Course Title: Advanced Placement Physics B-DL

Meeting Times: This course runs for 36 weeks. Students engage in the online class according to the same academic calendar of their schools. Additionally, they can expect to spend additional time on student activities such as reading, writing, researching and completing assignments.

Course Description:

AP Physics B provides an orderly development of the fundamental concepts and principles of physics with an emphasis on inquiry and critical thinking skills including: problem solving, mathematical reasoning, and experimental investigations. Topics of study from classical and modern physics include: Newtonian mechanics, fluid mechanics and thermal physics, electricity and magnetism, waves and optics, and atomic and nuclear physics. Laboratory work is an integral component of this course. Technology including graphing calculators, probeware, graphing and data analysis software, and physics apparatus is used throughout this course.

Though our system has an open enrollment policy, students should understand that this course is designed to be a second year physics course, and the equivalent of a yearlong introductory, algebra-based, college level physics course. The course requires a working knowledge of physics, algebra and basic trigonometry. The breadth, pace and depth of material covered exceeds the standard high school Physics course, as does the college-level textbook, laboratory work, and time and effort required of students. This course provides the physics foundations for college majors in the life sciences, pre-medicine, applied sciences, and non-science fields. AP Physics B provides a more conceptual understanding and approach than AP Physics C. Students are expected to take the AP Physics B Exam at the end of this course.

Course Purpose and Goals:

Philosophy

Scientific inquiry is the basis of this course. Scientific inquiry is defined as the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Scientific inquiry also refers to the activities through which students develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world (NSTA, 2004). This includes active use of the well-designed investigation in which students: 1) form testable questions and hypotheses, 2) design and conduct appropriate investigative procedures, including the identification and control of appropriate variables, 3) organize, display and critically analyze results, 4) draw inferences, summarize results and develop conclusions, and 5) communicate their results for critique by others. Based on the philosophy that scientific knowledge is best acquired through inquiry, the course uses a variety of techniques to promote inquiry in the classroom (ex. multiple revisions, high quality questioning, synthesis, making conclusions based on evidence, etc).

Instruction is designed and sequenced to provide students with learning opportunities in the appropriate settings. They include laboratories, classrooms, forms of

technology, and field studies. Teaching strategies include in depth laboratory investigations, demonstrations, collaborative peer-to-peer discussions, and student hands-on experiences. Inquiry requires adequate and timely access to the technology of scientific investigations including computers, internet and online resources, probeware, graphing calculators, databases, spreadsheets, word processes and presentation software, as well as the experimental apparatus of physics.

Goals

1. To understand the fundamental concepts and principles of physics through the investigation of physical phenomena, theories and experimental methods.
2. To develop problem solving skills, and mathematical reasoning, through the active asking and answering of testable questions, and employing the components of a well-designed experimental investigation.
3. To foster scientific habits of mind including curiosity, creativity, and objectivity.
4. To understand the interconnections of physics to the other sciences, society, culture, and technology.

The course is designed in accordance with the College Board AP Physics B Course Description, May 2006, May 2007. This instructor has read this document and incorporates its principals into instruction.

Conceptual Organization

In this course, the students are exposed to the equivalent of a college introductory physics course, meaning that the content and level of depth of the material is equivalent to a college level course. As with university courses, it is expected that students will be independent learners. Scientific inquiry is an integral component of this course, the elements of the well-designed investigation and the nature of the scientific methods are taught within the context of the topics, rather than treated as a separate introductory unit. As students investigate phenomena they extend their understanding of forming testable questions and hypotheses. Laboratory techniques are learned in the direct application of their use, rather than as a generic exercise isolated from their setting of application. Methods to collect, organize and display data are taught within the authentic use of real experimental data. This approach of learning uses the investigative skills within and throughout the authentic need of using and applying the skills.

The content and level of depth of the material is equivalent to a college level course. Topics within the course are developed in the historical and complexity developments of physics. Topics in mechanics precede Newton's laws, since the concepts of velocity and acceleration are fundamental to understanding force, work, energy and power. Impulse and momentum are covered before circular motion and rotation to provide appropriate understandings before investigating torque and harmonic motion. This work supports the study of kinetic theory and thermodynamics. Studies in electricity and magnetism precede topics in waves and optics in order to provide sequential understanding to the electromagnetic spectrum and atomic and nuclear physics.

