

Warren G. Harding High School

AP Physics B Syllabus

Course Overview

Advanced Placement Physics B is an algebra-based course in general physics. It is equivalent to an introductory algebra-based university level physics course, whose syllabus has been designed by the College Board. The Physics class meets 5 times per week for 42 minutes each day, with an additional 25 minute daily mentorship period which can be used for additional instruction or lab time, as needed. The major emphasis of the course is to understand the concepts of physics, and apply them along with formulae to solve problems. Laboratory experiments are done throughout reinforce the relationships and concepts currently being studied.

Texts: *Physics* by Giancoli, 6th edition, Pearson Education AP Test Prep Series *AP Physics B* by Connie J. Wells.

Course Outline

The following is a course content outline with an approximate time line. The amount of time spent on each topic corresponds to the percentages of material on the exam, as given in the AP Physics Course Description.

I. Introduction (2 weeks)

Unit 1: Math and Data Review (2 weeks) Giancoli: Ch 1 & 3

- A. Algebra/Trig Review
- B. Data collection and analysis
 - 1. Significant figures
 - 2. Unit conversion
- C. Vector addition
 - 1. Graphical methods
 - 2. Algebraic methods

II. Newtonian Mechanics (11 weeks)

Unit 2: Kinematics (4 weeks) Giancoli: Ch 2, 3, & 5

- A. Motion in One Dimension
 - 1. Position-time and velocity-time graphs
 - 2. Equations of motion under constant acceleration
- B. Motion in two dimensions
 - 1. Projectiles
 - 2. Circular motion

Unit 3: Newton's Laws of Motion (2 ½ weeks) Giancoli: Ch 4 & 8

- A. Static equilibrium (1st Law)
 - 1. First condition – translational equilibrium
 - 2. Second condition – rotational equilibrium (torque)
- B. Dynamics of a single particle (2nd Law)
- C. Systems of two or more bodies (3rd Law)

Unit 4: Work, Energy and Power (1½ weeks) Giancoli: Ch 6

- A. Work and the work-energy theorem
- B. Conservative forces and potential energy
- C. Conservation of energy
- D. Power

Unit 5: Systems of particles, linear momentum (1 week) Giancoli: Ch 7

- A. Impulse and momentum
- B. Conservation of linear momentum, collisions

Unit 6: Oscillations and gravitation (2 weeks) Giancoli: Ch 11 & 5

- A. Simple harmonic motion
- B. Mass on a spring
- C. Pendulum and other oscillations
- D. Newton's law of gravity
- E. Kepler's Laws

III. Fluid Mechanics & Thermal Physics (6 weeks)

Unit 7: Fluid Mechanics (3 weeks) Giancoli: Ch 10

- A. Density and pressure
 - 1. Density and specific gravity
 - 2. Pressure as a function of depth
 - 3. Pascal's Law
- B. Buoyancy – Archimedes' Principle
- C. Fluid flow continuity
- D. Bernoulli's equation

Unit 8: Thermal Physics (3 weeks) Giancoli: Ch 13, 14 & 15

- A. Temperature and heat
 - 1. Mechanical equivalent of heat
 - 2. Specific and latent heat
 - 3. Heat transfer and thermal expansion
- B. Kinetic Theory and Thermodynamics
 - 1. Ideal gases
 - a. Kinetic model
 - b. Ideal gas law
 - 2. Laws of thermodynamics

- a. First Law (PV diagrams)
- b. Second Law (heat engines)

IV. Electricity and Magnetism (7 weeks)

- Unit 9. Electrostatics (1½ weeks) Giancoli: Ch 16
- A. Charge, field and potential
 - B. Coulomb's Law and point charge field and potential
- Unit 10. Conductors and Capacitors (1 week) Giancoli: Ch 16 & 17
- A. Electrostatics with conductors
 - B. Capacitors – parallel plates
- Unit 11. Electric Circuits (2 weeks) Giancoli: Ch 18 & 19
- A. Current, resistance, power
 - B. Direct current circuits
 - C. Steady state capacitors in circuits
- Unit 12. Magnetostatics (1 week) Giancoli: Ch 20
- A. Forces on moving charges in magnetic fields
 - B. Forces on current carrying wires in magnetic fields
 - C. Fields of long current carrying wires
- Unit 13. Electromagnetic induction and waves (1 ½ weeks) Giancoli: Ch 21

