Curriculum Guide

Course *545*: *AP Physics B* **Level:** Grade 12

1. Course Structure

This full-year course meets four periods each week. There are no supplementary laboratory periods because investigations are incorporated into regular class periods.

2. Intended Audience

Advanced Physics is an elective course intended for senior students who have completed a year of physics with success.

3. Course Goals

Students in this course will build upon the following skills developed in their first year physics course: a solid understanding of many of the physical principles which govern our world, a proficiency in solving the mathematical problems which model the aforementioned physical principles, and the skills necessary to effectively collect and analyze laboratory data to form meaningful conclusions.

4. Course Objectives

Content:

I. *Light and Optics*
II. *Electricity*
III. *Magnetism*
IV. *Fluid Mechanics*
V. *Thermal Physics*
VI. *Atomic Physics*
VII. *Nuclear Physics and Relativity*

Skills:

- *Students will demonstrate habits of mind characteristic of physicists, including the constant questioning of how and why things happen in the physical world around them.*
- *Students will demonstrate an ability to solve physics problems in an ordered, logical fashion using a learned problem solving strategy.*
- *Students will become proficient in observing, recording, analyzing, and effectively reporting data collected in the laboratory.*
- *Students will be able to design and conduct meaningful investigations; they will recognize inherent limitations in experimentation, and they will design procedures that minimize sources of error.*
- *Students will demonstrate an ability to relate everyday experiences to the*

laws of physics. For example, students will be able to use Newton's three laws of motion to explain why seatbelts and airbags are necessary safety features in automobiles.

5. Essential Questions

I. Light and Optics
- *What are the characteristics of light?*
- *How does light behave?*
- *Is light a particle or a wave?*
- *How do mirrors and lenses work?*

II. Electricity
- *What force exists between stationary charges?*
- *How are electric fields and potentials different? What is the relationship between the two?*
- *What are the properties of a conductor?*
- *How do resistors and capacitors behave in a circuit?*

III. Magnetism
- *What is the relationship between electricity and magnetism?*
- *How is a magnetic field created?*
- *What is the relationship between a magnetic field and a magnetic force?*
- *How does a generator work?*

IV. Fluid Mechanics
- *What provides the buoyant force on an object?*
- *What are some applications of Bernoulli's Principle?*

V. Thermal Physics
- *Why do most objects expand when heated?*
- *What are the properties of an ideal gas?*
- *How are the first law and second law of thermodynamics related?*
- *How do heat engines and refrigerators work?*

VI. Atomic Physics
- *What does the photoelectric effect demonstrate?*
- *How can emission spectra be used to identify energy level changes within an atom?*

VII. Nuclear Physics and Relativity
- *What is binding energy?*
- *How do fission and fusion occur?*
- *What are the consequences of Einstein's postulates regarding the speed of light?*

6. Course Outline/ Curriculum Map

Quarter 1

I. Light and Optics

- *Physical Optics*
  - *Interference and diffraction*
  - *Dispersion of light and the electromagnetic spectrum*
- *Geometric Optics*
  - *Reflection and refraction*
  - *Mirrors (plane and curved)*
  - *Lenses*

Quarter 2

II. Electricity

- *Electrostatics*
  - *Charge, field, and potential*
  - *Coulomb's Law and field and potential of point charges*
  - *Fields and potentials of planar charge distributions*
- *Conductors, Capacitors, Dielectrics*
  - *Electrostatics with conductors*
  - *Parallel plate capacitors with dielectrics*
- *Electric Circuits*
  - *Current, resistance, power*
  - *Steady-state direct current circuits with batteries and resistors only*
  - *Steady-state circuits with capacitors*

III. Magnetism

- *Magnetostatics*
  - *Forces on moving charges in magnetic fields*
  - *Forces on current-carrying wires in magnetic fields*
  - *Fields of long current-carrying wires*
- *Electromagnetism*
  - *Electromagnetic induction (including Faraday's Law)*
  - *Lenz's Law*

Quarter 3

III. Fluid Mechanics

- *Hydrostatic Pressure*
- *Buoyancy*
- *Fluid Flow Continuity*
- *Bernoulli's Equation*

IV. Thermal Physics

- *Temperature and Heat*
  - *Mechanical equivalent of heat*
  - *Heat transfer and thermal expansion*
- *Kinetic Theory and Thermodynamics*
  - *Kinetic model of ideal gases*
  - *Ideal gas law*
  - *First law (including processes on PV diagrams)*
  - *Second law (including heat engines)*

Quarter 4

IV. Atomic Physics

- *Photons and the photoelectric effect*
- *Atomic energy levels*
- *Wave-particle duality*

V. Nuclear Physics and Relativity

- *Nuclear Reactions (including conservation of mass number and charge)*
- *Mass-energy equivalence*
- *Einstein's Theory of Special Relativity*

7. Course Text and Other Materials

The text for this course is:

- *Hecht, Eugene.* ***Physics: Algebra/Trig*** *Brooks/Cole (1998).*

Support materials include:

- *Physics Binder*
- *Graphing Calculator*

8. Instructional Methods and Course Activities

Content will be conveyed through:

- *Class dialogue and discussion*
- *Interactive lecture demonstrations*
- *Instructor-designed laboratory investigations*
- *Student-designed laboratory investigations*

9. Learning Strategies

- *Class discussion and problem-solving, accompanied by laboratory experiences, are designed to illustrate and reinforce physical*

principles learned in class.

- *Computer-assisted instruction (interactive lecture demonstrations, microcomputer based laboratories) will be used to increase learning and to support a variety of learning styles.*
- *The development and effective use of a problem solving strategy will also be used.*

10. Assessment

The assessment of students will occur through:

- *Evaluation of class preparation and participation*
- *Laboratory performance including observations, analysis, and reporting of data*
- *Formal testing and quizzing*

11. Course Evaluation

The assessment of this course will occur through:

- *Feedback from current students and graduates*
- *A formal student questionnaire*