The order of topics within the course, not only provides a logical and systemic study to physics, but also accommodates the frequent transfer of students within the schools of the system, so that transfer students can maintain a consistent flow of learning.

Course Format and Policies:

The online courses have the same level of rigor and adhere to the same standards set forth by the school system and the College Board. To access all courses, students need access to a computer and the Internet via a web browser. All classes are offered via the Blackboard Learning Management System.

There is a lab component to the course is dedicated to a hands-on experience for students. Approximately twenty-five percent of the instructional time is devoted to the laboratory experience. Students will maintain a laboratory journal in this course to verify completion of labs and to prepare for the AP Exam. (See also **Laboratory Experience** below.)

Homework in the form of assignments is the primary means for students to develop their competence in the physics concepts being studied. As such, homework completion is vital to course success. Late work is accepted up to the deadline for the submission of grades to schools. Feedback will be provided for all assignments through Blackboard. Additional tutoring is available from the teacher via email or phone conversations. Student tutoring will also be available via Discussion Board groups in the online course.

Grading: Quarterly grades are based on completion of assignments and tests according to the following formula:

- 20% of the quarterly grade is based on assignment completion such as problem sets.
- Approximately 20 % represent laboratory assignments.
- 60% is based on test scores.

All AP courses carry weighted grading potential. To receive the weighted grade the student must take the AP exam.

Unweighted Scale A=4	Weighted Scale A=5
Unweighted Scale B=3	Weighted Scale B=4
Unweighted Scale C=2	Weighted Scale C=3
Unweighted Scale D=1	Weighted Scale D=2
Unweighted Scale F=0	Weighted Scale F=0

Textbook, Materials and Other Resources:

Required Textbook

- Giancoli, Douglas C. 2003. *Physics Principles with Applications*, 5th edition, Upper Saddle River, N.J.: Prentice Hall/Pearson Education.

Supplemental Materials

- Christian, Wolfgang & Belloni, Mario. 2004, *Physlet Physics: Interactive Illustrations, Explorations, and Problems for Introductory Physics*, Upper Saddle River, New Jersey: Pearson Education, Inc.
- Loyd, David. 1998, *Physics Laboratory Manual*, 2nd edition, Stamford, CT: Thomson and Brooks/Cole Publishers.
- Serway, Raymond A & Faughn, Jerry S. 2003, *College Physics*, 6th edition, Vol. 1, Stamford, CT: Thomson Learning and Brooks/Cole Publishers.
- California Institute of Technology and Intelecom.1985, *The Mechanical Universe and Beyond*, Vol.1-52, Washington, D.C. Annenberg Media.

Other Resources

- Laboratory classroom includes the space, facilities and equipment to conduct hands-on, inquiry-based investigations in a supervised environment by a local science teacher or school facilitator.
- Lab equipment contained should include items such as carts, force tables and scales for Newtonian mechanics. The lab should also contain equipment for studies in light and electricity such as hand held generators, electrostatic equipment, wave tanks and light benches.
- Data gathering, graphing, analysis and presentation software include databases, spreadsheets and probeware interfaces such as temperature probe, dual range force sensor, photo gates, current/voltage probes, microphones and smart pulleys may also be used.
- Graphing calculators: TI 86
- Laptop computers
- Desktop computers
- Internet access and online resources such as www.physicsclassroom.com, http://cwx.prenhall.com/bookbind/pubbooks/giancoli/

Course Content Outline:

