1. SCHOOL INFORMATION

School Information
School__San Lorenzo Valley High School________________
District_San Lorenzo Valley USD_______________
City_Felton CA ___________________

School / District Web Site_ http://cougar.slvhs.slv.k12.ca.us/ http://www.slv.k12.ca.us/

School Course List Contact
Name: __Noreen Nolan____
Title/Position: __Head Counselor________
Phone: __831-335-4425________ Ext.: __113___
E-mail:__ nnolan@slvhs.slv.k12.ca.us____________

Teacher Contact ____________
Name: _Preston Boomer_______________
Title/Position: _Physics Teacher_____________
Phone:_831-335-4425 ____________ Ext.: _235________
E-mail:_pboomer@slvhs.slv.k12.ca.us __________________

2. PREVIOUSLY APPROVED COURSES

Complete outlines are not needed for courses that were previously approved by UC. Was this course previously approved? ___Yes _X__No

If yes, indicate category which applies.

A course reinstated after removal within 3 years.
Year removed from list? ____________
Same course title? ___Yes _X__No
If no, previous course title? _________________________________

___An identical course approved at another school in same district.
Which school? __________________
Same course title? ___Yes ___No
If no, course title at other school? _______________________________________

___Approved International Baccalaureate (IB) course

___Approved CDE Agricultural Education course

___Approved P.A.S.S./Cyber High course

___Approved ROP/C course. Name of ROP/C? _______________________________

___Approved A.V.I.D. course

___Approved C.A.R.T. course

___Approved Project Lead the Way course

___CSU Expository Reading and Writing course

___Other. Explain: _____________________________

___Advanced Placement Course

If Advanced Placement, has it been authorized by the College Board through the AP Audit process?
___Yes ___No If not, please explain why.__________________

Is this course a resubmission?
___Yes _X__No
If yes, date(s) of previous submission? ____________________________________
Title of previous submission? ____

Is this an Internet-based course?
___Yes __X_No
If "Yes", who is the provider?
___PASS/Cyber High ___Other_________________

Is this course modeled after an UC-approved course from another school <u>outside your district</u>?
___Yes __X_No
If yes, which school(s)? ____________________________________

Course title at other school ____

Is this course classified as a Career Technical Education? Yes ____ No __X__
If Yes:
Name of Industry Sector ___________________________________
Name of Career Pathway__________________________________

3. COURSE DESCRIPTION

Course Title___Honors Physics________

Transcript Title(s) / Abbreviation(s)___H Physics___________

Transcript Course Code(s) / Number(s)_______381________

Grade Level(s) for which this course is designed
__9 __10 _X_11 _X_12

Unit Value
__0.5 (half year or semester equivalent)
_X_1.0 (one year equivalent)
__Other: _________________________________

4. CATALOG DESCRIPTION
Brief Course Description (If school has a catalog, the description that is in the catalog. If not, a brief description of the course) (NOTE: DO NOT INCLUDE INFORMATION THAT COULD IDENTIFY YOUR SCHOOL OR DISTRICT.)

Honors Physics is a high school physics course that covers the classical and modern physics areas in depth with a problem solving approach. The course includes topics from mechanics, waves, sound, optics, electricity, magnetism, and modern physics and focuses on in class laboratory experiments. The math background is algebra and trigonometry.

Pre-Requisites

Biology	_X__ Required ___ Recommended
Algebra, Geometry, Algebra II	_X__ Required ___ Recommended

Co-Requisites

Trigonometry	___ Required _X__ Recommended
Chemistry	___ Required _X_ Recommended

5. OPTIONAL BACKGROUND INFORMATION

Context for Course (optional). (NOTE: DO NOT INCLUDE INFORMATION THAT COULD IDENTIFY YOUR SCHOOL OR DISTRICT.)

History of Course Development (optional) (NOTE: DO NOT INCLUDE INFORMATION THAT COULD IDENTIFY YOUR SCHOOL OR DISTRICT.)

We have many students interested in becoming physical science majors which requires a solid physics background. We currently offer an advanced course through our life science program in AP Biology. In order to have equity between the life and physical science offerings, we are requesting an Honors Physics class with an emphasis on problem solving.

6. **Texts and Supplemental Instructional Materials**: Include list of Primary and Secondary Texts. Make sure to note the books that will be read entirely and those that will be as excerpts. For the Visual and Performing Arts subject area (f), textbooks are not required, but if textbooks are used, please complete the information below.

Textbook(s)

TEXTBOOK 1.
Title___ *Holt Physics*., ________
Edition___2007______
Publication Date_2007__________
Publisher_ Holt, Rinehart, Winston ______________
Author(s)__ Serway and Faughn_____________

Usage:
_X_Primary Text __Supplementary or Secondary Text

_X_Read in entirety or near entirety __Excerpts (approximate number of pages__970)

Supplemental Instructional Materials (please describe)

All lessons are presented in colorful *PowerPoints*. These *PowerPoints* contain notes, sample problems, charts, graphs, diagrams, and video clips. They are found on our physics web site: http://boomeria.org/mightyphysics.html
First semester *PowerPoints*: http://boomeria.org/physicslectures/menu.html
Second semester *PowerPoints*: http://boomeria.org/physicslectures/secondsemester/menu2.html

Online labs for students to print out are found at: http://boomeria.org/labsphys/physicslabs.html

There is a summer assignment found here: http://boomeria.org/physicssummer.html

Our Practice and Review computer software that students may download are found here:
For Mac: http://home.comcast.net/~pqboom/download/FClubBlitzes.dmg
For Windows: http://home.comcast.net/%7epqboom/WindowsFClub.html

We use the *Vernier Software* sensors and transducers for demonstration labs on the computers with our LCD projector.

