

**AP Physics
Syllabus 2007-2008**

Mr. Fox

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Prerequisites: A or B in Honors Physics and teacher recommendation

Course Description:

This is the second year of a physics course, which covers the following topics: Newtonian Physics (Mechanics), Fluids, Waves, Thermodynamics, Electricity and Magnetism, and Atomic Physics. Mathematical modeling and laboratory investigations are an integral part of the AP physics course.

This course will follow a very fast pace, covering an average of one chapter per week. Students are expected to do a large amount of independent learning and are responsible for information from the text as well as from the instructor. Class will meet Monday, Thursday, and Friday for 48 minutes and Wednesday for 85 minutes (lab).

Course Objectives:

- Teach students the basic paradigms of physics
- Develop an appreciation for the "physics" approach to studying nature
- Develop and hone effective study skills
- Prepare students for the rigors of college course work
- Prepare students for the AP exam in Physics B on **May 14**.
- Students enrolled in AP physics are expected to take the AP Physics exam

Course Text:

Physics, 4th Ed. Prentice Hall, 1995, by Douglas Giancoli

Course Requirements:

Students are expected to bring the following to each class:

- scientific or graphing calculator
- notebook
- textbook
- AP information table

Course Content (Approximate Timetable):

- I. Newtonian Mechanics (45 days)
 - A. Motion in one dimension (ch. 2)
 1. Speed
 2. Reference frames
 3. Velocity and displacement
 4. Vectors and scalars
 5. Acceleration
 6. Falling bodies
 - B. Motion in two or three dimensions (ch. 3)
 1. Addition and subtraction of vectors

2. Relative velocity
3. Projectile motion
- C. Motion and force (ch. 4)
 1. Force
 2. Newton's first law
 3. Mass
 4. Newton's second law
 5. Newton's third law
 6. Weight and the normal force
 7. Vectors and free-body diagrams
 8. Friction
- D. Circular motion (ch. 5)
 1. Kinematics of uniform circular motion
 2. Dynamics of uniform circular motion
- E. Gravitation (ch. 5)
 1. Newton's law of universal gravitation
 2. Gravity near the earth's surface
 3. Satellites and "weightlessness"
 4. Kepler's laws
- F. Work and energy (ch. 6)
 1. Work done by a constant force
 2. Kinetic energy and the work-energy principle
 3. Potential energy
 4. Mechanical energy
 5. Conservation of energy
- G. Linear momentum (ch. 7)
 1. Momentum and force
 2. Conservation of momentum
 3. Collisions and impulse
 4. Conservation of energy and momentum in collisions
 5. Elastic collisions in one dimension
 6. Inelastic collisions
 7. Center of mass
- H. Rotational motion (ch. 8)
 1. Angular quantities
 2. Kinematic equations for uniformly accelerated rotational motion
 3. Torque
 4. Torque and rotational inertia
 5. Rotational kinetic energy
 6. Angular momentum and its conservation
- I. Equilibrium (ch. 9)
 1. Statics
 2. The conditions for equilibrium
- II. Fluid Mechanics (ch. 10) (5 days)
 1. Density and specific gravity
 2. Pressure in fluids
 3. Atmospheric pressure and gauge pressure
 4. Pascal's principle
 5. Measurement of pressure
 6. Buoyancy and Archimedes' principle
 7. Fluids in motion
 8. Bernoulli's equation

III. Thermodynamics (15 days)

- A. Temperature and kinetic theory (ch. 13)
 - 1. Atoms
 - 2. Temperature
 - 3. Thermal expansion
 - 4. Thermal stresses
 - 5. The gas laws and absolute temperature
 - 6. The ideal gas law
 - 7. Avogadro's number
 - 8. Kinetic theory
 - 9. Distribution of molecular speeds
- B. Heat (ch. 14)
 - 1. Heat as energy transfer
 - 2. Temperature, heat, and internal energy
 - 3. Internal energy of an ideal gas
 - 4. Specific heat
 - 5. Calorimetry
 - 6. Latent heat
 - 7. Heat transfer
 - i. conduction
 - ii. convection
 - iii. radiation
- C. The Laws of thermodynamics (ch. 15)
 - 1. The first law of thermodynamics
 - 2. The second law of thermodynamics
 - 3. Heat engines
 - 4. Entropy and the second law of thermodynamics
 - 5. Order to disorder
 - 6. Unavailability of energy; heat death