Unit 1 - Describing Motion: Kinematics in One Dimension			
Objective	**Topics**	**Laboratory**	**Major Assessments**
In this unit, students will be introduced to how physics is actually practiced. The concepts of measurement, estimating, and the relationship of physics to other fields are presented.	Reference frames & displacement Average velocity Instantaneous velocity Acceleration Motion at constant acceleration Resource: • Textbook Survey • Significant Figures	Graph Matching	Laboratory Journals Problem Set 1
Unit 2 - Kinematics in Two Dimensions: Vectors			
In this unit, students will examine the motion of objects traveling in one dimension. The concepts of rectilinear motion and the related concepts of force and energy are presented.	Vectors & scalars Addition and subtraction of vectors Projective motion Relative velocity Resource: Kinematics Worksheet	Physlet Simulation: Introduction Physlet Simulation: Dimensional Motion Lab: Projectile Motion	Problem Set Practice Quiz – Problems & Constructed Response Laboratory Journals
Unit 3 - Motion and Force: Dynamics			

This unit focuses on how to describe the motion of objects traveling in two dimensions. The concepts of vector arithmetic using both graphical and analytical methods are introduced and applied to relative velocity and projectile motion.	Force Newton's first law of motion Mass Newton's second law of motion Newton's third law of motion	Lab: Newton's Second Law of Motion Physlet Simulation: Two Dimensional Kinematics Lab: Acceleration	Online Quest- Vectors/Motion and Forces in Two Dimensions and Conceptual Questions Problem Set 1 Problem Set 2 Extra Credit (additional problem solving activities) Unit Test - Multiple Choice, Problems, Constructed Response Laboratory Journals
Unit 4 – Newton's Law of Motion			
Module 1 – Motion and Force In this module, we will investigate the connection between force and motion. Before we delve into this subject of dynamics, we first discuss the concept of force in a quantitative way.	Force, Mass, Inertia, Free Body Diagrams Newton's Laws of Motion and Applications	Physlet Simulation – Newton's Laws Lab: Atwood's Machine	Online Quest Conceptual Questions Problem Set 1 Conceptual Questions, Part 2 Problem Set 2 Problem Set 3 Laboratory Journal Extra Credit Laboratory Journal Extra Credit Practice Test - Problems & Constructed Response

Module 2- Circular Motion; Gravitation In this module, we study circular motion.	Newton's law of universal gravitation Satellites and "weightlessness" Kepler's laws & Newton's synthesis	Physlet Simulation – Newton's Laws 2	Online Quest Conceptual Questions, Part 1 Problem Set 1 Conceptual Questions, Part 2 Problem Set 2 Extra Credit 1 Extra Credit 2 Practice Test - Problems & Constructed Response Unit Test - Multiple Choice, Problems, Constructed Response
Unit 5 - Work and Energy			
The content in this unit explores the very important concept of energy and the closely related concept of work. Both of these quantities are scalar quantities.	Work done by a constant force Work done by a varying force Kinetic energy, and the work-energy principle Potential energy Conservative & nonconservative forces Mechanical energy and its conservation Other energy; energy transformations & the law of conservation of energy Energy conservation with dissipative forces Power	Lab: Conservation of Mechanical Energy using the Pendulum Physlet Simulation – Energy Lab: Energy of a Tossed Ball	Online Quest Conceptual Questions 1 Problem Set 1 Problem Set 2 Problem Set 2 Laboratory Journals Extra Credit Practice Test - Problems & Constructed Response

Unit 6 – Linear Momentum			
The law of conservation of energy, which we discussed in the previous unit, is one of several great conservation laws in physics. In this unit, we discuss linear momentum and its conservation. We then make use of the laws of conservation of linear momentum and of energy to analyze the interactions of two or more bodies that collide with each other.	Momentum and its relation to force, Conservation of momentum Collisions & impulse Conservation of energy & momentum in collisions Elastic collisions in 1-D Inelastic collisions Resources: • Momentum PowerPoint Presentation • Sample Momentum Problems – Collision of Two Objects	Physlet Simulation – Momentum Lab: Momentum, Energy and Collisions Lab: Impulse and Momentum	Online Quest Problem Set 1 Conceptual Questions Problem Set 2 Laboratory Journals Extra Credit Practice Test - Problems & Constructed Response Unit Test Multiple Choice, Problems, Constructed Response
Unit 7 – Circular Motion and Rotational Equilibrium			
In this unit, we will study a special case of motion when the net force on an object and the net torque on an object	Kinematics and dynamics of circular motion Dynamics of uniform circular motion torque Universal Law of	Physlet Simulation – Statics Lab: Equilibrium	Conceptual Questions Problem Set 1 Problem Set 2 Extra Credit Practice AP Problem 1 – Sample Free Response Question