7. Please indicate the subject and discipline proposed for this course.
Honors Physics

Seeking "Honors" Distinction?
_X__Yes ___No

8. If Not Seeking Honors Distinction:

__ a-History/Social Science
__ b-English
__ c-Mathematics
__ d-Laboratory Science
__ e-Language Other Than English
__ f-Visual and Performing Arts
__ g-College Prep Elective – History/Social Science
__ g-College Prep Elective – English
__ g-College Prep Elective – Mathematics
__ g-College Prep Elective – Science
__ g-College Prep Elective – Visual and Performing Arts
__ g-College Prep Elective – Interdisciplinary
__ g-College Prep Elective – Other

9. If Seeking Honors Distinction:
__ a-History/Social Science Honors
__ b-English Honors
__ c-Mathematics Honors
_X d-Laboratory Science Honors
__ e-Language Other Than English Honors
__ f-Visual and Performing Arts Honors

==
8. COURSE CONTENT – LABORATORY SCIENCE

[If "d-Laboratory Science" chosen]
Please choose a subject area for this course:
___ Biology
___ Chemistry
_X_ Physics
___ Integrated Science
___ Interdisciplinary Science

LABORATORY SCIENCE GUIDANCE
The intent of the laboratory science requirement is to ensure that entering UC freshmen have a minimum of one year of preparation in each of at least two of the foundational subjects of biology, chemistry, and physics. This requirement can be satisfied by taking two courses from among these specific subject areas. In order for courses to be approved in the "d" Laboratory Science area, they must provide a core set of knowledge in one of the three foundational subjects.

Generally, courses that are suitable for satisfying the minimum requirement will fall into one of three categories:

1. College preparatory courses in biology, chemistry, or physics.

2. College preparatory courses which may incorporate applications in some other scientific or career-technical subject area, but which nonetheless cover the core concepts that would be expected in one of the three foundational subjects. A few examples could include some courses in marine biology or agricultural biology, which may qualify as providing appropriate content in basic biology; and some advanced courses in earth and space sciences, which may provide suitable coverage of chemistry or physics. These are only examples; other possibilities exist. However, it is emphasized that courses in this second category must cover, with sufficient depth and rigor, the essential material in one of the foundational subjects in order to qualify for "d" certification.

3. The last two years of three-year sequences in Integrated Science, where rigorous coverage of at least two of the foundational subjects is provided.

Additional courses beyond the required minimum of two may be drawn from a fourth category:

4. Advanced courses in any scientific subject area which depend on (i.e., build upon while offering substantial new material), and specify as prerequisite, one or more courses from categories 1-3.

Lower-level / introductory science courses that do not specify prerequisite courses from categories 1-3 above, and do not address a majority of concepts that would be expected in any one of the foundational subjects, will be considered for certification in the "g" elective area. Examples of courses that would normally fall into this category include environmental science, physical science, earth science, and Integrated Science 1.

To be considered for certification in the "d" subject area, a course must:

- specify, at a minimum, elementary algebra as a prerequisite or co-requisite;

- take an approach consistent with the scientific method in relation to observing, forming hypotheses, testing hypotheses through experimentation and/or further observation, and forming objective conclusions; and

- include hands-on scientific activities that are directly related to and support the other class work, and that involve inquiry, observation, analysis, and write-up. These hands-on activities should account for at least 20% of class time, and should be listed and described in detail.

There is no preferred order to the sequence of courses that cover the foundational subject areas.

Online courses may be approved for credit toward the "d" requirement if they meet all the guidelines outlined above, including a supervised hands-on laboratory component comprising at least 20% of the course.

COURSE CONTENT

A. Course Purpose. What is the purpose of this course? Please provide a brief description of the goals and expected outcomes. Note: More specificity than a simple recitation of the State Standards is needed.

Goal: To Provide our students a more rigorous, mathematically challenging background in the principles of physics . Through advanced laboratory and mathematical applications, students will go beyond the content of our college prep physics course. Please see the full descriptions of our goals below in the Course Outline. The students will be proficient in the State Standards and the additional standards that make this course an Honors course.

B. Course Outline. Detailed description of topics covered. Show examples of how the text is incorporated into the topics covered.

The text is used at home for research, review and assigned problems. The following units in the text are covered:

Unit 1: Mechanics **Length of Time: 12 weeks.**

Content Standards and Student Outcomes:

Newton's laws predict the motion of most objects. As a basis for understanding this concept:

Students know how to solve problems that involve constant speed and average speed. Students know that when forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest (Newton's first law).

Students know how to apply the law F= ma to solve one-dimensional motion problems that involve constant forces (Newton's second law). Students know that when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (Newton's third law). Students know the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of Earth.

Students know applying a force to an object perpendicular to the direction of its motion causes the object to change direction but not speed (e.g., Earth's gravitational force causes a satellite in a circular orbit to change direction but not speed).

Students know circular motion requires the application of a constant force directed toward the center of the circle.

Students know how to solve two-dimensional trajectory problems. Students know how to resolve two-dimensional vectors into their components and calculate the magnitude and direction of a vector from its components. Students know how to solve two-dimensional problems involving balanced forces (statics). Students know how to solve problems in circular motion by using the formula for centripetal acceleration in the following form: $a=v^2/r$.

Students know how to solve problems involving the forces between two electric charges at a distance (Coulomb's law) or the forces between two masses at a distance (universal gravitation).

The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects. As a basis for understanding this concept:

- Students know how to calculate kinetic energy by using the formula $E=(1/2)mv^2$.
- Students know how to calculate changes in gravitational potential energy near Earth by using the formula (change in potential energy) = mgh (h is the change in the elevation).
- Students know how to solve problems involving conservation of energy in simple systems, such as falling objects.
- Students know how to calculate momentum as the product mv.
- Students know momentum is a separately conserved quantity different from energy.
- Students know an unbalanced force on an object produces a change in its momentum.
- Students know how to solve problems involving elastic and inelastic collisions in one dimension by using the principles of conservation of momentum and energy.

Instructional Strategies/Learning Activities:

Students will:

Identify the position, displacement, distance traveled, speed, velocity, and acceleration of an object undergoing uniform accelerated motion.

Consult position vs. time graphs to determine the direction of motion, speed, and velocity of an object.

Consult velocity vs. time graphs to determine the direction of acceleration, speed, and velocity of an object.

Use basic kinematic equations to predict the motion of an object in uniformly accelerated motion.

Qualitatively describe the motion of a projectile near the Earth's surface and in the absence of air resistance.

Use vector analysis to describe the motion of a projectile fired with a certain speed and at a specific angle.

Attack two-dimensional motion problems.

Identify the two components of a two-dimensional vector when the vector is described (i) graphically, as drawn; (ii) as a magnitude and angle with respect to a given axis; (iii) as two components in an (x,y) coordinate system.

Add two vectors graphically or numerically.

Apply the following rules:

Objects in free-fall accelerate at the same rate.

Velocity is the time rate of change of position. The direction of velocity is determined by the direction of the rate of change of position.

Acceleration is the time rate of change of velocity.

Speed and velocity are two different notions. One is a scalar quantity, the other is a vector quantity.

Acceleration is a vector quantity.