V. Waves and Optics (4 ½ weeks)

- Unit 14. Wave Motion (sound and physical optics) (3 weeks) Giancoli: Ch 11 & 22
- A. Properties of traveling and standing waves
 - B. Doppler effect
 - C. Superposition
 - D. Interference and diffraction
 - E. Dispersion of light and the electromagnetic spectrum
- Unit 15. Geometric Optics (1½ weeks) Giancoli: Ch 23
- A. Reflection and refraction
 - B. Mirrors
 - C. Lenses

VI. Modern Physics (3 weeks)

- Unit 16. Atomic physics and quantum effects (2 weeks) Giancoli: Ch 27
- A. Alpha particle scattering and Rutherford model
 - B. Photons and the photoelectric effect
 - C. Compton effect
 - D. Bohr model (atomic energy levels)

E. Wave particle duality

Unit 17. Nuclear physics (1 week) Giancoli: Ch 30

- A. Atomic mass, mass number, atomic number
- B. Mass defect and nuclear binding energy
- C. Nuclear processes and radioactive decay
 - a. α decay
 - b. β decay
 - c. γ decay
- D. Mass-energy equivalence

Laboratory

The labs are strategically placed throughout the year where they best fit into the curriculum. Some of the labs involve the PASCO Sensor Technology or TI-83 CBL technology, but many are still done using traditional methods. The labs are made up of all three varieties, ranging from teacher directed to limited investigations to open-ended investigations. For the latter two types, they are presented with an objective or question, led in a class discussion to formulate a hypothesis concerning the problem, and left to use the assortment of materials provided to design an experiment and test the hypothesis. At the conclusion of the lab, a report is written which includes the purpose, background, hypothesis, procedure, data, necessary calculations and graphs, analysis, and conclusion. Errors that occurred will also be included with the report.

The following is a list of our potential labs and their types:

1. Measuring Temperature: CBL Temperature Probe, Open Ended
2. Analyzing Motion: PASCO Motion Sensor, Teacher Directed
3. Addition of Force Vectors: Limited Investigation
4. Accelerated Motion: PASCO Motion Sensor, Teacher Directed
5. Acceleration Due to Gravity: Open Ended
6. Projectile Motion: Teacher Directed
7. Range of a Projectile: Open-Ended
8. Circular Motion: Limited Investigation
9. Friction: Open Ended
10. Torques: Limited Investigation
11. Conservation of Energy: Teacher Directed
12. Conservation of Momentum: PASCO Motion Sensor, Teacher Directed
13. Hooke's Law: Limited Investigation
14. Archimedes Principle: Limited Investigation
15. Specific Heat: CBL Temperature Probe, Teacher Directed
16. Investigating Static Electricity: Limited Investigation
17. Ohm's Law: CBL voltage and current probe, Teacher Directed
18. Series Resistance: CBL voltage and current probe, Open Ended
19. The Nature of Magnetism: Open Ended
20. Standing Waves on a String: Limited Investigation
21. Resonance in an Open Tube: Teacher Directed

22. Intensity of Light: Limited Investigation
23. Snell's Law: Teacher Directed
24. Image Formation by Spherical Mirrors and Lenses: Limited Investigation
25. Double-Slit Interference: Teacher Directed
26. Photoelectric Effect: Teacher Directed

Classes

Classes generally consist of a 25 minute concept review of their reading assignment including applications and demonstrations, followed by 20-35 minutes of applied problem solving. The problems may be reviewing ones that were assigned for homework on a previous day, or working in class on ones that are assigned for the following day. Students will generally be allowed to work in pairs to help each other, as well as getting individual help from the instructor. A systematic approach to problem solving is modeled and encouraged throughout the year.

Evaluation

The students will be evaluated in the following areas:

1. Tests & Quizzes (50%)
2. Labs (25%)
3. Classwork/Homework (25%)

Tests will consist of both of multiple choice questions and free-response problems. Lab based questions will also be included. Students are permitted to use AP reference tables and calculators.