

Advanced Placement Physics (2007-2008 School Year)

Mr Morse

Course Description

This two semester course meets each day for one 45 minute period and is structured as an equivalent to a one year college physics course normally taken by students in life sciences, premedicine and some applied sciences. It also provides excellent preparation for students intending to major in physics, engineering or other physical sciences. The course includes topics in Newtonian mechanics, electricity and magnetism, optics, fluid mechanics, thermal physics and atomic and nuclear physics. All students are expected to take the AP B Physics exam in May 2008. Colleges may offer course credit to entering students, depending on their scores on the AP test. Students will perform a number of hands-on, open-ended laboratory experiments and investigations. The details of these labs will be reported in the laboratory notebooks. A formal lab report will be required for some labs. Students should ensure that they keep their laboratory notebooks after completion of the course because some colleges may request to inspect them before issuing course credit. The course uses a college level text and will be paced and graded as would a college physics class.

First Semester

Week	Topics
<u>1st quarter</u>	
1	<u>Newtonian Mechanics</u> <i>Chapter 1 – introduction:</i> physics skills – measurements and calculations <i>Chapter 2 – kinematics in one dimension:</i> motion in one dimension, speed, velocity and acceleration
2	Constant acceleration, falling objects, graphical analysis
3	<i>Chapter 3 – kinematics in two dimensions:</i> two dimensional motion – vectors and scalars, vector math, projectiles
4	<i>Chapter 4 – Newton's laws of motion:</i> force and mass, weight, free body diagrams, inclined planes, <u>test on chapters 1-4</u>
5	<i>Chapter 5 – circular motion and gravitation:</i> kinematics of circular motion, highway curves, Newton's law of universal gravitation
6	<i>Chapter 6 – work and energy:</i> work and force, work-energy equivalence, conservative and nonconservative forces
7	Kinetic and potential energy, mechanical energy, work-energy problem solving, <u>test on chapters 5-6</u>
<u>2nd quarter</u>	
8	<i>Chapter 7 – linear momentum:</i> linear momentum, conservation of momentum, collisions and impulse
9	<i>Chapter 8 – rotational motion:</i> angular quantities, angular velocity and angular acceleration, torque
10	<i>Chapter 9 – static equilibrium:</i> conditions for equilibrium, statics problems,
11	<u>Test on chapters 7-9</u>
<u>Fluid Mechanics</u>	
12	<i>Chapter 10 – fluids:</i> nature of fluids, gauge and absolute pressure, Pascal's principle, Archimedes principle and buoyancy Continuity equation, Bernoulli's equation, fluids problems

Waves

- 13 *Chapter 11 – vibrations and waves:* simple harmonic motion, simple pendulums, damped harmonic motion, wave motion, types of waves, energy transport, reflection and transmission
- 14 Interference, standing waves, refraction and diffraction
Chapter 12 – sound: characteristics of sound, organ pipes, stringed instruments, interference and beats, Doppler effect
- 15 Solving sound problems, test on chapters 10-12, first semester review
- 16 First semester exam

Second Semester

Week	Topics
<u>3rd quarter</u>	
<u>Optics</u>	
1	<i>Chapter 23 – geometric optics:</i> ray model of light, mirrors and types of images, ray tracing, refraction and Snell's law, thin lenses
2	<i>Chapter 24 – wave nature of light:</i> light as a wave, Huygens' principle, Young's experiment, dispersion, diffraction, diffraction gratings, thin films
3	Polarization of light, review of optics, <u>test on chapters 23-24</u>
<u>Electricity and Magnetism</u>	
4	<i>Chapter 16 – electric charges and fields:</i> nature of electric charge, Coulomb's law, electric fields, electric field lines, electric field surrounding point charges
5	Gauss's law <i>Chapter 17 – electric potential:</i> electric potential energy, electric potential and electric fields, electric potential difference and work
6	Capacitance, electric energy storage <i>Chapter 18 – electric currents:</i> batteries, current, Ohm's law, resistivity, electric power, alternating current
7	<i>Chapter 19 – DC circuits:</i> EMF, internal resistance and battery terminal voltage, resistors in series and parallel
8	Kirchoff's rules, capacitors in series and parallel, voltage and current in RC circuits, ammeters and voltmeters
9	<u>Test on chapters 16-19</u> <i>Chapter 20 – magnetism:</i> magnets and magnetic fields, magnetic force on a current carrying wire
<u>4th quarter</u>	
10	<i>Chapter 21 – electromagnetic induction:</i> electromagnetism, magnetic flux, Faraday's law
11	Lenz's law, induced EMF, electric generators, <u>test on chapters 20-21</u>
<u>Thermal Physics</u>	
12	<i>Chapter 13 – temperature and kinetic theory:</i> temperature, thermometers, thermal equilibrium, thermal expansion, ideal gas law, Avogadro's hypothesis, kinetic theory and molecular basis of temperature
13	<i>Chapter 14 – heat:</i> heat as energy transfer, mechanical equivalent of heat <i>Chapter 15 – thermodynamics:</i> first law of thermodynamics, thermodynamic processes, PV diagrams, work in thermodynamic processes, second law of thermodynamics, heat engines, Carnot cycle