The acceleration due to gravity on the surface of the Earth, 9.8 m/s^2, is different from the acceleration due to gravity at other locations in the solar system.

Projectiles in motion follow a parabolic path under the influence of gravity.

Motion in one direction is independent from motion in a second (perpendicular) direction.

Labs:

Measuring with Accuracy.

(Hands-on during class) The students will devise THREE methods to accurately measure the volume of a beaker, Test the methods, and Evaluate the methods. They will be supplied with 1) a metric ruler, 2) a graduated cylinder, 3) a centigram balance, and 4) a 100 mL beaker to measure. They will use a calculator and remain within the realm of significant digits.

Finding the Density by Mass and Volume of five elements.

The students will measure with an accuracy of 0.1 centimeter the dimensions of five samples of elements, calculate their volumes using significant digits, mass the samples with an accuracy of 0.1 grams, and calculate the densities of the elements. Then the students will compare their results with the accepted values for the samples, and calculate their percentage errors. They will write a critique of the lab.

Speed and Acceleration of various balls on flat and sloped surfaces.

The students will measure the time in seconds and the distance in meters of three rolling balls and calculate their average speeds. Then they will measure the time and distance of three balls accelerating down a ramp and calculate the accelerations. They will adhere to the rules of significant digits and write a critique of the lab.

Speeds of a 50 meter run.

The students will measure the time and calculate the average speeds for a 50 meter dash of each student in the class and calculate the distance run in 5 seconds. They will show their method of calculating and adhere to the rules of significant digits and write a critique of the lab.

Finding g by timing falling objects.

The students will calculate a rough value for the acceleration of gravity at our altitude (100 meters) by dropping balls from a height of 3 meters and comparing that with the accepted value at sea level ($9.8 m/sec^2$). They will write a critique of the lab explaining why their results may be far off from the accepted value.

Force Vectors at various angles.

The students will find Forces, Resultants, and Equilibrants using force boards with spring balances. Each person does one diagram with help from the others. Then they will draw vector diagrams to compare with the measurements and angles made on the force boards. Then they will solve two vector problems both graphically and trigonometrically. They will write a critique of the lab.

Coefficient of Friction.

The students will calculate the coefficient of friction of two sliding objects and one rolling ball down a slope. They will use vector diagrams to solve for the normal force and the slide down force. The slide down force is equal and opposite to the force of friction. They will write a critique of the lab.

Measuring Power at a five meter staircase.

The students will time in seconds a run of all of us up *The Great Stairs* which are 5.0 meters of vertical height. Then, going back to the lab, they will measure their masses in kilograms and calculate for each student the work done, and the power needed to do it. They will write a critique of the lab.

Hook’s Law of Elasticity.

The students will use spring balances and masses to hang on them to measure the distances and forces in newtons needed to stretch the spring with different forces. Then they will calculate the value of the spring constant for the balance and verify Hooke’s Law of Elasticity. They will write a critique of the lab.

Finding Torques and Center of Mass.

The students will use meters sticks balanced on a fulcrum and hooked masses to hang onto the meter sticks to set up several balanced systems. Then they will calculate forces and distances from the fulcrum needed to establish equilibrium. They will compare their measured values with the calculated values and write a critique explaining discrepancies.

By the end of this unit, students will be familiar with the following vocabulary words:

Position, distance, displacement, speed, velocity, acceleration, linear motion, parabolic motion, scalar, vector, magnitude, direction, uniformly accelerated motion, air resistance.

Newton' Laws of Motion:

By the end of this unit, students will be able to

Qualitatively describe Newton's Three Laws of motion.

Use Newton's Three Laws to qualitatively and quantitatively predict motion.

Describe and mathematically analyze the forces on an object on an inclined plane.

Describe and mathematically analyze centripetal forces and accelerations.

Describe and mathematically analyze Newton's Universal Law of Gravity; make qualitative and quantitative analyses of inverse-square laws in general.

Describe and mathematically describe the force of air resistance.

Identify action/reaction pairs in accordance with Newton's Third Law.

Discuss and Evaluate elevator problems.

Apply the following rules:

Accelerations are always caused by a net force; for motion at constant speed in a straight line, no net force is required.

Friction forces depend on the magnitude of the normal or contact force.

Centripetal forces are center-pointing forces in circular motion.

Objects in motion in constant speed are experiencing a net (centripetal) force.

Mass and weight are two different concepts; the first is a property of matter, related to the amount of matter, and the second is a gravitational force that depends on the gravitating body.

Newton's Laws can describe an incredibly broad range of everyday phenomena.

Labs: (Hands-on during class)

Forces and Acceleration on various masses. Newton's Law of Acceleration.

The students will calculate the accelerations of three different masses caused by three different forces applied by spring balances. From the distances and times they will use the acceleration formulas to calculate the average accelerations. Students will then acquire time and distance data to calculate the acceleration of a ball accelerating down an incline. They will write a critique of the lab.

Center of Gravity.

The students will calculate the center of gravity of a meter stick with masses hanging on it by using the equilibrium principle of clockwise torques equal counterclockwise torques. They will then compare that with actually balancing the meter stick at the balance point and measuring the mass of the stick with a centigram balance. They will write a critique of the lab.

Rotation and Conservation of Angular Momentum.

Students will experience the effects of conservation of angular momentum by spinning around on a piano stool with masses in held out and pulled in. Wow! big spin rate increase. They will feel the awesome precession effect of a bicycle wheel gyroscope and rotational inertia. Great! And they will wrestle with a powerful electric gyroscope. And they will experiment with a Foucault pendulum. They will write a critique of this lab.

Centrifugal and Centripetal Effects.

The students will spin rubber stoppers on strings in circular motion using hooked masses to apply forces to the string to balance the centrifugal and centripetal effects. They will time the orbital time and measure the radius of the spin circle. Then they will calculate the centripetal force. They will write a critique of this lab.

Levers of physics.

The students will set up systems of the three classes of levers and measure the distances from various forces to the fulcrums applied with masses and spring balances. They will then calculate the value of a missing force or distance and compare that with the measured value. They can then calculate the efficiency of the setup. They will write a critique of this lab.

Inclined Planes.

The students will set up three different inclined planes with boards, place the *Physics Car* on the plane balancing it with a string and force mass. Using vector diagrams, they will find the values of the normal force and slide down force and use these to calculate the mechanical advantage and efficiency of this machine. They will write a critique of this lab.

Pulleys.

