gravitational Potential Energy	
	Gravitational Field	

- **Evaluation/assessment/rubrics**

"A" –level of work (90-100 %)
"B" –level work (80-89%)
"C" – level work (70-79%)
"D" – level work (60-69%)

"F" – level work (50-59%)

The grade is weighted using the following percentages:
Tests/Quizzes – 55%
*Labs, Activities, Projects – 20%
Homework – 10%
Final Exam – 15%

*Approximately one class period per week/chapter will be devoted to laboratory/field experimentation. Labs will provide opportunities for students to solve problems, to form hypotheses, make observations, quantify/record data, interpret and analyze data and results, draw conclusions, think critically and apply what is explored in the course of their daily lives and future careers.