14 Test on chapter 13-15

Atomic and Nuclear Physics

Chapter 27 – early models of the atom: Planck's quantum hypothesis, photoelectric effect, photon theory of light, energy and linear momentum of a photon, Compton effect

15 Wave-particle duality, wave nature of matter, Davisson-Germer experiment, atomic spectra and electron energy levels

Chapter 30 – nuclear physics: structure and properties of the nucleus, mass numbers and nuclear charge, binding energy and radioactivity, alpha decay, beta decay, gamma decay, mass-energy equivalence, nuclear reactions

16 *Chapter 31 – nuclear energy:* nuclear reactions, fission, test on chapters 27,30,31

17 Course review and AP exam preparation

18 AP Exam (Monday May 12), lab investigations

19 Lab investigations and special topics

Labs

Laboratory experiments form an integral part of the AP Physics class. Labs will be included as part of each unit of study. All labs will be hands-on and will sometimes span two regular class periods. Most labs will be posed as questions to be investigated or problems to be solved. As they proceed with the lab, students are encouraged to formulate additional related questions of their own and to investigate these questions as well. Equipment will be provided, but the details of how to perform experiments are normally to be determined by the student. A variety of computer based sensors will be provided to facilitate accurate collection of data when appropriate. When using computer based sensors, students should save the data on the laptop computers for future analysis. The data can be transferred to student provided flash drives or “memory sticks” for analysis at home. All students will receive a copy of the Vernier LoggerPro software that they can load on home computers. This software is an excellent tool for data plotting and analysis.

Planned Labs (generally 1 class period per lab, expansion to 2 class periods as needed)

Lab	Goal
Free-fall acceleration	plot velocity vs time and determine g
Motion on an inclined plane	determine the value of coefficient of friction
Atwood's machine	plot acceleration vs mass delta, correlate with theory
Determination of g on an incline	plot acceleration vs incline slope, determine g, correlate with theory
Bungee jump acceleration	plot acceleration vs time, analyze to find max, min acceleration and free-fall, correlate with theory
Linear momentum, energy and collisions using dynamics carts	observe and measure energy changes during completely inelastic collisions
Determination of the speed of sound	find speed of sound using resonance tube
Mirrors and convex lenses	measure image and object distances, correlate with theory
Wavelength of a laser	find wavelength of laser using CD or DVD
Ohms law	find relationship between I,R and V, correlate with theory

Series and parallel circuits	measure I and V for various circuits, correlate with theory
RC circuits	plot voltage and current vs time, find mathematical relationship, correlate with theory
Simple DC motor	build a simple motor using battery, magnet and wire
Efficiency of motors	measure work done, power used, determine efficiency
Photoelectric effect	find Planck's constant using simple LED circuit

Grading

<u>1st semester</u>	<u>2nd semester</u>	
60%	70%	Tests
10%	-	Final exam
20%	20%	Homework/class participation
10%	10%	Lab notebooks and lab reports

Tests will be given four or five times each semester. Tests will cover a related set of concepts spanning several chapters in the text. A final exam covering major topics in Newtonian mechanics, fluid mechanics and waves will be given at the end of the first semester. This final exam will span two class periods - one period devoted to multiple choice questions, one period devoted to free response questions.

Lab notebooks will be collected and graded at least once per quarter. The lab notebook is bound and quadrille ruled and must be completed according to science class lab notebook guidelines. Details are specified in a separate lab notebook guideline document that will be distributed in class. Basic requirements are these:

- Table of contents at beginning of lab notebook listing all labs by title and page number
- Title of lab indicated on every page used to document each lab
- Alphanumeric date indicated on each page documenting each lab
- Lab partners indicated on each page documenting each lab
- Any handouts provided for lab are attached to pages in lab notebook
- Introduction section written at beginning of entry for each lab
- Discussion/conclusion section written at end of entry for each lab
- Signature and date at end of entry for each lab
- Large empty spaces in lab notebook marked with large "X" to indicate no entry of data
- Erroneous entries crossed out (but still legible) – no erasures or whiteout
- All entries made in black pen

Lab reports will be required for many lab experiments performed in class. Experiments requiring these reports will be specifically identified as the course proceeds. Lab reports are intended to be a brief (1-2 single spaced typed pages) summary of the experiment performed by the student. Strive for conciseness, clarity and readability – longer is not better. Be sure to highlight "extension" areas in your experiments where you have expanded your investigations beyond answering the original question posed for the lab. Lab reports should follow the following template. Include each section listed below in every report and label the sections. Try to include a graph of your data in every report. If possible use a computer tool such as Excel or the Vernier Data Pro software to analyze and plot the data.