The students will set up multiple pulley systems, establish forces and loads to balance the systems, calculate the mechanical advantage and efficiency of the systems. Using a larger pulley system suspended from the 5 meter high ceiling, students may hoist them selves up to appreciate mechanical advantage. They will write a critique of this lab.

Surface tension.

The students will measure the length and width of a wooden block to the nearest 0.1cm, calculate its area in cm^2, set up a balance to support the block with a string attached to the balance, place the block above a beaker full of water, measure how much force is needed to pull the block away from the surface, and calculate the surface tension in newtons per cm^2 . They will write a critique of this lab.

Using Archimedes' Principle to find the density of minerals.

The students will mass five minerals in air and under water to the nearest 0.1g, calculate the buoyant force and the density of the minerals. They will compare their results with other groups and write a critique of this lab.

Demonstrations: The instructor will perform many demonstrations during class illustrating the principles being studied. The students will take notes on them.

Video Field Trips: The students will take notes on the videos.

By the end of this unit, students will be familiar with the following vocabulary words:

Force, normal force, weight, mass, air resistance, the Newton of force, gravitational force, spring force, spring constant, static friction, kinetic friction, coefficient of friction.

Resources:

PowerPoint presentations including notes, diagrams, charts, photos, and video clips.

Our Physics website, boomeria.org, which includes all of the *PowerPoint* presentations for practice and review notes and problem solutions. Links to other helpful WebPages.
Our Practice and Review computer software that students may download.

The textbook: Holt Physics.

Unit 2: Heat and Thermodynamics **Length of Time 5 weeks.**

Content Standards and Student Outcomes:

Energy cannot be created or destroyed, although in many processes energy is transferred to the environment as heat. As a basis for understanding this concept:

Students know heat flow and work are two forms of energy transfer between systems.

Students know that the work done by a heat engine that is working in a cycle is the difference between the heat flow into the engine at high temperature and the heat flow out at a lower temperature (first law of thermodynamics) and that this is an example of the law of conservation of energy.

Students know the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. The greater the temperature of the object, the greater the energy of motion of the atoms and molecules that make up the object.

Students know that most processes tend to decrease the order of a system over time and that energy levels are eventually distributed uniformly.

Students know that entropy is a quantity that measures the order or disorder of a system and that this quantity is larger for a more disordered system.

Students know the statement "Entropy tends to increase" is a law of statistical probability that governs all closed systems (second law of thermodynamics).

Students know how to solve problems involving heat flow, work, and efficiency in a heat engine and know that all real engines lose some heat to their surroundings.

Instructional Strategies/Learning Activities:

By the end of this unit, Students will:

be able to:

Calculate the thermal energy of a system of particles with a specified temperature.

Calculate the force exerted by a uniform pressure over some area.

Calculate the pressure at a certain depth in a liquid in a gravitational field.

Easily convert between density, mass, and volume. Recognize mass as the product of density and volume.

Qualitatively derive the ideal gas law PV = nkT.

Discuss Bernoulli's Principle to qualitatively describe the behavior of fluids in motion.

Recognize high entropy and low entropy states.

Recognize and work with the laws of thermodynamics.

Apply the following rules:

First Law

Energy and matter cannot be created nor destroyed, only changed in form.

Second Law

The Law of Entropy. The tendency to acquire a state of maximum disorder.

During exchanges of energy, some amount is always converted into a random form (thermal energy).

The entropy of a closed system is statistically bound to increase.

Heat tends to flow from high temperature to low temperature systems.

Entropy is a measure of the amount of disorder in a system.

Entropy is a statistical description of the degree of disorder in a system.

Labs: (Hands-on during class)

Finding Specific Heat of five elements. Using the Law of Heat Exchange.

The students will calculate the specific heats of five elements by heating them in boiling water and transferring them into a styrofoam calorimeter containing a measured mass of cold water by measuring the temperature change, delta t, and using the appropriate formula. They will calculate the specific heat of each element. They will then compare their values with the accepted values and find the percentage errors. They will then write a critique on what causes the errors of this lab.

Finding the Heat of Fusion for ice.

The students will calculate the heat of fusion for ice by using the calorimeter stated above, temperature changes, and the appropriate formula for the Law of Heat Exchange wherein heat lost by the water equals the heat gained by the melting ice. They will then compare their values with the accepted value and find the percentage error. They will then write a critique on what causes the errors of this lab.

Finding the Heat of Vaporization for water.

The students will calculate the heat of vaporization for water by using the calorimeter stated above, temperature changes, and the appropriate formula for the Law of Heat Exchange wherein heat gained by the water equals the heat lost by the condensing vapor. They will then compare their values with the accepted value and find the percentage error. They will then write a critique on what causes the errors of this lab.

Determination of Absolute Zero.

The students will determine a value for absolute zero by using Charles' Law. They will measure the volumes of air in a flask at 100^{o}C and at 0^{o}C. On a graph they will place points at these two temperatures and extrapolate the curve down to where the volume of air would be close to zero. The temperature at that volume will approximate absolute zero. Students will write a critique on this experimental procedure.

Determining the Mechanical Equivalent of Heat.

The students will drop a measured mass of copper shot down a one meter PVC tube 100 times to simulate a drop from 100 meters high. By measuring the temperature change of the shot and using the appropriate formulas, they will calculate the number of joules of work produced by one calorie of heat. They will then compare their experimental values with the accepted value and calculate their experimental errors. Students will write a critique on this experimental procedure.

The Coffee-Cream Problem.

The students will determine by experiment whether a cup of coffee will be warmer after 10 minutes if the cream is added immediately or after 10 minutes. They will write an explanation for the results they get using the Law of Heat Conduction and the Law of Radiation. They will write a critique of this lab.

Which Freezes Faster, Hot or Cold Water?

The students will perform this lab at home. They will devise an experiment to answer this long disputed question. They will analyze their result by discussing the factors the would make a difference.

Demonstrations: The instructor will perform many demonstrations in class illustrating the principles being studied. The students will take notes on them.

Video Field Trips: The students will take notes on the videos.

By the end of the unit, students will be familiar with the following vocabulary words:
Thermodynamics, heat, work, thermal energy, Boltzmann Statistics, temperature, entropy.

Resources:

PowerPoint presentations including notes, diagrams, charts, photos, and video clips.

Our Physics website, boomeria.org, which includes all of the *PowerPoint* presentations for practice and review notes and problem solutions. Links to other helpful WebPages.
Our Practice and Review computer software that students may download.

The textbook: Holt Physics.

