Introduction:

OK, so here we are at the end of your senior year…well, most of you are anyway (there may be a small handful of juniors in here), and you couldn't possibly care less about school anymore. You're frustrated over the idea that Mr. Hubbard is actually taking up a notebook (in spite of the fact that the syllabus says that he's going to)! Mr. Hubbard has two windows in his classroom, a door to the veranda (that he never lets us use), the sun is out, it's spring semester, and all we can think about is how great SB2K-WHATEVER was. Thinking back over this semester, let's remind ourselves of just how much physics we've learned so that the pain that we've experienced along the way can be justified. After all, we can look at graphs differently – with an emphasis on analyzing them for what significance they hold. Physics has taught us to think differently about the world we live in – and honestly - we've gotten good at thinking outside the box and solving problems when we understand the concepts. And, we can appreciate how much time and effort some people (like Mr. Hubbard) can put into something that he/she really loves doing.

Oops, back to reality and the present: I hope that – by the time we do arrive at the end of the semester – that you ARE able to reflect back over the things we've done in this course and realize just how differently you go about solving problems – and I'm not talking strictly about physics problems! Skills learned in this course can be used in ANY major at ANY university and I'm looking forward to teaching you this year!

Description:

Physics is the most basic of all sciences; it is the foundation of chemistry, biology, and all other science disciplines. Physics is one of the greatest creations and adventures of the human mind. It represents a continuing effort on the part of humans to solve problems, to answer questions, and to understand and interpret our experiences in a logical and an orderly way. Physics is a body of knowledge made up of observations, experiences and interpretations thus far and it is an ongoing endeavor. Physics is a way of thinking by means of which we venture into the unknown searching for knowledge and understanding. Physics is a never-ending quest. In this course, we are concerned with questions and problems that relate to matter and energy interactions. We study these interactions in the fields of mechanics, kinetics, optics, wave behavior, sound and musical acoustics, electrostatics, and fluid dynamics.

This course is designed to meet the needs of students (1) who are planning to major in a science or science related field in college, and / or (2) who need physics as a college entrance requirement. The curriculum will be taught using the principles of a differentiated classroom. The learning environment will be tailored to create different learning experiences for different students with the aim of promoting creativity and higher levels of thinking skills using open-endedness, grouping strategies, independent study, and collaborative and problem-based learning.

Rationale:

This course concentrates on the subjects of classical physics, a term that usually refers to mechanics, light, heat, sound, electricity, and magnetism - subjects well understood in the late 19th century before the advent of relativity and quantum theory, which were developed in the early 20th century. The application of special relativity, and particularly quantum theory, is often referred to as modern physics. Although modern physics has made many important contributions to technology, the great bulk of technical knowledge and skill is still based squarely on classical physics. Except for the interior of the atom and for motion at speeds near the speed of light, classical physics correctly and precisely describes the behavior of the physical world. Modern physics builds on the concepts of classical physics and cannot be understood without them.

The main objective of this course is to present an opportunity for the student to build a knowledge base of useful concepts -- concepts which will help he/she feel at home in our present, technologically oriented society. The student will take part in an organized investigation of his/her universe. The student will raise questions, form ideas, and relate concepts. The emphasis will be placed on ideas and concepts rather than facts -- on thinking, discussing and understanding -- instead of rote memorization.

The study of physics lends itself perfectly to the practical application of the math concepts learned in other classes, since physical laws are usually expressed as mathematical equations. The student taking this course is capable of algebraic thinking; it would be an opportunity lost and a waste of his/her skills to neglect mathematics completely and work only with verbal descriptions of the concepts. Problem solving is an important tool in understanding physics and making the concepts useful. In this course we will approach problem solving using verbal arguments and mathematics where appropriate.

Materials Needed:

- ✓ Textbook: **<u>Physics</u>** by Wilson/Buffa/Lou / Copyright 2007 / Prentice Hall (Sixth Edition)
- ✓ Three-ring binder – (1" spine recommended - will be collected and graded) – Tabs for: Notes / Homework / Labs
- ✓ Protractor, Small Ruler, Calculator, Loose-leaf Notebook Paper & Pencil(s)

