Gifted LearningLinks Program
Course Syllabus

Instructor name: Dan DuBrow
E-mail address: xxx@xxx.xxx

Course Title: Physics C

Course Description:

All fields of science, including chemistry and biology, investigate systems where properties are based upon the laws of physics. This advanced course provides students with a detailed study of both classical mechanics and classical electromagnetism. Physics C is designed for those students who typically have some prior physics experience and are interested in majoring in technical science or engineering in college. The rigor of the course requires the use of calculus to solve college-level problems and prepares students to take the AP Physics C exams.

Outcomes: Upon successful completion of this course, students will work through the following topics, as outlined by the College Board:

AP Physics C-Level Curriculum
Semester I: Newtonian Mechanics

A. Kinematics (includes vectors, vector algebra such as dot and cross products, coordinate systems, displacement, velocity and acceleration)
   1. One dimensional motion
   2. Two dimensional motion (including projectile motion)

B. Newton's laws of motion (including friction and centripetal force)
   1. First law for static equilibrium
   2. Dynamics of a single particle (2^{nd} law of motion, F = ma)
   3. Systems of two or more objects (3^{rd} law of motion)

C. Work, energy and power
   1. Work and work-energy theorem
   2. Conservative forces and potential energy
   3. Conservation of energy
   4. Power

D. Systems of particles and linear momentum
   1. Center of mass
   2. Impulse and linear momentum
   3. Conservation of linear momentum
   4. Elastic and inelastic collisions

E. Circular motion and rotations
   1. Uniform circular motion
   2. Angular momentum and its conservation
      a. Point particles
      b. Extended bodies, including rotational inertia (rigid bodies)
   3. Torque and rotational statics (2^{nd} condition for equilibrium)
   4. Rotational kinematics and dynamics

F. Oscillations and gravitation
   1. Simple harmonic motion
   2. Mass on a spring
   3. Pendulum and other oscillations
   4. Newton's law of universal gravitation
   5. Orbits of satellites (circular and elliptical)

Semester II: Classical Electricity and Magnetism

A. Electrostatics
   1. Charge, electric field and potential
   2. Coulomb's law for point charges
   3. Electric field and potential for systems of charges
      a. Planar
      b. Spherical symmetry
      c. Cylindrical symmetry
   4. Gauss's law

B. Conductors, capacitors and dielectrics
   1. Electrostatics with conductors
   2. Capacitors (parallel plate, spherical and cylindrical)
   3. Dielectrics

C. Electric circuits
   1. Current, resistance and power (including Ohm's law)
   2. Steady-state direct current circuits with resistors and batteries
   3. Capacitors in series and parallel
      a. Steady-state
      b. Transients in RC circuits

D. Magnetostatics
   1. Forces on moving charges in magnetic fields
   2. Forces on current-carrying wires in magnetic fields
   3. Fields generated by long current-carrying wires
   4. Biot-Savart law and Ampere's law

E. Electromagnetism
   1. Electromagnetic induction (Faraday's and Lenz's laws)

2. Inductance (including LR and LC circuits)
3. Maxwell's equations (including derivations of Gauss's, Faraday's, Ampere's laws and wave equation)

For a very detailed, point-by-point listing of course objectives, see the Course Objectives links at **http://facweb.eths.k12.il.us/chemphys/Links.htm**.

Resources and Materials:

We will use a good university textbook for this class:
University Physics, 11th edition, by Young and Freedman (2004). The publisher is Addison Wesley, San Francisco. The ISBN number is 0-8053-8768-4.

An extensive set of web sites past students have found to be helpful can be found at http://facweb.eths.k12.il.us/chemphys/Links.htm.

Students in this course will need their textbook and a calculator. It is recommended that they take notes as they progress through the topics in any given chapter. Students will have some experiments, both physical and computer-based, which need to be written up as well.

Student Evaluation and Grading Policies for Credit Courses Only:

A+ 97-100 (A+ is at instructor's discretion; an instructor can use 97-100 A)
A 93-96
A- 90-92
B+ 87-89
B 83-86
B- 80-82
C+ 77-79
C 73-76
C- 70-72
D+ 67-69
D 63-66
D- 60-62
F Below 60

Breakdown of final grade (Approximate percentages):
50% quizzes, 25% Homework sets, 10% labs, 15% final exams

Schedule: Mechanics

Note that this schedule assumes you are planning on taking the AP exam. If you do not want to take the AP exams, a different, less aggressive schedule will be worked out with you.

Due Date	Topic	Activity	Assignment
5 weeks	Motion	Problem Sets	Ch 1, #7,35,41,49,65,86,97

			Ch 2, #3,9,13,19,21,25,31,39,44,61,67,76 Ch 3, #1,5,9,19,23,29,31,37,41,54,60,63,89* Ch 4, #3,5,7,15,17,19,33,39,45,49,55 Ch 5, #3,8,11,13,19,23,31,35,39,43,46,49,62,73, 89,115,127*
		Exam, Ch. 1-5	
4 weeks (week 9)	Energy & Momentum	Problem Sets	Ch 6, #1,7,17,23,29,30,31,37,43,67,81,83 Ch 7, #1,5,9,13,17,24,33,37,42,43,46,63,65,74 Ch 8, #1,4,7,9,13,17,23,27,34,35,39,45,59,64,70 93,99
		Exam, Ch 6-8	
Due Date	Topic	Activity	Assignment
4 weeks (week 13)	Rotations	Problem Sets	Ch 9, #1,5,11,13,21,23,31,37,41,45,65,85,86 Ch 10, #1,3,13,19,26,27,35,38,39,42,43,67,83 91 Ch 11, #1,7,12,13,19,42,72*
		Exam, Ch 9-11	
2 weeks (week 15)	Gravity & SHM	Problem Sets	Ch 12, #5,6,13,15,23,27,29,45,46,50,61 Ch 13, #1,4,5,9,12,13,41,45,59,63

Mechanics Labs

Experimentation is what makes science science, and it is invaluable to your understanding of physics to observe firsthand the various physical phenomena in action.