Unit 3: Waves, Sound, Light **Length of Time: 6 weeks.**

Content Standards and Student Outcomes:

Waves have characteristic properties that do not depend on the type of wave. As a basis for understanding this concept.

Students know waves carry energy from one place to another.

Students know how to identify transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves).

Students know how to solve problems involving wavelength, frequency, and wave speed.

Students know sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.

Students know radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately 3×10^8 m/s (300,000 km/second).
Students know how to identify the characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.

Instructional Strategies/Learning Activities:
By the end of this unit, students will be able to
Qualitatively describe simple harmonic motion (SHM) of a pendulum and a mass on a spring.
Solve simple problems involving the period of motion of these types of systems.
Calculate the frequency, wavelength, or speed of a wave given the other two parameters.
Explain why the product of frequency and wavelength is speed.
Identify the amplitude, frequency, wavelength, speed, and period of a wave.
Calculate the speed of sound at different ambient temperatures, and explain why the sound speed increases with temperature.
Explain how waves interfere. Calculate destructive and constructive interference patterns from existing waveforms.

Explain how standing waves form. Calculate the wavelength and frequency of a standing wave on a string. Calculate the same for a standing sound wave in open and closed tubes.
Predict the resonant frequency of a pendulum or mass-on-a-spring system.
Explain how musical instruments produce sound.
Use Snell's Law or the Law of Refraction to calculate the change in direction of a light ray incident on a lens or mirror.
Calculate the angle of total internal reflection at an interface between two media.
Calculate the position of an image upon reflection or refraction.
Discriminate between real and virtual images. Predict the orientation of real and virtual images formed by mirrors and lenses.
Explain and calculate the interference pattern produced by shining light through two or multiple slits.
Explain and calculate the diffraction pattern produced by shining light through a single hole or slit.
Explain and calculate the Doppler shift that occurs when the source of a light or sound wave is moving with respect to the observer.

Apply the following rules:
Longitudinal and transverse waves can be described with the same mathematical models, but are different physical processes.
Light dispersion by color occurs when the index of refraction of a material depends on wavelength.

Two-slit interference is a fundamental property of waves.

The index of refraction of a medium determines the speed of light in the substance.

Musical instruments rely on standing waves to produce sound in a resonant chamber.

Labs: (Hands-on during class)

The Laws of the Pendulum.

The students will set up pendula with masses suspended on threads. They will verify Galileo's Laws by changing the masses, the displacements, and the lengths. They will measure their periods and calculate the value of the acceleration of gravity at our school. They will write a critique on the experimental procedures.

Wave Pulses on Springs.

The students will use springs and slinkys to investigate the wave motion of transverse waves and longitudinal waves. They will experience the superimposition of waves, harmonics, and interference. Impedance will be witnessed when two different media are involved. They will diagram and explain the phenomenon of this fun lab.

Waves in Ripple Tanks.

The students will use the ripple tanks of physics to generate flat waves and circular waves from point sources. They will diagram the patterns of reflection, refraction, interference, and the results of changing the speed of a wave over a shallow region. They will write a critique of this lab.

Coupled Pendula.

The students will set up several sets of pendula suspended from the same string, Coupled Pendula. They will observe and note the patterns of energy transfer when one or more pendula are started and their energies are conserved by transfer via "The Hamiltonian Coupling". They will write a critique of this lab.

Resonance in Tubes and Finding the Speed of Sound.

The students will set up resonance tubes who's resonant length is varied with water. Using tuning forks, they will measure the length of the resonator at maximum resonance. From the measurements and the formulae they will calculate the velocity of sound at room temperature. The results will be compared to the accepted value and a percentage error determined. They will write a critique on the experimental procedures.

Photometry Measurements.

The students will determine the intensity of several light sources by using the Bunsen Photometer. The illumination of the unknown light source is equated to the illumination of the standard 1-candela source. Then the students will calculate the intensity of the unknown light source. They will write a critique on the experimental procedures.

Plane Mirrors.

The students will use the Law of Reflection to construct the images of objects observed in a plane mirror. The angle of incidence equals the angle of reflection. They will write a critique of this lab.

Curved Mirrors.

The students will use the Law of Reflection to construct the images of objects observed in a converging mirror and a diverging mirror. The angle of incidence equals the angle of reflection. They will project the images of a candle flame onto a screen for measurements. They will then use the appropriate mirror formulas to calculate the images' distances and sizes compared to the object's distance and size. They will write a critique on the experimental procedures.

Finding the Index of Refraction in Air and Water.

The students will measure and calculate the index of refraction in glass and water by observing an object through glass and water. They will find their experimental error by comparing to the accepted values listed in a table. They will write a critique on the experimental procedures.

Converging and Diverging Lenses.

The students will use the Law of Refraction to construct the images of objects observed in a converging lenses and a diverging lense. The angle of incidence is related to the angle of refraction by Snell's Law. They will project the images of a candle flame onto a screen for measurements. They will then use the appropriate lens formulas to calculate the distances and sizes. They will write a critique on the experimental procedures.

Magnification.

The students will set up a simple magnifier (Sherlock Holmes). They will use it to magnify several objects and calculate the magnification using the magnification formula. They will compare their constructions to their calculations. They will write a critique on the experimental procedures.

Diffraction and Interference.

The students will use diffraction gratings to produce spectra and verify Huygens' principle. They will use single slits, double slits, and full diffraction gratings. They will diagram their results. They will write a critique on the experimental procedures.

Adding and Subtraction of Colors of Light and Pigment.

The students will use colored filters and colored papers to transmit and reflect different colors of light. They will verify the additive and subtractive principles of colors and the primary colors of pigment and light. They will write a critique of this lab.

Diffraction Interference and Patterns in Soap Bubbles.

The students will produce many soap bubbles and draw diagrams of the patterns and diffraction colors resulted by the changing thickness of the bubble. Fun! Acknowledgment is given for the group that produces a 40cm bubble that lasts long enough to be measured. Methane filled bubbles are ignited with great spectacle. They will write a critique of this lab.

Demonstrations: The instructor will perform many demonstrations in class illustrating the principles being studied. The students will take notes on them.

Video Field Trips: The students will take notes on the videos.

By the end of this unit, students will be familiar with the following vocabulary words:

Simple harmonic motion, pendulum, sine wave, oscillation, frequency, period, wavelength, wave speed, amplitude, wave amplitude, sound speed, medium, dispersion, reflection, refraction, total internal reflection, Snell's Law, angle of incidence, angle of refraction, angle of reflection, normal to a surface, interference, diffraction, index of refraction, longitudinal wave, transverse wave, real image, virtual image, resonance, resonant frequency, laser.