IV. Electricity and Magnetism (40 days)

- A. Electric charge and electric field (ch. 16)
 - 1. Static electricity
 - 2. Electric charge and its conservation
 - 3. Electric charge in the atom
 - 4. Insulators and conductors
 - 5. Induced charge
 - 6. Coulomb's law
 - 7. The electric field
 - 8. Field lines
 - 9. Electric fields and conductors
- B. Electric potential and electric energy (ch. 17)
 - 1. Electric potential and potential difference
 - 2. Relation between electric potential and electric field
 - 3. Equipotential lines
 - 4. The electron volt
 - 5. Electric potential due to single point charges
- C. Capacitance (ch. 17)
 - 1. Capacitance
 - 2. Dielectrics
 - 3. Storage of electric energy
 - 4. Thermionic emission and the cathode-ray tube
- D. Electric currents (ch. 18)

1. The electric battery
 2. Electric current
 3. Ohm's law: resistance and resistors
 4. Resistivity
 5. Electric power
 6. Alternating current
- E. DC circuits (ch. 19)
1. Resistors in series and parallel
 2. EMF and terminal voltage
 3. Kirchoff's rules
 4. EMFs in series and in parallel
 5. Circuits containing capacitors in series and in parallel
 6. Circuits containing a resistor and a capacitor
- F. Magnetism (ch. 20)
1. Magnets and magnetic fields
 2. Electric currents produce magnetism
 3. Force on an electric current in a magnetic field
 4. Definition of **B**
 5. Force on an electric charge moving in a magnetic field
 6. Magnetic field due to a straight wire
 7. Force between two parallel wires
- G. Electromagnetic induction (ch. 21)
1. Induced EMF
 2. Faraday's law of induction
 3. Lenz's law
 4. EMF induced in a moving conductor
 5. Changing magnetic flux produces an electric field
 6. Electric generators
 7. Transformers
- V. Harmonic Motion and Waves (20 days)
- A. Vibrations and waves (ch. 11)
1. Simple harmonic motion
 2. Energy in the simple harmonic oscillator
 3. The simple pendulum
 4. Damped harmonic motion
 5. Forced vibrations
 6. Resonance
 7. Wave motion
 8. Types of waves
 9. Reflection and interference of waves
 10. Standing waves
- B. Sound (ch. 12)
1. Characteristics of sound
 2. Intensity of sound
 3. Sources of sound
 4. Doppler effect
- C. Electromagnetic waves (ch. 22)
1. Changing electric fields produce magnetic fields
 2. Maxwell's equations
 3. Production of electromagnetic waves
 4. Light as an electromagnetic wave
 5. The electromagnetic spectrum

