PHS 101-4T/X7 Physical Science

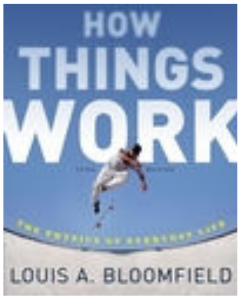
Summer Term 2007

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

Instructor and Office Hours:

Dr. Renato Camata, camata@uab.edu
CH 306; (205) 934-8143

Friday 3:00pm-4:00pm (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 11

Web Page: http://www.phy.uab.edu/~rcamata/PHS101-4T.htm
(Syllabus, class materials, and grades will be posted on the class web page)

Course Grade:

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:

Letter grades will be assigned according to the following table:
(All calculated grades will be rounded up to the nearest 0.1%.)

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**

***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
06/03	**Skating & Coasting**	**Frictionless**	**1: Laws of Motion**
06/10	**Falling Balls**	**Falling Ball**	**1: Laws of Motion**
06/17	***Review & Quiz 1*** *(1st half)*		
	Wheels & Friction *(2nd half)*	**Friction**	**2: Laws of Motion**
06/24	**Energy & Roller Coasters**	**Roller Coaster**	**1, 3, 7: Energy**
07/01		**-**	**7, 8: Energy**
07/08	***Review & Quiz 2*** *(1st half)*		
	Spring Scales *(2nd half)*	**Hooke's Law**	**3: Mechanical Objects**
07/15	***Review & Quiz 3*** *(1st half)*		
	Waves & Clocks *(2nd half)*	**Waves**	**9: Oscillations**
07/22	***Review & Quiz 4*** *(1st half)*		
	Fluids & Structure of Matter *(2nd half)*	**Density**	**5, 6: Fluids & Matter**
07/29	***Review & Quiz 5*** *(1st half)*		
	Fluids & Structure of Matter *(2nd half)*	**-**	**6, 7: Fluids & Matter**

Final Comprehensive Exam: Sunday, August 5, 2:00pm – 4:30am

Course Learning Objectives:

By successfully completing this course you should be able to:

Skating & Coasting: Motion of objects subject to zero net force

(1) Define the concepts of *position*, *velocity*, *acceleration,* and *force*.
(2) Explain these concepts in your own words.
(3) Compare and contrast the concepts of *speed* and *velocity*.
(4) Compute the *speed* of moving objects.
(5) Determine the *velocity* of moving objects.
(6) Measure the *velocity* of objects using video capture and Videopoint software.
(7) Define the concept of *net force*.
(8) Determine the *net force* acting on an object.
(9) Decompose the *net force* acting on an object in its various components.
(10) Explain in your own words the Law of Inertia (Newton's 1st Law of motion).
(11) Predict the motion of objects subject to zero net force using the Law of Inertia.
(12) Determine the *net force* on an object moving according to the Law of Inertia.

Falling Balls: Motion of objects subject to (non-zero) constant net force

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

Wheels & Friction: Motion of objects subject to frictional forces

(25) Explain the phenomenon of *friction* in terms of concepts defined in objectives (1)-(24).
(26) Explain the difference between *static friction* and *sliding friction*.
(27) Provide everyday life examples of *static friction* and *sliding friction*.
(28) Distinguish between situations when *static friction* is at work and when *sliding friction* dominates.
(29) Compare and contrast the relative magnitude of the peak *static friction* and the *sliding friction* between two surfaces.
(30) Explain how wheels and ball bearings can reduce the wear caused by friction.
(31) Compute the frictional force between two sliding surfaces when the force normal to the surfaces and the coefficient of sliding friction are known.
(32) Explain the meaning of the coefficient of sliding friction.

(33) Measure the *frictional* and *normal forces* between surfaces sliding against each other.
(34) Measure the *coefficient of sliding friction* between two surfaces.

Roller Coasters: Energy

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

Spring Scales: Restoring forces and equilibrium

(48) Define the concept of *restoring force* of a spring.
(49) State the concept of *mechanical equilibrium*.
(50) Link the concepts of *mechanical equilibrium* and *net force* defined in objective (7).
(51) Restate the concept of *mechanical equilibrium* in terms of the Law of Inertia.
(52) State Hooke's Law.
(53) Explain in your own words the meaning of the *"spring constant"* or *"elastic constant"* of a spring.
(54) Compare and contrast the behavior of a spring with a *high spring constant* with that of a spring with a *low spring constant.*
(55) Compute the restoring force produced by a spring of know spring constant when it is subjected to a given distortion.
(56) Measure the spring constant of a spring.
(57) Explain the principle of operation of a Spring Scale.

Waves & Clocks: Motion of objects subject to oscillating forces

(58) Define and explain the concepts of *amplitude, frequency* and *period* of an oscillation.
(59) Explain how the interplay between *potential energy* and *kinetic energy* can lead to oscillations in a physical system.
(60) Compute the *period* and *frequency* of simple systems that oscillate with small amplitudes.
(61) Using the results of Newton's 2nd Law, predict the *period* and *frequency* of a mass-spring system with known mass and spring constant.

(62) Measure the period of oscillation of the same mass-spring system using video capture and Videopoint software.
(63) Compare and contrast the period of oscillation *predicted* by Newton's 2nd Law with values *measured* experimentally.
(64) Draw inferences based on agreement or disagreement between *predicted* and *measured* quantities.
(65) Explain the effect (if any) of changing the *mass* on the period of the mass-spring system.
(66) Explain the effect (if any) of changing the *amplitude* on the period of the mass-spring system.
(67) Explain how oscillating systems can be used to make accurate clocks.

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

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

Overall

(78) Compute physical quantities using the International System of Units (SI).
(79) Transform SI units to the English system of units and vice versa.
(80) Solve 1st order polynomial equations on one variable.
(81) 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.
(82) Rewrite mathematical expressions of objective (81) in different ways with proper algebraic transformations.
(83) Translate the mathematical expressions referred to in objective (81) into verbal statements of the corresponding physical laws and principles and vice versa.
(84) Identify sources of *error* and *fluctuations* in data obtained in laboratory activities.
(85) Organize the data obtained in the laboratory activities in the form of tables.
(86) Construct graphs using *graph paper* and *pencil* based on data presented in tables.
(87) Construct graphs using *computers* based on data presented in tables.
(88) Construct graphs using *computers* based on data acquired through Videopoint.
(89) Distinguish between *trends* and *fluctuations* in data presented in graphs.
(90) Analyze, interpret, and draw conclusions from data presented in graphs.
(91) Obtain the slope from graphical data exhibiting a linear relationship and interpret its physical meaning.

(92) Explain the difference between values *predicted* by a theory and values *measured* in an experiment.
(93) Evaluate the possible reasons for disagreement between *predicted* and *measured* values.
(94) 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.
(95) 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.
(96) Write laboratory reports that integrate mathematical, tabular, and graphical representation of data.
(97) Write laboratory reports that compare and contrast *theoretical predictions* and *experimental measurements* and draw conclusions and inferences from agreements and/or disagreements observed.
(98) Define the various modes of plagiarism.
(99) Write laboratory reports without resorting to plagiarism.
(100) Write laboratory reports in own words without cutting and pasting from other electronic sources or copying from other written sources.
(101) Write laboratory reports with ethical acknowledgement of used sources.