Resources:

PowerPoint presentations including notes, diagrams, charts, photos, and video clips.

Our Physics website, boomeria.org, which includes all of the *PowerPoint* presentations for practice and review notes and problem solutions. Links to other helpful WebPages.
Our Practice and Review computer software that students may download.

The textbook: Holt Physics.

Unit 4: Electricity & Magnetism **Length of Time: 6 weeks.**

Content Standards and Student Outcomes:

Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept:
Students know how to predict the voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors.
Students know how to solve problems involving Ohm's law.
Students know any resistive element in a DC circuit dissipates energy, which heats the resistor.
Students can calculate the power (rate of energy dissipation) in any resistive circuit element by using the formula Power = IR (potential difference) × I (current) = I^2R.
Students know the properties of transistors and the role of transistors in electric circuits.
Students know charged particles are sources of electric fields and are subject to the forces of the electric fields from other charges.
Students know magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arising from the magnetic fields of other sources.
Students know how to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.
Students know changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.
Students know plasmas, the fourth state of matter, contain ions or free electrons or both and conduct electricity.
Students know electric and magnetic fields contain energy and act as vector force fields.
Students know the force on a charged particle in an electric field is qE, where E is the electric field at the position of the particle and q is the charge of the particle.
Students know how to calculate the electric field resulting from a point charge.
Students know static electric fields have as their source some arrangement of electric charges.

Instructional Strategies/Learning Activities:

By the end of this unit, students will be able to:

Calculate the number of fundamental charges in a macroscopic charge.
Determine the charge state of an electroscope based on the charging process and the position of the electroscope leaves.
Reason about how static charges are generated when two materials are brought in contact.
Describe the processes of charge by induction, polarization, and conduction.
Calculate two-dimensional vector forces using Coulomb's Law.
Sketch the electric field of a small collection of positively and negatively charged objects.
Reason about the strength of the electric field based on the density of field lines.
Likewise, be able to sketch an electric field pattern.

Apply the following rules:
Electric charge is a property of fundamental particles.
The fundamental unit of electric charge can be determined through Millikan's oil drop experiment.
Neutrally charged objects can experience an attractive electric force when polarized by a nearby charged object.
A useful but analogy can be made between electric potential and pressure.
Seen from a force perspective, electric fields cause the acceleration of charged particles.
Electric current is a measure of the net amount of charge which passes by some location in a certain amount of time.

Labs: (Hands-on during class)

Electrostatics, Electroscopes, Charging, Capacitors.
The students will charge electroscopes with hard rubber rods (negative) and glass rods (positive) and compare the results. They will charge a capacitor and observe the affects of varying surface area of the plates, and varying the distance between the plates. They will write a critique of this lab.

Electrical Conductivity of various substances.
The students will use an ohm meter to measure the conductivity of various substances. They will compare their results with metals, non-metals, distilled water, tap water, and ionic solutions. They will write a critique of this lab.

Finding the Resistance of Various Resistors.
The students will use voltmeters and ammeters to calculate the resistance in ohms of various ceramic resistors. They will compare their results with the values printed on the resistors and calculate their percentage errors within the realm of significant digits. They will write a critique of this lab.

Resistors in Series, Kirchhoff's Laws. Solving the circuit. Using electric meters.
The students will set up series circuits with batteries and three ceramic resistors, measure the total resistance, the voltage drops across each resistor, the current through each resistor, the total current, and the total power of the circuit. They will calculate the same for the circuit and compare the measured values with the calculated values. They will show all calculations and write a critique of the results of this lab.

Resistors in Parallel, Kirchhoff's Laws. Solving the circuit. Using electric meters.

The students will set up parallel circuits with batteries and three ceramic resistors, measure the total resistance, the voltage drops across each resistor, the current through each resistor, the total current, and the total power of the circuit. They will calculate the same for the circuit and compare the measured values with the calculated values. They will compare the results of the series circuit vs the parallel circuit. They will show all calculations and write a critique of the results of this lab.

Resistors in Series/Parallel, Kirchhoff's Laws. Solving the circuit. Using electric meters.

The students will set up series/parallel circuits with batteries and three ceramic resistors, measure the total resistance, the voltage drops across each resistor, the current through each resistor, the total current, and the total power of the circuit. They will calculate the same for the circuit and compare the measured values with the calculated values. They will compare with the results of the series circuit vs. the parallel circuit. They will show all calculations and write a critique of the results of this lab.

Diagramming and Wiring a Three-Way Switch to a lamp.

The students will be given two double throw double pole switches, connectors, a battery, and a lamp. They will first draw a wiring diagram for the circuit and then they will wire it up and test it. The instructor will verify that it is working properly. The students will write a critique for this lab.

Demonstrations: The instructor will perform many demonstrations in class illustrating the principles being studied. The students will take notes on them.

Video Field Trips: The students will take notes on the videos.

By the end of this unit, students will be familiar with the following vocabulary words:

Charge, positive, neutral, negative, fundamental charge, electric force, inverse-square law, vector field, scalar field, superposition, charge by induction, charge by conduction, charge by polarization, capacitor, dielectric, current.

Magnetism:

By the end of this unit, students will be able to apply these principles:

Measure and sketch the magnetic field of a bar magnet, a horseshoe magnet, a straight current-carrying wire, and a current loop.

Explain how a magnet can stick to a refrigerator.

Use the left-hand-rule to calculate the direction of magnetic force on a moving, charged particle.

Sketch the magnetic field of the Earth.

Diagram the radius of circular orbit for a charged particle moving within a uniform magnetic field.

Show the magnetic flux through a surface.

Use Lenz's law to determine the direction of induced current in a wire loop due to a changing magnetic flux.

Use Faraday's law to determine the induced emf in a current loop.

Apply the following rules:

The motions of charged particles give rise to magnetic fields. These fields can, in turn, affect the motion of charged particles. The tiny, aligned motion of electrons within atoms can generate macroscopic magnetic fields.

Magnetism bears a special relationship to electricity. Changing electric fields give rise to magnetic fields, while changing magnetic fields give rise to electric fields.

A wave (or quantum) of mutually inducing electric and magnetic fields is called a light wave.

Electric motors convert electricity into motion; electric generators to the opposite; both rely on the principle of electromagnetic induction.

