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# PETERS TOWNSHIP HIGH SCHOOL

## COURSE SYLLABUS: AP PHYSICS C: MECHANICS AND ELECTRICITY & MAGNETISM

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### **Course Overview and Essential Skills**

AP Physics C: Mechanics and AP Physics C: Electricity and Magnetism together represent a rigorous, year-long second year course of study in physics designed primarily for seniors in high school. Students are expected to have completed either AP Physics I (A/B grade) or Academic Physics (A grade) before taking this course. Since AP Physics C utilizes both algebraic manipulations and differential and integral calculus for problem solving throughout the course, calculus must be at least a co-requisite of this course. The AP Physics C exam is two separate exams, representing two semesters of college physics course work, with students being encouraged to take either one or both of the exams.

AP Physics C emphasizes a thorough understanding of physical principles and concepts and the advanced placement physics student is expected to develop sophisticated problem solving skills through which he/she is able to apply those principles and concepts to varied situations. The primary objectives of this course are as follows:

1. To read, understand, and interpret physical information.
2. To explain the sequence of steps in the analysis of a particular physical phenomenon or problem.
3. To use mathematical reasoning in a physical situation or problem.
4. To perform experiments and interpret the results of the observation.

Upon completion of the course, the student should have an appreciation of the world in which he/she finds him/herself, a working knowledge of physical principles, and an ability to think critically in problem solving situations.

Applications of the principles discussed are investigated in the laboratory.

### **Course Textbook and Required Materials**

- Textbook: *Physics for Scientists and Engineers*. Eighth Edition. Serway/Jewett. 2010. ISBN: 978-0-495-82781-8
- *Student Solutions Manual and Study Guide – Physics for Scientists and Engineers, 8<sup>th</sup> Edition, Volume 1*. Serway/Jewett. 2010. ISBN: 978-1-4390-4854-2
- *Student Solutions Manual and Study Guide – Physics for Scientists and Engineers, 8<sup>th</sup> Edition, Volume 22*. Serway/Jewett. 2010. ISBN: 978-1-4390-4852-8
- Lab notebooks (spiral notebook + 1 inch binder), class notebook, writing utensils, graphing calculator, ruler and protractor
- Edmodo.com

### **Course Outline of Material Covered:**

| Unit or Topic           | Concepts/Skills/Resources<br><b>*Note - Each unit includes HW, in-class activities, and quizzes as appropriate</b> | Timeframe |
|-------------------------|--|-----------|
| Mathematical Methods of | What is physics? Mathematical methods including  | 1.5 week  |

