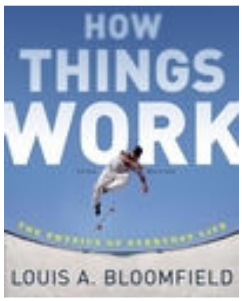
PHS 101-UY/VT Physical Science

Summer Term 2008

Class meets: Sunday 1:00pm-6:30pm; CH 461 *or* CH 405

Instructor and Office Hours:
Dr. Renato Camata, camata@uab.edu
CH 306; (205) 934-8143

Monday, Wednesday 1:30-3:00 PM (CH306)
(Other times by appointment)



Textbook: "How Things Work – The Physics of Everyday Life," Louis A. Bloomfield, Wiley, 3rd Edition,
http://www.wiley.com//college/sc/bloomfield/index2.html

Course Description: This course provides non-science major students with a view of physics and science to help establish a connection between science and everyday life experiences through integrated laboratory, discussion, and lecture.

Course Goals: Through a learning environment motivated by everyday life experiences, this course trains non-science majors in how to utilize physical principles to understand the world around them. The goals of this course are as follows: (i) provide students with objective knowledge of established physical laws and principles that govern natural phenomena; (ii) enable students to apply this knowledge in problem-solving, hands-on laboratory experiences that foster the development of their analytical and quantitative skills; (iii) guide students in the use of computer resources for analysis of experimental data; (iv) train students in effective written communication skills in the physical sciences; (v) expose students to the high ethical standards in collaborative work and in the preparation of written reports; and (vi) foster a collaborative learning environment with significant oral participation and information exchange.

Prerequisite: Completion of Core Curriculum mathematics requirement.

Last Day to Withdraw with "W": July 7

Web Page: http://www.phy.uab.edu/~rcamata/PHS101-UY.htm
(Syllabus, class materials, and grades will be posted on the class web page)

Course Grade: Student performance in the course will be determined using the following assessment tools with corresponding weights:

30% - In class quizzes on material (best **3** out of **5**)
20% - Homework exercises
20% - Lab activities:
Breakdown of Lab activities:
10%: Average Score of Data Sheets of Experiments (best ***n*-2** out of ***n***)
10%: Average Score of Assigned Laboratory Reports
30% - Final Exam with open book/notebooks

Grading Scale:
The weights shown in the previous page will be used to calculate the course weighted average and letter grades will be assigned according to the following table:

89.0% to 100% inclusive*	**A**
79.0% to 88.9% inclusive	**B**
65.0% to 78.9% inclusive	**C**
50.0% to 64.9% inclusive	**D**
0.0% to 49.9% inclusive	**F**

Weighted averages will be rounded up to the nearest 0.1%

***Turning in all assigned work is a necessary condition for an "A" grade**

Homework Policy:
Group work and discussions prior to turning in homework are appropriate.
Late homework:

- ½ credit while solutions have not been discussed in class
- 0 credit after solutions have been discussed in class

Missed Quiz Policy:
There will be no make-up quizzes.

Missed Laboratory Activity Policy:
There will be no make-up laboratory activity.

Work for extra credit:
No additional work will be assigned for extra credit.

Special accommodations:
Please contact Dr. Camata for an appointment to discuss special accommodations.

Course outline

Date	How Things Work	Lab. Activity	Textbook Chapters in which Content can be Found
Level 1: Introductory Topics (Basic concepts common to all PHS 101 Sections)			
06/08	**Skating & Coasting**	**Frictionless**	**1: Laws of Motion**
06/15	**Falling Balls**	**Falling Ball**	**1: Laws of Motion**
06/22	***Review & Quiz 1*** *(1st half)*		
	Wheels & Friction *(2nd half)*	**Friction**	**2: Laws of Motion**
06/29	***Review & Quiz 2*** *(1st half)*		
	Energy & Roller Coasters ***(2nd half)***	**Roller Coaster**	**1, 3, 7: Energy**
07/06	**Energy & Roller Coasters** *(1st half)*		**7, 8: Energy**
	Spring Scales *(2nd half)*	**Hooke's Law**	**3: Mechanical Objects**
07/13	***Review & Quiz 3*** *(1st half)*		
	Waves & Clocks *(2nd half)*	**Waves**	**9: Oscillations**
07/20	***Review & Quiz 4*** *(1st half)*		
Level 2: In-depth Specialized Investigation (Specific to PHS 101-UY/VT Section)			
	Fluids & Structure of Matter *(2nd half)*	**Density**	**5, 6: Fluids & Matter**
07/27	***Review & Quiz 5*** *(1st half)*		
	Fluids & Structure of Matter *(2nd half)*	**-**	**6, 7: Fluids & Matter**