are equal to zero. This module will introduce students to basic civil engineering principles that relate to the design and construction of bridges, buildings and other rigid structures.	Gravitation Satellites and weightlessness		Practice AP Problem 2 - Sample Free Response Question Practice Test - Problems, Constructed Response
Unit 8 – Fluid Mechanics			
In this unit, we consider some properties of fluids (both liquids and gases).	Pressure in fluids, Atmospheric pressure & gauge pressure, Pascal's principle Buoyancy & Archimedes' principle Fluids in motion Bernoulli's equation Application of Bernoulli's principle	Physlet Simulation - Fluids Static Physlet Simulation – Fluids in Motion Lab: Fluid Dynamics *Or* Lab: Pascal's principle	Conceptual Questions Problem Set 1 Problem Set 2 Extra Credit 1 Extra Credit 2 Practice Test Unit Test - Multiple Choice, Problems, Constructed Response Practice AP Problem 3 - Sample Free Response Question Laboratory Journals
Semester Two **Unit 9 – Thermal Physics**			
Module 1 – Temperature and Kinetic Theory This module is devoted to temperature and the	Thermal expansion, Gas laws & absolute temperature Ideal gas law Universal gas constant Molecular kinetic energy	Lab: Gas Laws	Conceptual Questions Problem Set 1 Problem Set 2 Problem Set 3 Extra Credit Practice Test - Problems,

fundamental theory that matter is made up of atoms and molecules. Temperature is a measure of the average kinetic energy of atoms and molecules. The idea of constant motion in the atoms and molecules that make up matter is the kinetic theory.	Kinetic theory of gases Critical temperature		Constructed Response
Module 2 – Heat This module relates heat to a form of energy. Heat is the energy that flows from a warm object to a cooler object. The heat energy can flow or transfer in three different ways: conduction, convection or radiation.	Mechanical equivalent of heat, internal energy Heat of fusion Latent heat Heat of evaporation	Lab: Specific Heat of Solids and Liquids	Conceptual Questions Problem Set 1 Problem Set 2 Extra Credit Practice AP Problem 4 - Sample Free Response Question Practice Test - Problems, Constructed Response
Module 3 - Laws of Thermodynamics In this module we	First law of thermodynamics Second law of thermodynamics	Physlet Simulation – Kinetic Theory and Thermodynamics	Conceptual Questions Problem Set 1 Problem Set 2 – Sample Free Response Question

will define *thermodynamics* as the study of how heat energy can be converted into motion most efficiently. We will discuss how thermodynamics includes many important areas such as the study of power plants and automobile engines.	Heat engines Third law of thermodynamics entropy		Practice AP Problem 5 - Extra Credit Practice Test - Problems, Constructed Response Laboratory Journal Unit Test - Multiple Choice, Problems, Constructed Response
Unit 10 – Vibrations, Waves and Sound			
Module 1 - Vibrations and Waves In this module we will discuss vibrations and wave motion as related subjects—vibrations as the source of wave motion, vibration and mechanical waves described by Newtonian mechanics.	Simple harmonic motion Energy in simple harmonic oscillator Period & sinusoidal nature of SHM Simple pendulum Wave motion Types of waves Energy transported by waves Reflection & interference of waves Standing waves; resonance	Physlet Simulation – Periodic Motion Physlet Simulation – Waves Lab: Simple Harmonic Motion (SHM)	Conceptual Questions Problem Set 1 Problem Set 2 Problem Set 3 Extra Credit Practice Test - Problems, Constructed Response Laboratory Journals
Module 2: Sound	Characteristics of sound	Physlet Simulation-	Conceptual Questions