The magnetic field of the Earth acts as protection from the solar wind. The interaction of the solar wind with the atmosphere at the magnetic poles is known as aurora.

Permanent magnets are made from iron, nickel, or cobalt.

Magnetic fields can be induced in metal alloys containing iron, nickel, or cobalt.

Magnetic fields can do no work because the force always acts at a right angle to velocity.

Changing magnetic flux causes an induced emf. Emf, at the level of this course, behaves as an electric potential, generating a current.

Electricity and magnetism have a fundamental relationship.

Labs: (Hands-on during class)

Sketching the Magnetic Fields around various combinations of Permanent Magnets.

The students will use sets of permanent magnets, paper and iron filings to detect and sketch the patterns of "lines of force" around various combinations of magnets. They will pay special attention to poles that attract and repel. They will write a critique for this lab.

Demonstrations: The instructor will perform many demonstrations illustrating the principles being studied. The students will take notes on them.

Video Field Trips: The students will take notes on the videos.

By the end of this unit, students will be familiar with the following vocabulary words:

Magnet, magnetic field, compass, magnetic monopole, magnetic dipole, ferromagnetism, diamagnetism, paramagnetism, magnetic flux, magnetic induction, electromotive force (emf), solar wind, aurora, electromagnetic wave, left-hand rule.

Electric Circuits::

Electric circuits are practical applications of the theory of electricity and magnetism developed in the previous two units. A source of electric potential generates a current through objects that depends on their electrical resistance.

DC circuits can be analyzed by breaking them into idealized components: voltage sources, current sources, resistors and capacitors. AC circuits display different behavior.

The power dissipated in a resistive light bulb is related to its brightness, thus one can learn about simple circuits by studying bulb-and-switch circuits.

Calculating the equivalent resistance of a circuit allows you to determine the current drawn from a voltage supply.

The voltage drop across a conducting wire is essentially zero; in other words, they have zero resistance.

Kirchhoff's Laws allow you to solve for all currents and voltage drops in all resistor/voltage supply circuits. The first law says that the voltage drop around a complete circuit is zero. The second says that current into a junction equals current out of the junction.

Power (and brightness, for lamps) is related to the product of current and voltage. Thus energy delivery depends on both of these quantities, not just one or the other.

Light bulbs are inefficient; light-emitting diodes stay cool by emitting most of their dissipated energy as light.

Labs:

Solenoids and Electromagnetic Fields.

The students will use coils of copper wire (solenoids), batteries, iron filings, and a compass to plot the electromagnetic field about a coil. They will sketch the fields and write a critique of the lab.

Electromagnetic Induction in Wires and Coils.

The students will use magnetically coupled coils of copper wire to investigate the electromagnetic coupling of two coils.. A permanent magnet will be inserted in one coil. When it is in motion, the induced voltage in the second coil will be measured with a volt meter. A battery will charge one coil and a volt meter will detect the induced voltages in the second coil. Ah, the principle of the transformer. Changing the direction and speed of motion of the permanent magnet and the rate of turning on and off the battery will make a big difference in the output voltage. Students will explain why this is so and write a critique for this lab.

Demonstrations: The instructor will perform many demonstrations in class illustrating the principles being studied. The students will take notes on them.

Video Field Trips: The students will take notes on the videos.

By the end of this unit, students will be familiar with the following vocabulary words:

Power supply, voltage supply, cell, resistor, wire, power, voltage drop, ammeter, voltmeter, galvanometer.

Resources:

PowerPoint presentations including notes, diagrams, charts, photos, and video clips.

Our Physics website, http://boomeria.org/mightyphysics.html which includes all of the *PowerPoint* presentations for practice and review notes and problem solutions. Links to other helpful web pages. Our Practice and Review computer software that students may download.

The textbook: Holt Physics.

Unit 5: Modern Physics **Length of Time: 5 weeks.**

Content Standards and Student Outcomes:

There are no State Content Standards for this unit.

Atomic, Nuclear, and Modern Physics:

Instructional Strategies/Learning Activities:

By the end of this unit, students will be able to:

Describe atomic energy level transitions due to the absorption and emission of photons.

Explain how the radioactive decay rate changes with time, and how this phenomenon is related to the randomness (uncertainty) of the decay process.

Distinguish between alpha, beta, and gamma decay, and analyze complex nuclear reaction equations representing real decays.

Calculate the energy released when matter is converted in a nuclear reaction.

Demonstrate that the intensity of radiation decreases as the square of the distance from the source. Make calculations using the inverse-square law to determine radiation intensity.

Explain the wave and particle properties of matter.

Apply the following rules:

Atomic energy levels are quantized.

Radioactivity arises in the tension between forces in the nucleus of an atom.

All matter, all energy, displays both wave properties <u>and</u> particle properties. All these things are known as quanta.

Matter and energy are interchangeable.

There is an uncertainty principle that prevents an observer from knowing both the exact position and exact momentum of a quantum particle.

The Standard Model of Particle Physics attempts to categorize all matter and interactions in the universe.

The four fundamental forces vary enormously in their relative strength.

Nuclear fission is the splitting apart of heavy nuclei; nuclear fusion is the joining together of light nuclei; both release energy.

Radioactive carbon dating allows us to determine the era in which dead organic material lived.

The intensity of radiation decreases as the square of the distance from the source.

A small amount of matter can be converted into an enormous amount of energy.

Planck's constant is the *Fundamental Constant* of quantum mechanics.

Antimatter particles share the same mass as their corresponding matter particles, but have opposite electric charge.

Matter-antimatter annihilation releases energy according to $E = mc^2$.

The properties of fundamental particles are often determined through collisions in high-energy accelerators.
Study of fundamental particles and high-energy interactions is intimately related to the study of the early universe when these particles were created.
String theory attempts to address discrepancies between Einstein's theory of gravity and quantum mechanics. The theory has not been fully accepted or established due to the difficulty in experimental verification.

Labs: (Hands-on during class)

Sketching the Action of Particles in The Crooke's Electric Discharge Tube.
The students will sketch the action in the demonstration Crooke's Tube. They will write a critique of this demonstration.

Sketching the Action of Particles in The Canal Ray Discharge Tube.
The students will sketch the action in the demonstration Crooke's Tube. They will write a critique of this demonstration.

Sketching the Action of Particles in The Paddle Wheel Discharge Tube.
The students will sketch the action in the demonstration Crooke's Tube. They will write a critique of this demonstration.