Final Comprehensive Exam: Sunday, August 3, 2:00pm – 4:30pm

Course Learning Objectives:

By successfully completing this course you should be able to:

Skating & Coasting: Describe and explain the motion of objects subject to zero net force

(1) Explain the goals and methods of kinematics
(2) Define the concepts of position, distance, displacement, speed, velocity, acceleration, and force.
(3) Explain these concepts in your own words.
(4) Compare and contrast the concepts of distance and displacement, speed and velocity.
(5) Compute the speed of moving objects.
(6) Determine the velocity of moving objects.
(7) Measure the velocity of objects using video capture and Logger Pro software.
(8) Explain the goals and methods of dynamics.
(9) Define the concept of force and net force.
(10) Contrast ideas of Aristotle and Newton about the true effect of net force.
(11) Decompose the net force acting on an object in its various components.
(12) Explain how individual non-zero forces can lead to zero net force.
(13) Identify individual forces which contribute to zero net force in examples.
(14) Explain in your own words the Law of Inertia (Newton's 1st Law of motion).
(15) Predict the motion of objects subject to zero net force using the Law of Inertia.
(16) Determine the net force on an object moving according to the Law of Inertia.

Falling Balls: Describe and explain the motion of objects subject to constant (non-zero) net force

(17) Illustrate, through everyday life examples, situations in which the net force acting on an object is different than zero.
(18) Compute the acceleration of an object from the change it its velocity.
(19) Compare and contrast the concepts of velocity and acceleration.
(20) Define the concepts of mass and weight of an object.
(21) Compare and contrast the concepts of mass and weight of an object.
(22) State Newton's 2nd Law of motion.
(23) Explain how Newton's 2nd Law is also a statement of the Law of Inertia.
(24) Apply Newton's 2nd Law to predict the motion of object subject to constant net force.
(25) Compare and contrast the motion of an object subject to zero net force with that of an object subject to a non-zero constant net force.
(26) Compute the acceleration of an object using Newton's 2nd Law.
(27) Measure the acceleration of objects using video capture and Logger Pro software.

Wheels & Friction: Describe and explain the motion of objects subject to frictional forces

(28) Explain the phenomenon of friction in terms of concepts defined in earlier objectives.
(29) Distinguish among different frictional forces, such as static friction, sliding friction, and drag forces in fluids.
(30) Provide everyday life examples of each type of frictional force in the previous question.
(31) Distinguish between situations when static friction is at work and when sliding friction dominates.

(32) Compare and contrast the relative magnitude of the peak static friction and the sliding friction between two surfaces.
(33) Explain how wheels and ball bearings can reduce the wear caused by friction.
(34) Compute the frictional force between two sliding surfaces when the force normal to the surfaces and the coefficient of sliding friction are known.
(35) Explain the meaning of the coefficient of sliding friction.
(36) Measure the frictional and normal forces between surfaces sliding against each other.
(37) Measure the coefficient of sliding friction between two surfaces.

Roller Coasters: Describe and explain the motion of objects in terms of energy

(38) Define the precise meaning of the physical quantity known as energy.
(39) Identify at least **10** different forms of energy observed in everyday life.
(40) Quantitatively define the concept of gravitational potential energy.
(41) Quantitatively define the concept of kinetic energy.
(42) Define the concept of mechanical energy.
(43) State the principle of conservation of mechanical energy.
(44) Extrapolate the principle of conservation of mechanical energy to include all forms of energy and state the general principle of conservation of energy.
(45) Distinguish between situations in which the principle of conservation of mechanical energy can be applied and situations in which it cannot.
(46) Compare and contrast situations in which mechanical energy is conserved and situations in which it is not.
(47) Explain in your own words how energy can be transformed from one form to another.
(48) Illustrate, through everyday life examples, at least **5** processes in which energy is converted from one form to another.
(49) Predict the behavior of systems using the principle of conservation of energy.
(50) Measure the gravitational potential energy and kinetic energy of objects using video capture and Logger Pro software.

Spring Scales: Describe and explain the motion of objects subject to restoring forces

(51) Define the concept of restoring force of a spring.
(52) State the concept of mechanical equilibrium.
(53) Link the concepts of mechanical equilibrium and net force defined earlier.
(54) Restate the concept of mechanical equilibrium in terms of the Law of Inertia.
(55) State Hooke's Law.
(56) Explain in your own words the meaning of the "spring constant" or "elastic constant" of a spring.
(57) Compare and contrast the behavior of a spring with a high spring constant with that of a spring with a low spring constant.
(58) Compute the restoring force produced by a spring of know spring constant when it is subjected to a given distortion.
(59) Measure the spring constant of a spring.
(60) Explain the principle of operation of a Spring Scale.