In this module, we will distinguish between three aspects of any sound: 1) the source for a sound as a vibrating object, 2) energy transferred from the source in the form of longitudinal sound waves, and 3) the sound detected by an ear or an instrument.	Intensity of sound: decibels Amplitude related to intensity Interference of sound waves; beats	Sound Lab – Resonance *and/or (time permitting)* Lab – Sound Waves and Beats	Problem Set 1 Problem Set 2 Problem Set 3 Extra Credit Practice Test - Problems, Constructed Response Laboratory Journals
Unit 11 – Electricity and Magnetism			
Module 1 - Electric Charge and Electric Field In this section students explore the forces that exist between charged particles.	Static electricity; charge & conservation Electric charge in the atom Insulators & conductors Induced charge Coulomb's law The electric field Field lines	Physlet Simulation - Electrostatics Physlet Simulation - Electric Fields Lab: Newton's Law of Cooling	Conceptual Questions Problem Set 1 Extra Credit 1 Problem Set 2 Extra Credit 2 Practice Test - Problems, Constructed Response Laboratory Journals
Module 2 Electric Potential and Electric Energy In this module, students are introduced to	Electric potential & potential difference Relation between electric potential & electric field Capacitance Dielectrics	Physlet Simulation - Electric Potential Physlet Simulation – Electric Potential 2 Lab: Capacitance	Concept Questions Problem Set 1 Problem Set 2 Problem Set 3 Extra Credit Practice Test - Problems, Constructed Response

electricity as a form of energy. We will use the law of conservation of energy as it applies to electrical energy.			Practice AP Problem 6 - Sample Free Response Question Unit Test - Multiple Choice, Problems, Constructed Response Laboratory Journals
Module 3 - Electric Currents In this module, we will study the origin of electric currents and material science underlying the flow of charges.	Electric battery Electric current Ohm's law Resistivity Electric power Power in household circuits	Lab: Ohm's Law Lab: Electric Power	Conceptual Questions Problem Set 1 Problem Set 2 Laboratory Journals
Module 4 –DC Circuits This module deals with the concepts and the vocabulary associated with the basic principles of direct current (DC) circuit. The study of these concepts allows us to understand the operation of a number of useful instruments necessary to	Resistors in series & parallel EMF Kirchhoff's rules EMFs in series and parallel Circuits containing capacitors in series & parallel RC circuits	Physlet Simulation – DC Circuits	Conceptual Questions Problem Set 1 Problem Set 2 Extra Credit Practice AP Problem 7 - Sample Free Response Question Practice Test - Problems, Constructed Response Laboratory Journals

analyze simple series and parallel circuits.			
Module 5 – Magnetism This section deals with the two ways in which electricity and magnetism are related: (1) an electric current produces a magnetic field; and (2) a magnetic field exerts a force on an electric current or moving electric charge.	Electric currents produce magnetism Force on an electric current in magnetic field Force on electric charge Magnetic field due to straight wire Force between 2 parallel wires Ampere's law	Physlet Simulation - Magnetic Fields and Forces Lab: Magnetic Fields	Conceptual Questions Problem Set 1 Problem Set 2 Extra Credit Practice AP Problem 8 - Sample Free Response Question Practice AP Problem 9 - Sample Free Response Question Laboratory Journals
Module 6 - Electromagnetic Induction and Faraday's Law This chapter deals with how changing magnetic fields can induce electric currents in conducting materials.	Induced EMF Faraday's Law Lenz's law EMF in a moving conductor Inductance	Physlet Simulation – Faraday's Law	Conceptual Questions Problem Set 1 Problem Set 2 Extra Credit Practice AP Problem 10 - Sample Free Response Question Practice AP Problem 11 - Sample Free Response Question Unit Test - Multiple Choice, Problems, Constructed Response Laboratory Journals
Unit 12 – Optics			

