

## Syllabus AP Physics B

Text: Physics by Giancoli 6<sup>th</sup> Edition Prentice Hall

Prerequisites: Successful completion of or concurrent enrollment Pre-Calculus or higher mathematics.

Physics is the study of naturally occurring phenomena. For those taking the Advanced Placement test at the end of the year, College Credit can be obtained from participating institutions. Student involvement in this process is imperative. Reading, doing problems, developing labs and maintaining a good set of notes along with a notebook of labs is required. This course is Algebra and Trigonometry based. Calculus concepts will be discussed. For most College majors, this course will count toward your degree program, if you score a 3, 4, or 5 on the AP Exam. The exam fee is approximately \$83.00.

For those not taking the course for the exam preparation, this is a good preparation for subsequent Physics classes with Calculus along with a good explanation of the principles behind all physical sciences. This course will also enhance your understanding of any math class you have had or are currently enrolled in, especially Calculus.

Each unit will include:

1. Introduction and objectives
2. Lab assignments – folder required
3. Problem sets – folder required for problem sets and exams
4. Exam

A unit may contain one or several chapters. The following topics will be covered this school year. All labs are “hands-on” and fall into three basic categories:

Fill-in-the-blank guided labs

Open ended Labs – self designed with specified equipment

Projects – research, design, perform, report

All labs follow the following outline:

Title

Purpose: Hypothesis based on in-class discussion or focus of each experiment

Procedure: including a materials list, setup and step by step procedure

Data collection tables and observation

Calculations using the collected data. Graphs to show relationships

Error analysis including possible sources of error

Suggestions for improving procedure to nullify error sources

## I. Optics

### a. Geometric Optics (chapter 23) ( Approximately 10 class days per topic)

- i. Reflection, refraction
- ii. Thin lenses, mirrors
- iii. Image formation
- iv. Optical devices \*  
Plane Mirror Lab  
Refraction Lab  
Lens Lab (6 cases of converging lens)  
Inversion Goggles Activity

### b. Sound and Waves Optics (chapter 11, 12, 24, 25)

- i. Interference, standing waves
- ii. Slits, gratings, diffraction
- iii. Polarizing, thin films \*
- iv. Doppler Effect
- v. Coherence, the laser
- vi. SHM – spring and pendulums
- vii. SHM
- viii. Resonance \*  
Slinky Lab(wave types and interactions)  
Spring Lab(SHM)  
Pendulum Lab(SHM)  
Speed of Sound Lab(resonance)  
Diffraction Grating Lab  
CD/ Album Lab(use laser to measure spacing)

## II. Mechanics

### a. Kinematics (2)

- i. Uniform acceleration
- ii. Analyzing motion
- iii. Vectors  
G – Lab(gravity)  
Terminal Velocity Lab(net  $F = 0$ )  
Toy Car Lab(constant  $v$ )  
Inertial Pendulum Lab  
Vector Lab(resolution of forces)

### b. Dynamics (3, 4)

- i. Newton's Laws of Motion
- ii. Systems of units
- iii. Friction

- iv. Gravitational force
- v. Projectile motion \*
  - Rocket Lab(projectile motion)
  - Atwood Machine Lab(Newton's Laws)
  - Friction Lab(coefficient of friction)
  - Inclined Plane Lab( $\text{Net } F = ma - F_f$ )
- c. Rotation (5, 8)
  - i. Linear and Angular analogies
  - ii. Circular motion, centripetal force
  - iii. Moment of inertia, angular momentum, rotational energy
  - iv. Kepler's Laws
    - Torque-Lever Lab
    - Centripetal Force Lab
    - Pulley Lab
- d. Statics (9)
  - i. Equilibrium, rotational and translational \*
  - ii. Center of gravity, center of mass
    - Center of Mass Lab
- e. Momentum, Energy and Work (6, 7)
  - i. Impulse and Momentum
  - ii. Conservation of momentum
  - iii. Work as a scalar product (dot product)
  - iv. Mechanical forms of Energy
  - v. Conservation of Energy
  - vi. Power \*\*
    - Power Lab(definition of Work, Power and Energy)
    - Barbie Bungee Project(conservation of energy)
    - Conservation of Energy Lab(linear and rotational)
    - Cork Gun – Ballistic Pendulum(inelastic collision)
    - Billiards Lab(elastic collisions)
    - Elastic Collision Lab(virtual)
    - Inelastic Collision Lab(virtual)
- f. Fluids (10)
  - i. Density
  - ii. Pressure
  - iii. Buoyancy
  - iv. Bernoulli's principle \*\*
    - Fe atom size lab
    - Buoyancy Lab

- Hydrometer Lab(build, calibrate, use)
- III. Heat and Thermodynamics (13, 14 , 15)
- a. Kinetic Theory
- i. Zero law of thermodynamics
  - ii. Thermal expansion
  - iii. First Law of Thermodynamics
  - iv. Specific Heat and latent heat
  - v. Heat transfer
  - vi. Ideal gases
  - vii. 2<sup>nd</sup> Law of thermodynamics \*\*
- Calorimeter Lab  
Heat of Fusion Lab  
Can Crush Lab  
Tennis Ball Cannon Project
- IV. Electricity and Magnetism
- a. Electricity (16, 17, 18, 19)
- i. Charge, Coulomb's Law
  - ii. Electric Field, potential
  - iii. Capacitors \*
  - iv. Ohm's Law, Power Laws
  - v. Kirchoff's Laws
  - vi. DC circuits \*
- Resistance Lab(compare resistoe stripe to actual R)  
Resistivity Lab  
DC Circuits:Series Lab/Parallel LabCombination Lab  
E-Field/Equipotential Lab  
RC Circuit Lab
- b. Electromagnetism ( 20, 21, 22)
- i. Moving charges in a magnetic field
  - ii. Magnetism laws
  - iii. Electromagnetic waves \*\*
- Magnetic Field Lab  
Solenoid Lab
- V. Modern Physics
- a. Relativity (26)
- i. Inertial frames of reference
  - ii. Special relativity
    1. time dilation
    2. mass dilution

3. length contraction
  4. Mass-energy equivalence \*
- b. Atomic Physics (27, 28, 29)
- i. Charge and mass of electron
  - ii. Photoelectric effect, photons \*
  - iii. Uncertainty Principle
  - iv. Nuclear Atom
  - v. Bohr Atom
  - vi. Basic Quantum mechanics \*\*
- c. Nuclear Physics(30, 31, 32)
- i. Radioactive decay, transmutations
  - ii. Conservation laws
  - iii. Nuclear stability, binding
  - iv. fission, fusion
  - v. Elementary particles \*\*

Radioactivity Lab

\* normal exam locations

\*\* major exam locations