Graphing Half-Life Curves from the "Decay" of Pennies.
The students will 1. Take 100 pennies. 2. Mix them in a cup. 3. Dump 'em on the table. 4. Sort out those whose heads are up and stack them. 5. Return the remainder to the cup, mix, dump, and stack those whose heads are up. 6. Continue until all pennies are consumed. 7. Mark a piece of graph paper into quarters in preparation to making four graphs. 8. Bar graph the stacks with the number of pennies on the y-axis and the number of the stack on the x-axis. 9. Repeat the above two more times. 10. Average your three graphs onto a fourth graph by totaling the pennies in each cup. They will explain how this works and what it has to do with radioactivity.

Demonstrations: The instructor will perform many demonstrations in class illustrating the principles being studied. The students will take notes on them.

Video Field Trips: The students will take notes on the videos.

By the end of this unit, students will be familiar with the following vocabulary words:
Nucleus, isotope, gamma ray, beta particle, alpha particle, alpha decay, beta decay, gamma decay, neutron, proton, quark, electron, electron neutrino, lepton, fermion, boson, half-life, inverse square law, particle, interaction, charge conservation, matter & antimatter, annihilation, virtual particles, uncertainty, quantum, wave-particle duality.

C. Laboratory Activities. Acceptable courses include hands-on scientific activities that are directly related to and support the other class work, and that involve inquiry, observation, analysis, and write-up. These hands-on activities should account for at least 20% of class time, and should be listed and described in detail. Please itemize and describe the laboratory activities in detail.

We perform 59 labs in class. At approximately one hour per lab, this amounts to about 35% of our teaching hours in the school year.

The students download and print out the lab instructions in advance and bring them to class where they can write their data, observations, discussions, calculations and critiques.

To help students better prepare in advance of class activities and labs, these labs are posted at: http://boomeria.org/labsphys/physicslabs.html

We use the *Vernier Software* sensors and transducers for demonstration labs on the computers with our LCD projector.

About our Labs:

Our Honors Physics labs have been obtained from various sources such as the *Woodrow Wilson Physics Institutes*, the *American Association of Physics Teachers*, the *Holt Physics* (our text book) chapter Laboratory Exercises, and separate laboratory manuals. We have typed them up and placed them on our website so that students may download them and print them out prior to performing them in our physics lab at school.

The reasons for the printouts are 1) the students are assigned to read them before coming to class as a pre-lab preparation, 2) the students may write on the lab printouts, which saves them from having to copy them onto separate papers, 3) the students will save their lab write-ups in their journals, which are later collected and evaluated.

In-Class Lab Performance:

The students will perform **hands-on** labs conducted in the classroom laboratory in small cooperative groups.
The students will apply the *Scientific Method* as guided by lab printouts.
They will collect and write reliable data by observation and measurements taken both mechanically and electronically.
They will organize the date in tables.
They will make hypotheses and test them where applicable.
They will make their mathematical calculations showing their method of solution. They will determine their percentage error by comparing their results with accepted values.
They will write an essay *critique* of the lab. As part of the critique they will suggest ideas on how to obtain better results and any other input they wish to discuss.

D. Key Assignments: Detailed descriptions of the Key Assignments including tests, and quizzes. How do assignments incorporate topics? Include all assignments that students will be required to complete.

All assignments are kept in a spiral notebook which is graded each semester. The assignments are in the Text, Holt Physics. The topics are incorporated by the chapters being studied.
The assignments are found on-line at: http://boomeria.org/physassn2000.pdf
There is an exam for each unit in addition to the comprehensive semester and final exams. Each exam is approximately one half each essay and problems.

E. Instructional Methods and/or Strategies

All lessons (lectures) are presented in colorful *PowerPoints*. These *PowerPoints* contain notes, sample problems, charts, graphs, diagrams, and video clips. They are also found on our physics web site to assist students in re-enforcing class activities: http://boomeria.org/mightyphysics.html
First semester *PowerPoints*: http://boomeria.org/physicslectures/menu.html
Second semester *PowerPoint*: http://boomeria.org/physicslectures/secondsemester/menu2.html

Labs: Hands-on labs conducted during class are available for students to print out at:
http://boomeria.org/labsphys/physicslabs.html

We have a very large assortment of demonstrations which are either performed by the instructor or by student volunteers. A list of these demonstrations can be found here:
http://boomeria.org/grades/demos/menud.html

To prepare students for the year of Physics, students complete a summer assignment found here:
http://boomeria.org/physicssummer.html

Our Practice and Review computer software that students may download are found here:
For Mac: http://home.comcast.net/~pqboom/download/FClubBlitzes.dmg
For Windows: http://home.comcast.net/%7epqboom/WindowsFClub.html

We use the *Vernier Software* sensors and transducers for demonstration labs on the computers with our LCD projector. These include motion, pressure, temperature, oscilloscope for sound waves, light detectors, microphones, thermistors, thermocouple.

F. Assessment Methods and/or Tools

Each unit will have a written examination half of which will be essays on concepts, the other half will be mathematical calculations.
We also have on-line, take-home, open notes exams which are found here:
http://boomeria.org/blitzmenu.html

There will be a comprehensive final exam in June that encompasses all of the material covered in the physics course for the entire school year. It is composed of 25 analytical essay & math problems, as well as 100 multiple choice questions. In addition, there will be a final exam for the first semester material that will be administered in January.

G. Corresponding Non-Honors Course. Indicate the name of the regular non-honors course corresponding to this proposed honors course.

This will be called, *Conceptual Physics.*

H. Differences in Honors/Non-Honors Courses. Describe in detail how this honors course differs from the regular course offered in the same subject area. Be specific.

Both Honors Physics and Conceptual Physics courses will cover the California State Standards. The concepts are the same.
Conceptual Physics does not include completion of the mathematical problem solving that requires a solid background of Algebra and Trigonometry.

Honors Physics requires competency in both Algebra 2 and Trigonometry and requires assignments that demonstrate that level of math sophistication. The labs listed above that include the mathematical problem solving and extra hours of lab work will be included in the Honors Physics curriculum. Also, honors students will complete all of the mathematical problems on the assignments sheets and on the exams.
Conceptual students will be excused from the mathematical portion of the assessments. In addition, honors students will be required to complete an Assignment Portfolio, which contains all of the semester assignments. The Assignment Portfolio will contain both the mathematics of physics and the essay explanations of physics phenomenon. Finally, honors physics students require a certain number of "extra" hours required for instruction and labs.