Module 1 – Geometric Optics In this module, students will learn the geometric mirror and lens equation. They will also be able to use concave and convex mirrors and lenses to prove the mirror and lens equation.	Resources – • Mirrors • Lenses • Optics (including Refraction)	Physlet Simulation – Mirrors Physlet Simulation – Refraction Physlet Simulation - Lenses	Problem Set 1 Problem Set 2 Problem Set 3 Practice Test - Problems, Constructed Response
Module 2 – The Wave Nature of Light The focus of this module is the question: Is light a wave or is light made up of matter?	Light as EM wave Refection Index of refraction Lenses Interference Visible spectrum & dispersion Diffraction Interference Resource: Characteristics of Light	Behavior of Light Physlet Simulation - Diffraction	Problem Set 1 Problem Set 2 Laboratory Journals
Unit 13 – Atomic and Nuclear Physics			
Module 1 – Early Quantum Theory and Models of the Atom The revolution of	Photon theory Photon interactions, Wave-particle duality Atomic spectra Bohr model		Laboratory Journals Semester 2 Assessment Multiple Choice, Problems, Constructed Response

quantum theory took almost three decades to unfold, and many scientists contributed to its development. While Newtonian mechanics is a theory of physical systems in our macro-world, the focus of this module, quantum theory, is a theory of physical systems on the micro-scale.	Quantum mechanics Mass-energy equivalence Conservation of nucleon number Nuclear reactions		Long Term Inquiry Project
Module 2 – Nuclear Physics and Radioactivity As we have learned previously, Rutherford's experiments led to the idea that at the center of an atom there is a tiny, but massive, nucleus. The strong nuclear force holds the nuclei together. The weak nuclear force			

is responsible for radioactive decay. In this chapter, we will take a close look at how these forces affect the nucleus over time.			

Laboratory Experience

Laboratory investigations are an integral component of this course, making up 20% of the course grade. These investigations are equivalent to those in a college level laboratory course. The lab work in this course supports, enhances and extends the concepts and principles presented in the classroom. They also provide students with the opportunity to learn and apply new laboratory skills, foster collaborative relationships with others, and improve problem-solving skills.

The laboratory investigations, which make up approximately 25% of instructional time are inquiry based, student-centered and are a primary vehicle for learning the fundamental concepts and principles of physics. This includes active use of the well-designed investigation in which students 1) form testable questions and hypotheses, 2) design and conduct appropriate investigative procedures, including the identification and control of appropriate variables, 3) organize, display and critically analyze results, and conduct error analysis, 4) draw inferences, summarize results and develop conclusions, and 5) communicate their results for critique by others. Laboratory investigations reflect a balance of structured, guided and open-ended inquiry. Students are expected to develop explicit laboratory reports.

Students are required to maintain and keep a laboratory journal. Because colleges often require students to present their laboratory materials from AP courses before granting college credit for laboratory, students are expected to retain their laboratory notebooks, reports, and other materials.

Students are expected to complete lab activities using lab materials available at their school in a supervised situation with a local science teacher or school facilitator. Students should coordinate with the distance learning teacher if necessary equipment is not locally available.

Lab Exercise	Description	Goal	Time	Inquiry
Graph Matching	**Analyze the motion of a student walking across the room. Predict, sketch, and test distance vs. time kinematics graphs. Predict, sketch, and test velocity vs. time kinematics graphs.**	**Describe motion making the distinctions between distance and displacement; speed and velocity.**	**1.0**	**Student-conducted**
Projectile Motion	**Measure the speed of a ball using photo gate timing. Calculate trajectory based on horizontal speed.**	**Using kinematic equations show how velocity and x.y components are found for a projectile.**	**2.0 hrs**	**Student-conducted**
Newton's Second Law of Motion	**Measure the force required to move different masses over the same distance and at the same velocity horizontally, vertically, and up an inclined plane.**	**Develop an understanding of the relationship between force, distance and velocity as masses are lifted in various ways.**	**2.0**	**Student-conducted**
Acceleration	**Determine the acceleration constant due to gravity.**	**Validate Galileo's assumption of uniform acceleration. Model uniformly accelerated motion with algebraic equations.**	**1.0**	**Student-conducted**
Attwood's Machine	**Measure the force of friction of a wood block sliding on a wood tabletop.**	**Collect acceleration data for a system of opposing weights and determine the relationship of acceleration to total mass and mass difference of the system.**	**1.5**	**Student-conducted**
Conservation of Mechanical Energy using the Pendulum	**Measure the period of pendulum motion.**	**Collect time data for pendulum motion and determine the mathematical relationship for**	**1.5**	**Student-conducted**