Title – the name of the experiment performed. Normally this will be the name assigned in class and written in your lab notebook.

Introduction – explains the hypothesis you set out to test or problem you set out to solve. It could include a summary of information you already know from previous studies and how that knowledge would be expanded, challenged or verified by doing the experiment. If appropriate it could include references to specific scientific laws or theories.

Materials and methods – provides a brief description of what you did. It should include a list of the materials and equipment used and a description of the experimental procedure. Provide enough detail that another student would be able to perform a similar experiment by referring to this section. Include the names of your lab partner(s) in this section.

Results - summarizes the key data gathered in the experiment. You don't need to include all your measurements – this should already be in your lab notebook. Just provide a summary of the data in the form of a simple table or graph to enable the reader to quickly understand your results. Make an effort to present data in a way that enables the reader to quickly grasp trends and relationships between measurements. Graphs can be especially effective at doing this. Use a computer tool such as Excel or Vernier LoggerPro to generate the graph. If you use a graph, you don't need to also include a table with all the data. Explain how the data relate to the hypothesis you are testing or problem you are solving.

Discussion – explains your interpretation of the results of the experiment. Did the experiment provide a valid test of your hypothesis? Did it support or refute your hypothesis? Did you solve the problem? What were the likely sources of error? Include possible ways to minimize errors and improve the overall experimental process.

Homework will be assigned almost every day. Regular completion of homework is essential to success in physics class. Most homework assignments will be submitted electronically by using an internet based service called WebAssign. Each student will receive login information for WebAssign during the first week of class. WebAssign will provide instant grading and feedback for each homework assignment as well as other features that will be explained in class. To provide additional feedback on homework, we will allocate time at the beginning of each class for detailed homework discussion. In addition to written homework assignments, students will be required to read material from the text and from selected other sources. Students are expected to complete the reading assignments and be ready to participate in class discussions based on these assignments. Class participation will be partly evaluated on the student's ability to discuss key points covered in the reading assignments.

Text

Giancoli – Physics: Principles with Applications, 6th edition
Upper Saddle River, NJ: Pearson Prentice Hall, 2005

Course expectations

1. Each student will take the AP Physics B exam. This exam is scheduled for Monday May 12, 2008.
2. Each student will attend several supplemental class sessions held after school or on the weekend. It is expected that there will be two or three of these sessions held during the month prior to the AP exam. The sessions will cover material that may be tested on the exam, but has not been discussed during normal class time. One session will be dedicated to taking an actual AP exam from a previous year.

3. It is suggested that students form study groups to help them review material prior to the AP exam. The exam is difficult and covers a wide variety of topics spanning two semesters of class work. Review work should begin no later than a month prior to the exam.
4. During the 4th quarter, each student will complete 50 free response questions from previous AP Physics B exams as part of the homework assignments. These questions can be done cooperatively in student study groups, but each student must turn in his or her own answers to each question. The questions will be checked for completion once a week during the 8 weeks prior to the AP exam.

Course materials and other requirements

1. A scientific calculator that provides trigonometric functions (sine, cosine, etc), logarithms and scientific notation. Graphing capability and an equation solver will prove useful. A calculator such as TI-83 or TI-84 is a good choice. A basic scientific calculator with a one line display is adequate to perform the calculations, but it will be easier to keep track of your calculations on a multi-line display. Much of the course work will consist of solving problems. Students must bring their calculator to class every day.
2. Bound lab notebook. (Most students will use notebooks started in previous science classes.)
3. A Student Safety Contract read, understood and signed by the student and his/her parent or guardian. For everyone's safety in the lab, terms of the safety contract will be strictly enforced.
4. A copy of this course description sheet signed by the student and his/her parent or guardian, acknowledging having read it.
5. Log-in account on WebAssign. During the first week of class, each student will receive a log-in profile that can be used to access this account.
6. (Suggested) Purchase an AP Physics B review book. These are available at any good bookstore. Several examples will be available in class for your inspection. There are a number of good choices. I suggest avoiding a book that includes both Physics B and Physics C material. Physics B and Physics C are two different exams which cover different material at different levels. Focus your review just on the material that will be covered on the Physics B exam. You will find this sufficiently challenging!

Signatures

Each student and his/her parent or guardian is to sign this course description sheet, acknowledging having read it. Please return this page of the course description to Mr. Morse.

Additional copies of this course description are available on the Ridgeview Classical Schools website: www.ridgeviewclassical.com.

Student signature

Parent/guardian signature