Most labs we do will be written up with the following requirements:

- hypothesis based on common experiences and/or class material

- procedures developed and used in the experiments; these will tend to vary between students because they may have entirely different materials available at home or from local high schools

- clear, organized data section, with appropriate error analysis

- data analysis, including propagation of error when appropriate

- questions and conclusions based on data and observations

As a correspondence course, formal physical labs are more difficult because often students have no access to laboratories and equipment. You will receive more information on this at a later date, once you have begun the course.

Students also do simulated experiments and other types of computer simulated demonstrations, particularly on the *ActivPhysics* web site, which is designed for our textbook. There are references within chapters when there is a computer lab associated with the material being studied:

http://wps.aw.com/aw_young_physics_11

There are dozens of simulations available on this site for all the topics we study. Students are encouraged to communicate with each other on all course work.

Specifically, students will work on the following ActivPhysics exercises when you are working on the course material:

- 1.1-1.3 Motion Graphs and Understanding Derivatives

- 1.12 Solving two-vehicle problems (kinematics)

- 4.2 Circular Motion Problem Solving

- 6.3 Momentum Conservation in Collisions

- 7.6 Rotational Inertia

Instructional Strategies:

Throughout the semester, students should try to work alone on homework sets, but they may wish to participate in a class email list and/or a discussion group on Blackboard when they are having difficulty with any of the material. They should have email or telephone contact with the instructor if they have questions on material or any aspect of the course. They may prefer to use an extensive list of Internet sites dedicated to the topic at hand; an extensive set of sites is provided through links sent to each student by the instructor. For visual learners, computer simulated 'labs' are provided for every topic we study on the *ActivPhysics* site, which is designed for our textbook. Physical experiments using some basic household items are used throughout the course, as well. As the year progresses, old AP problems will be provided on a password-protected

Moodle site the instructor has set up and makes available to all students (this is more relevant by April). In addition, there are several good reference and review books written specifically for the AP Physics C course, which can be found in public libraries as well as all the major book stores. The College Board online site has review materials and sample exam questions/problems for all AP courses.

Week 16 Mechanics Final Exam AP Multiple Choice Exam

End of 1st Semester

==========

Schedule: Electricity & Magnetism

Due Date	Topic	Activity	Assignment
4 Weeks (Week 20)	Electrostatics	Problem Sets	Ch 21, #1,7,11,19,25,29,31,45,71,75,94* Ch 22, #3,4,7,15,19,36,37,45 Ch 23, #1,3,7,13,21,22,31,51,70,81
		Exam, Ch 21-23	
4 Weeks (Week 24)	Circuits	Problem Sets	Ch 24, #1,14,15,19,27,59,71,72 Ch 25, #1,9,32,37,39,43 Ch 26, #1,8,9,39,54 & Additional AP capacitor problems

Due Date	Topic	Activity	Assignment
5 weeks (Week 30)	Magnetism	Problem Sets	Ch 27, #1,3,11,15,20,30,31,35,59 Ch 28, #5,11,17,31,32,35,54,61,62 Ch 29, #6,9,16,18,20,25,27,54,61 Ch 30, #7,19,23,28 & Additional AP RL-circuit problems

Electricity and Magnetism Labs

As a correspondence course, formal physical labs are more difficult to do because often students lack access to laboratories and equipment. However, approximately 10% of the course will consist of a combination of physical and simulated laboratory work. Experimentation is what makes science science, and it is invaluable to your understanding of physics to observe firsthand the various physical phenomena in action. Labs will be assigned at a later date, after you have begun the course.

Students will also do simulated experiments and other types of computer simulated demonstrations, particularly on the *ActivPhysics* web site, which is designed for our textbook. There are references within chapters when there is a computer lab associated with the material being studied:

http://wps.aw.com/aw_young_physics_11

There are dozens of simulations available on this site for all the topics we study. Specific computer labs to do and turn in are done when working on the corresponding materaial:

- 11.1 Coulomb's law

- 11.2 Superposition

- 11.7 Electric Flux

- 12.8 RC Circuit Time Constants

- 13.1-3 Magnetic Fields

- 13.7 Mass Spectrometer

- 13.9 EM Induction (generators)

Instructional Strategies:
Throughout the semester, students should try to work alone on homework sets, but they may wish to participate in a class email list and/or a discussion group on Blackboard when they are having difficulty with any of the material. They should have email or telephone contact with the instructor if they have questions on material or any aspect of the course. They may prefer to use an extensive list of Internet sites dedicated to the topic at hand; an extensive set of sites is provided through the Blackboard class site, as well as sent to each student by the instructor. For visual learners, computer simulated 'labs' are provided for every topic we study on the *ActivPhysics* site, which is designed for our textbook. Physical experiments using some basic household items are used throughout the course, as well. As the year progresses, old AP problems will be provided on a password-protected *Moodle* site the instructor has set up and makes available to all students (this is more relevant by April). In addition, there are several good reference and review books written specifically for the AP Physics C course, which can be found in public libraries as well as all the major book stores. The College Board online site has review materials and sample exam questions/problems for all AP courses.

Week 31 Electricity & Magnetism Final Exam AP Multiple Choice Exam

Once done with the formal assignments of the course, and if you are planning on taking the AP exam in May, review and practice exams begin and go into May.

AP EXAM: MAY 2011