		pendulum motion, mass and length of the pendulum.		
Ball Toss	**Analysis of the transnational motion of a ball thrown vertically. Motion detector used to measure velocity / acceleration.**	**Measure and graph displacement, velocity, and acceleration of accelerating objects.**	**2.0 hrs**	**Student-conducted**
Momentum, Energy and Collisions	**Measure the velocity of projectile using conservation of momentum.**	**Measure the projectile velocity by using conservation of momentum, conservation of energy and dissipation of energy through frictional forces.**	**2.0 hrs**	**Student-conducted**
Impulse and Momentum	**Measure a cart's momentum change and compare to the impulse it receives.**	**Distinguish between elastic and inelastic collisions** **Compare average and peak forces in impulses**	**1.5 hrs**	**Student-conducted**
Equilibrium	**Measure the forces needed to produce equilibrium for an object resting on an inclined plane.**	**Calculate and measure concurrent forces in equilibrium.**	**2.0 hrs**	**Student-conducted**
Fluid Dynamics	**Apply Bernoulli's equation to fluids**	**Calculate the range of a fluid expelled from a hole in a container. Relate the range to the velocity of the fluid.**	**2.0 hrs**	**Student-conducted**
Pascal's Principle	**Apply Pascal's principle to systems of fluids under pressure.**	**Demonstrate Pascal's principle in practical situations.**	**2.0 hrs**	**Student-conducted**
Gas Laws	**Measure pressure of a gas using pressure sensor.**	**Confirm Boyle's Law through measurement and graphing.** **Calculate the pressure acting on**	**2.0 hrs**	**Student-conducted**

		a system. Explain the difference between gauge press and absolute pressure and be able to convert from one to another.		
Specific Heat of Solids and Liquids	**Determine the heats of fusion and vaporization of water.**	**Document the correct phase change equation and solve this equation for the unknown parameter. Be able to explain the phase change diagram in terms of energy added or removed forma substance.**	**2.0 hrs**	**Student-conducted**
Simple Harmonic Motion (SHM)	**Determine the amplitude, period and phase constant of a mass-spring system.**	**Develop an understanding of the relationship between amplitude, period and phase constant.**	**2.0 hrs**	**Student-conducted**
Resonance	**Determine the resonant length of a closed tube for a known frequency.**	**Determine the speed of sound in air at a known temperature.**	**1.5 hrs**	**Student-conducted**
Sound Waves and Beats	**Measure pressure and time for pure musical tones using microphones**	**Collect pressure-time data from a tuning fork and mathematically analyze the pressure (sound)**	**1.5 hrs**	**Student-conducted**
Newton's Law of Cooling	**Record how the temperature of water enclosed in a small container cools.**	**Verify Newton's Law of Cooling by determining how the temperature of warm water in small container cools.**	**1.5 hrs**	**Student-conducted**
Capacitance	**Measure the capacitance in several places in a network of capacitors.**	**Calculate capacitance for a network of capacitors.**	**2.0 hrs**	**Student-conducted**
Ohm's Law	**Measure current and resistance using a simple DC circuit**	**Calculate the resistance of a resistor from Ohm's Law.**	**2.0 hrs**	**Student-conducted**

		Develop an understanding of the relationship between the voltage, current and resistance in a simple circuit.		
Electric Power	**Design and calculate current in series and parallel circuits.**	**Understand circuits and solve equations related to circuits.**	**2.0 hrs**	**Student-conducted**
Magnetic Fields	**Measure magnetic field strength using a magnetic sensor.**	**Calculate magnetic strength change as a function of distance. Relate theoretical value to measured value.**	**2.0 hrs**	**Student-conducted**
Behavior of Light	**Measure the brightness of a light source as it varies with distance from the source using light meters.**	**Measure the brightness of a light source as it varies with distance and mathematical verify the inverse square relationship between light intensity and distance**	**1.5 hrs**	**Student-conducted**