Waves & Clocks: Define and explain the motion of an oscillating system.

(61) Define and explain the concepts of amplitude, frequency and period of an oscillation.

(62) Explain how the interplay between potential energy and kinetic energy can lead to oscillations in a physical system.
(63) Compute the period and frequency of simple systems that oscillate with small amplitudes.
(64) Using the results of Newton's 2nd Law, predict the period and frequency of a mass-spring system with known mass and spring constant.
(65) Measure the period of oscillation of the same mass-spring system using video capture and Videopoint software.
(66) Compare and contrast the period of oscillation predicted by Newton's 2nd Law with values measured experimentally.
(67) Draw inferences based on agreement or disagreement between predicted and measured quantities.
(68) Explain the effect (if any) of changing the mass on the period of the mass-spring system.
(69) Explain the effect (if any) of changing the amplitude on the period of the mass-spring system.
(70) Explain how oscillating systems can be used to make accurate clocks.

Fluids & The Structure of Matter: Density of solids and liquids

(71) Define the concept of volume.
(72) Compute the volume of various geometrical solids.
(73) Compare and contrast the concepts of mass, weight, and volume of an object.
(74) Define the physical quantity known as density (i.e., mass density).
(75) Measure the mass, volume, and density of solids.
(76) Measure the mass, volume, and density of liquids.
(77) Compare and contrast the densities obtained from different solids and liquids.
(78) Predict the behavior of insoluble and immiscible substances of various densities when these are immersed in liquids of known densities.
(79) Draw inferences about the atomic organization of matter based on the density of substances.
(80) Draw conclusions about the chemical nature of a substance based on knowledge of its density.

Overall Scientific Method, Tools, and Communication

(81) Compute physical quantities using the International System of Units (SI).
(82) Transform SI units to the English system of units and vice versa.
(83) Solve 1st order polynomial equations on one variable.
(84) Write physical laws and principles (e.g., Newton's 2nd Law, The Principle of Conservation of Energy) in the form of mathematical expressions using symbols.
(85) Rewrite mathematical expressions of objective (84) in different ways with proper algebraic transformations.
(86) Translate the mathematical expressions referred to in objective (84) into verbal statements of the corresponding physical laws and principles and vice versa.
(87) Identify sources of *error* and *fluctuations* in data obtained in laboratory activities.
(88) Organize the data obtained in the laboratory activities in the form of tables.
(89) Construct graphs using *graph paper* and *pencil* based on data presented in tables.

(90) Construct graphs using *computers* based on data presented in tables.
(91) Construct graphs using *computers* based on data acquired through Videopoint.
(92) Distinguish between *trends* and *fluctuations* in data presented in graphs.
(93) Analyze, interpret, and draw conclusions from data presented in graphs.
(94) Obtain the slope from graphical data exhibiting a linear relationship and interpret its physical meaning.
(95) Explain the difference between values *predicted* by a theory and values *measured* in an experiment.
(96) Evaluate the possible reasons for disagreement between *predicted* and *measured* values.
(97) Write laboratory reports with organized and logical flow of ideas containing: Title, Introduction, Objective of Experiments, Method Used, Results and Discussion, Conclusions, and Cited References.
(98) Write laboratory reports that define unfamiliar terms and concepts used, establish the importance of the activity reported, provide sufficient information to enable activity to be reproduced by the reader, and make critical analysis of the results.
(99) Write laboratory reports that integrate mathematical, tabular, and graphical representation of data.
(100) Write laboratory reports that compare and contrast *theoretical predictions* and *experimental measurements* and draw conclusions and inferences from agreements and/or disagreements observed.
(101) Define the various modes of plagiarism.
(102) Write laboratory reports without resorting to plagiarism.
(103) Write laboratory reports in own words without cutting and pasting from other electronic sources or copying from other written sources.
(104) Write laboratory reports with ethical acknowledgement of used sources.
(105) Compare and contrast the Scientific Method with other means of gaining knowledge.
(106) Define terms hypothesis, model, law, theory, and generalization.
(107) Compare and contrast pairs of terms, which are easily confused in the scientific context, such as law and theory.
(108) Explain what priorities scientists use to choose among conflicting generalizations to explain nature.
(109) Explain the roles of inductive and deductive logic in the scientific method.
(110) Discuss the concept of proof and its presence or absence in natural science.
(111) Explain why honesty and clear communication are essential to achieving success when using the scientific method.