- D. Light: Geometric optics (ch. 23)
 - 1. The ray model of light
 - 2. The speed of light and index of refraction
 - 3. Reflection: image formation by a plane mirror
 - 4. Refraction: Snell's law
 - 5. Total internal reflection
 - 6. Thin lenses
 - 7. Ray tracing
 - 8. The lens equation
- E. The wave nature of light (ch. 24)
 - 1. Huygens' principle and diffraction
 - 2. Huygens' principle and the law of refraction
 - 3. Interference – Young's double slit experiment
 - 4. The visible spectrum and dispersion
 - 5. Diffraction by a single slit or disk
 - 6. Diffraction grating
 - 7. The spectrometer and spectroscopy
 - 8. Interference by thin films
 - 9. Polarization
- VI. Atomic and Nuclear Physics (20 days)
 - A. Early quantum theory and models of the atom (ch. 27)
 - 1. Discovery and properties of the electron
 - 2. Planck's quantum hypothesis
 - 3. Photon theory of light
 - 4. The photoelectric effect
 - 5. Photon interactions; Compton effect and pair production
 - 6. Wave-particle duality
 - 7. Wave nature of matter
 - 8. Early models of the atom
 - 9. Atomic spectra: key to the structure of the atom
 - 10. The Bohr model
 - 11. de Broglie's hypothesis
 - B. Quantum mechanics of atoms (ch. 28)
 - 1. Quantum mechanics
 - 2. The wave function and its interpretation; the double-slit experiment
 - 3. The Heisenberg uncertainty principle
 - 4. Quantum-mechanical view of atoms
 - 5. Quantum mechanics of the hydrogen atom
 - 6. Quantum numbers
 - 7. Complex atoms; the exclusion principle
 - 8. The periodic table of elements
 - 9. X-ray spectra and atomic number
 - C. Nuclear physics and radioactivity (ch. 30)
 - 1. Structure and properties of the nucleus
 - 2. Binding energy and nuclear forces
 - 3. Radioactivity
 - 4. Alpha decay
 - 5. Beta decay
 - 6. Gamma decay
 - 7. Conservation of nucleon number and other conservation laws
 - 8. Half-life and rate of decay
 - 9. Calculations involving decay rates and half-life

- 10. Decay series
- 11. Radioactive dating
- D. Nuclear energy (ch. 31)
 - 1. Nuclear reactions and the transmutation of elements
 - 2. Nuclear fission
 - 3. Fusion
 - 4. Passage of radiation through matter
 - 5. Measurement of radiation

Possible Laboratory Experiments:

- 1. Measurement lab
- 2. Speed and acceleration down an inclined plane
- 3. Measuring the acceleration due to gravity
- 4. Projectile lab – “Hit the cup”
- 5. Measuring the coefficient of friction
- 6. Centripetal force lab
- 7. Determining the work and power of different muscle groups
- 8. Conservation of momentum lab
- 9. Statics lab – balanced forces
- 10. Density
- 11. Hooke’s law
- 12. Speed of sound
- 13. Thermal expansion
- 14. Calorimetry
- 15. Static electricity
- 16. Series and parallel circuits – Ohm’s law
- 17. The earth’s magnetic field
- 18. Image formation by spherical mirrors and lenses
- 19. Determining the wavelength of a laser – Young’s double slit experiment
- 20. Atomic spectra
- 21. Physics Day at Canobie Lake Park – The physics of amusement park rides

Quarterly Grading Standards:

- 50% Written Examinations
- 20% Homework Readings and Problems
- 20% Labs / Activities
- 10% Classwork / Participation

Final Grade Standards:

- Quarterly grades: 20% each
- Midyear Exam and Final Exam: 10% each

Description of Quarterly Grading Standards

Written Examinations

The written exams will be administered approximately every two chapters and will typically have the following format:

- Multiple choice - 10 questions (20 points total)
- Problems - tests students' problem solving abilities using equations and principles developed in class (30 points total)

Questions will mostly consist of questions from past AP physics examinations or will be similar in design to typical AP questions. These questions will consist of problem solving as well as questions concerning concepts covered in class.

Homework Readings and Problems

There will be several types of homework assignments

Reading notes - should be located in **reading notes** section in your notebook

Problems - should be located in **problem solving** section of your notebook

Problems and questions will be checked for completion on the day that these assignments are due. Homework will either be collected or checked for completeness by the instructor on the day it is due. Late assignments may be turned in for half credit up until the test on the material the assignment covers.

Labs / Activities

Labs and activities will be conducted on a semi-weekly basis. Lab work will either be collected or inserted into the notebook. Formal lab reports will be completed several times each term and should be completed according to the "Formal Lab Report Format" that the instructor will go over in class.

Labs are hands-on activities that will expand upon topics covered during class in order to improve student understanding. Some labs will have specific procedures to follow, but many labs will require students to determine their own procedure based on the objective of the lab.

Classwork / Participation

Students are expected to actively participate in class activities and discussions.

I (the parent/guardian) of _____ have read and understand the
(student name)
syllabus for AP Physics.

parent/guardian signature