Assessment:

Assessment and evaluation are essential to learning and teaching. Ongoing assessment and evaluation are significant in supporting student achievement, motivating student performance and providing the basis upon which teachers make meaningful instructional decisions. All aspects of progress in science are measured using multiple methods such as authentic assessments, performance assessments, formative assessments, observational assessments, lab reports, projects, research activities, reports, and conventional summative assessments. Student understanding is evaluated using an assessment cycle that includes pre-test, formative assessments and summative assessments. Pre-tests are used to determine the students' level of understanding prior to beginning a unit of instruction. The pre-tests are used by the teacher to plan instruction. Formative assessments are used to check student understanding while learning is occurring, and provide students and teachers with learning progress information. Pre and formative assessments are not used to determine grades. Summative assessments, such as unit and semester tests, evaluate student achievement, and along with other measures such as laboratory and project work are data points used to determine the level of student performance.

Assessment Type	Goal	Description
Laboratory Journals	To assess understanding of physics concepts, principles, and application of skills and processes of the laboratory.	Students maintain laboratory journals of all lab work. It includes lab notes, data, graphs, and responses to questions, lab write-ups, error analysis, and further questions. Students are encouraged to keep their lab journals to demonstrate lab activity in a college AP review.
Laboratory Simulations	To assess understanding of physics concepts, principles, and application of skills and processes of the laboratory.	Specific problems associated with various physics concepts are presented through online simulations. Students are able to manipulate variables to solve the problems. They them must describe how solutions are reached and show calculations to demonstrate the thought process used to solve the problems. The students access these activities via a

		CD-ROM entitled: *Physlet Physics: Interactive Illustrations, Explorations, and Problems for Introductory Physics.* For more information, please see **Supplemental Materials** listing.
Practice Tests	To provide opportunities for students to practice solving sample problems utilizing concepts demonstrated for each topic.	Students may seek assistance for these assignments, make multiple attempts before submission and are graded on the process by which problems are solved. Students are required to show the equations that apply, what information is provided in the problem, substitute known info into the equations and then show the answer with correct units.
Unit Tests	To provide students with the opportunity to solve problems in a simulated AP Exam experience. Students must work alone, can use a graphing calculator and the AP Physics B equation sheet only.	Student must be able to complete the test in one session consisting of no longer than 90 minutes to simulate the AP Exam experience. The tests include examples of both objective and free-response questions.
Concept Questions	To challenge students to explore the basic concepts that are fundamental their understanding physics.	Students are assigned questions for completion within each unit of instruction. Many of the examples are taken from everyday life and aim at being realistic applications of physics principals.
Problem Sets	To develop competence in using problem-solving skills to physics concepts being studied.	Students are presented with a number of problems that represent various levels of difficulty.
Practice AP Problems	To develop competence in using problem-solving skills and simulate the AP Free	Students are presented with a problem that involves concepts under study in the

	Response section of the exam	course. The problem is a sample free response question from a former AP Physics B exam.
Online Quests	To provide additional background information in the form of online physics tutorials.	At the end of each a tutorial students are directed to multimedia animations that help students visualize and understand major physics concepts. Students are also presented with exercises that enable them to apply the concepts.
Online Discussion Boards	To enable students to engage in collaborative problem-solving and team-building.	Discussions help students to learn from and help each other and build confidence in applying the physics concepts. The discussion boards are also used by the instructor to provide tutoring and helpful hints to address the needs
Long-term Student Inquiry Project	Provide students with an opportunity to investigate a physics topic of their choice in detail and demonstrate the skills and processes of an experimental, well-designed investigation.	An independent student research project, in which students ask and answer their own testable question of a physics topic of personal interest. It includes the write-up of a full laboratory report and/or publishable paper.
Extra Credit	Provide extra opportunities to solve problems that incorporate concepts from previous units.	In order to receive credit, students must show all equations that apply, substitute known information in the equations and provide the final answer in the appropriate units.

Supporting Services

To help students maintain successful participation, each student has a designated local facilitator who serves as the liaison between the teacher, the student, parents and school administrators.