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| Physics                            | vectors of physics.<br>Faucet Lab; Error Analysis; Vector manipulation lab;<br>Quest Ch. # 1, 3  |           |
| Motion in One and Two dimensions   | Representations of constant and accelerated motion using diagrams, words, graphs, and mathematical manipulations including the use of derivatives and integrals; Equations of uniformly accelerated motion; Horizontal motion, free fall, projectile motion and uniform circular motion<br>Confronting misconceptions Lab; Demon Drop; Acceleration due to gravity Lab; Projectile studies; Kinematics with calculus quiz; Motion exam | 3.5 weeks |
| Forces And Newton's Laws of Motion | Forces; Newton's Three Laws of Motion; Force diagrams; Applications of Newton's Second Law<br>Inertial balance lab; Atwood machine lab; Coffee filter mini-lab; Flying pigs lab; Quiz Ch. #5, Exam Ch. #5, 6   | 3.5 weeks |
| Work and Energy                    | Work done by constant and variable forces; Work- Kinetic energy theorem; Energy – its forms and changes; Conservative vs. dissipative forces; Law of Conservation of Energy<br>Mousetrap mini-lab; Conservation of energy lab; Quiz Ch. #7; Exam Ch. #7, 8<br>(Trajectory project is assigned during November/December)  | 2.5 weeks |
| Impulse and Momentum               | Impulse; Linear momentum in one and two dimensions; Types of collisions; Law of Conservation of Linear Momentum; Center of mass<br>Egg drop mini-lab; Conservation of momentum lab; 2D collisions lab; Exam Ch. #9   | 2 weeks   |
| Rotational Kinematics and Dynamics | Rotational kinematics; Torque; Moment of inertia; Newton's Second Law for rotation; Angular momentum and its conservation; Static equilibrium<br>Yo-yo challenge lab; Torque and equilibrium lab; Determining the shape constant of a basketball lab; Quiz Ch. #10, Exam – Rotational motion   | 2 weeks   |
| Oscillatory Motion                 | Characteristics, equations and energy considerations of simple harmonic motion; Mass-spring systems; Simple, physical and torsional pendulums<br>Studies of springs lab; Quiz Ch. #15  | 1 week    |
| Gravity and Satellite Motion       | Law of Universal Gravitation; Kepler's Laws of Planetary Motion; Satellite motion<br>Kepler's Laws mini-lab; Gravity lab; Exam Ch. #12 – 15; First semester take home exam   | 1.5 weeks |
| Electric Forces and Fields         | Nature of charge; Coulomb's Law; Nature of the electric field; Electric field of a continuous distribution of charge; Motion in an electric field<br>Coulomb's law lab; Electric field mapping lab; Quiz Ch. #23   | 2 weeks   |
| Gauss's Law                        | Electric flux; Gauss's Law; Applications of Gauss's Law to various charge distributions<br>Electric field of a line of charge activity; Exam Ch. #23, 24   | 1.5 weeks |
| Electric Potential and Capacitance | Electric potential difference; Electric potential energy; Electric potential and energy for uniform fields, point charges and continuous charge distributions; Relationship between electric field and electric potential;   | 2.5 weeks |

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|   | Definition of capacitance; Determining capacitance; Energy storage in capacitors; Networks of capacitors; Capacitors with dielectrics<br>Millikan mini-lab; Capacitance and capacitors lab; Quiz Ch. #25; Exam Ch. #25, 26  |           |
| Current, Resistance and Electric Circuits   | Current; Resistance; Model of electric conduction; Electric Power; Electromotive force; Resistors in series and parallel; Kirchhoff's rules; Simple and multi-loop circuits; RC circuits<br>Playdoh lab; Ohm's Law lab; Joule heating lab; Wheatstone bridge lab; RC circuit lab; Quiz Ch. #27; Exam Ch. #27, 28                      | 2 weeks   |
| The Nature of the Magnetic Field            | Magnetic fields and magnetic forces; Motion of a moving charge in a magnetic field; Magnetic force on a current carrying wire; Torque on a current carrying loop in a magnetic field; Applications of the magnetic field<br>Magnetic field of a magnet lab; Quiz Ch. #29  | 2 weeks   |
| Sources of the Magnetic Field               | Biot-Savart Law; Magnetic forces between parallel conductors; Ampere's law; Solenoids; Gauss's Law for magnetism and magnetic flux; Sources of magnetism in matter<br>Magnetic field of a SLINKY lab; Exam Ch. #29, 30  | 1.5 weeks |
| Faraday's Law and Electromagnetic Induction | Faraday's Law of Electromagnetic Induction; Lenz's law; Motional emf; Generators and motors; Self inductance and inductance; RL circuits; LC circuits; RLC circuits<br>Build a motor mini-lab; Quiz Ch. #31; Exam Ch. # 30 – 32; Second semester take home exam   | 2 weeks   |
| AP Exam Preparation                         | Practice MC and FR questions, topics review   | 1 week    |
| Special Topics in Physics                   | Following the AP Exam additional lab activities in electricity and magnetism will occur. In addition, geometric and wave optics will be studied with labs on mirrors and lenses and determining the wavelength of red and green lasers through diffraction. Opportunities for student directed projects or research may be available. | 4-5 weeks |

***\*Depending on the needs of the class or changes in the school year, the course outline is subject to change.***