Course Outline

Week	Topic	Chapter(s)	Lab Notebook
1 – 2	I. Introduction to Physics A. Review of Mathematics B. Metric System C. Measurement	1	> Measurement Precision: Meter Sticks, Vernier Caliper > Linearization of Data > Graphing Experimental Data
3 – 4	II. Kinematics I – Graphical Analysis of Motion A. Constant Velocity B. Accelerated Motion	2	> Graph Matching
5 – 6	III. Kinematics II – Mathematical Analysis of Motion A. Constant Velocity B. Accelerated Motion	2	> Picket Fence Free-Fall > Graphs and Tracks
7 – 8	IV. Vector Quantity A. Definition B. Addition 1. Graphically 2. Algebraically C. Resolution	3	> Force Boards
9 – 10	V. Dynamics – Newton's Laws A. First Law – Inertia B. Second Law – Acceleration C. Third Law – Action & Reaction Forces	4	> Newton's 2nd Law
11 – 12	VI. Motion in Two-Dimensions A. Projectile Motion B. Circular Motion C. Simple Harmonic Motion	3 13	> Projectile Motion: Investigation of a Trajectory > Centripetal Force
13 – 14	VII. Universal Gravitation A. Kepler's Laws B. Newton's Laws C. Cavendish Experiment	7	
15 – 16	VIII. Momentum and it's Conservation A. Impulse B. Collisions	6	> J / p Theorem > Conservation of p > Collisions in 2-D > VideoPoint Collisions
17 – 18	IX. Work and Power A. Simple Machines B. Mechanical Advantage	5	> Pulleys > "Spring Work"
19 – 20	X. Energy and it's Conservation A. Kinetic Energy B. Gravitational Potential Energy C. Elastic and Inelastic Collisions	5	> Conservation of NRG > Releasing Your Potential
21 - 22	XI. Waves and Wave Behavior A. Transverse / Longitudinal B. Boundary Phenomena 1. Transmission, Reflection, Refraction D. Diffraction E. Interference / Superposition F. Standing Waves	13	> "Ripple While You Work"
23 – 24	XII. Sound and Musical Acoustics A. Nature of Sound B. Speed of Sound C. Intensity and Loudness D. Frequency and Pitch E. Doppler Effect	14	> Standing Wave Lab

25 – 26	XIII. Geometric Optics A. Reflection B. Refraction	22 – 23	> Flat Mirror Lab > Concave Mirror Lab > Snell's Law Plates / (n)
27 – 28	XIV. Physical Optics A. Diffraction B. Interference C. Polarization	24	> Diffraction of Light Lab (Young's Double Slit) > Diffraction of Light (Spectrum Tubes)
29 – 30	XV. Current Electricity A. Ohm's Law B. Series & Parallel Circuits E. Coulomb's Law G. Electromagnetic Induction and Waves	15 – 17	> Ohm's Law Lab (Circuit Boards)
31 – 32	XVI. Fluid Dynamics A. Pascal's Principle B. Archimedes Principle C. Bernoulli's Equation	9	
33 – 34	XVII. Modern Physics A. Atomic Physics and Quantum Effects B. Rutherford Model C. Photoelectric Effect D. Radioactivity and Half-life	27 – 30	
35 – 36	XVIII. Heat, Kinetic Theory, and Thermodynamics A. Mechanical Equivalent of Heat B. Specific and Latent Heat C. Heat Transfer & Thermal Expansion D. Ideal Gas Law E. Laws of Thermodynamics (pV Diagrams / Heat Engines)	10 – 12	

Teaching Strategies:

1. Lecture-Demonstration. As a group, we will work together to expand your problem-solving skills. Since Physics is somewhat considered a way of thinking, you will hopefully gain these skills as you learn to think like a physicist. Lectures on key points as well as demonstrations of these key points will be the tools we will use on this journey.

2. Large Group Discussion. Discussing homework problems will give you the opportunity to address your ideas to the entire class.

3. Laboratory / Small Group Discussion. STUDENTS ARE REQUIRED TO KEEP A LAB NOTEBOOK CONTAINING ALL OF THEIR LAB REPORTS. During laboratory experiments and problem-solving sessions, **you will be working with as few as two but no more than four people.** This small-group atmosphere is a comfortable setting for idea exchanges. It may also provide you with a means to explain a topic that you are familiar with to someone who may not be.

4. Individual Endeavor. This mode will be used for all tests, all quizzes, some processing lab data, and some problem-solving practice. We all know that some of the best thinking is done alone. This mode allows me to monitor your progress and see where you may need help.

MAKE THESE SHEETS THE FIRST PAGES OF YOUR NOTEBOOK.