

PHYS 1210: Physics I

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Lecture: MWF 10:00-11:40 in Physical Sciences 133 (Barrans & Dale)
Lecture: MWF 14:10-15:50 in Physical Sciences 133 (Barrans & Tang)
Materials: Sears & Zemansky's *University Physics*, 12th edition, by Young & Freedman
Calculus-Based University Physics I, by Rudi Michalak
Online homework access via bookstore or www.masteringphysics.com
Student Response Handset available from the bookstore
Web page: www.barransclass.com/phys1210
Prerequisites: MATH 2200
USP: This course satisfies the SP category of the University Studies Program

Course Content

We are excited to teach you! This course is an introduction to the fundamental physical phenomena that shape our universe. Topics you will learn about include linear and rotational motion, gravity, energy, work, oscillations/waves, and fluids. You will gain physical intuition and problem solving ability which will allow you to explain and predict what goes on in the physical world. Physics I is the foundation which underlies disciplines as diverse as astronomy, biology, chemistry, electronics, engineering, geology, medicine, and meteorology.

Class Meetings

For the first time this course will be taught in the style known as “workshop physics” or “studio physics”, whereby lecture, lab, and discussion are all folded together. Though this style of teaching has been shown to improve student learning, this will be our first attempt using this technique. We are confident you will benefit from and enjoy the experience, but please bear with us whenever hiccups occur.

Since ideas and definitions from the text will be used freely in class, it is necessary for you to read and study the assigned chapters before class. We will avoid presenting the exact examples in your text. Instead, class meetings are for addressing the difficult points in the text as well as for helping to place the readings in a larger context. The more actively engaged you are during class, the more you will learn and the better you will perform.

To encourage the reading of material before lecture, there will be frequent in-class reading quizzes (~5 minutes in length). The dates and times of the quizzes will generally be unannounced. The quizzes will contain both conceptual and *short* quantitative questions, but will largely be used to check that you have simply done the reading.

As mentioned above, discussion-like group work and labs are built into the class meetings. Participation in these activities is essential for the successful completion of this course. If you must miss a lab, it is your responsibility to let us know well in advance of your absence.

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Labs will consist of a **pre-lab assignment** to be completed before you come to class on Monday, the **lab report** itself done during lab activities, and a **post-lab assignment** which must be turned in by Monday of the following week. Points will automatically be deducted from late work. Thus, it is better to do work late rather than not at all, but it will be difficult to do well in this course if you are consistently late.

Exams

Homework will contain mostly quantitative problems, whereas lectures will provide you with many conceptual, multiple-choice questions to tackle in class. Hence, the exams will contain both quantitative and conceptual problems, and have both multiple-choice and written formats. The exams will be closed book and closed notes, although to each exam you will be allowed to bring a calculator. Relevant formulae will be provided, so you will need not memorize equations. Exams from previous semesters will be made available. *No make-up exams will be given.*

Partial credit: One negative aspect of the multiple-choice format is its “all or nothing” nature. For this course's exams, you may earn partial credit on a multiple-choice problem by opting to select two (and sometimes three) of the possible answers. For example, if you answer both A and C on a 4 point question that has the possible choices of A,B,C,D, you will earn 2 points if either answer A or C is correct.

All examinations are required and none of the scores will be dropped or replaced. The exams will be held at the following times, and cover the following chapters in *Young & Freedman*:

Exam 1 – Thursday February 18	17:00-19:00	Ch 01-05, in CR 310
Exam 2 – Thursday April 01	17:00-19:00	Ch 06-11, in CR 310
Exam 3 – Monday May 03	10:15-12:15	Ch 12-16

Homework

Assignments will be posted and graded online (see below). A typical assignment would include eight online and two written problems. Students are encouraged to work together, but each student must submit their own work (see below). The deadline for each homework will be indicated online. Typically the written problems will have the same deadline and be turned in at the beginning of lecture.

For the written exercises you should give credit to any sources or people you find helpful. For example, if you work on a problem in a group, the names of all the other members in that group should be given. Also, by citing references, your writings will be more useful to you in the future. To receive full credit, your work must be legible and the logic easy to follow.

No credit will be given for incomplete work. Late written homework will not be accepted, and a penalty that increases with time will be assessed to the online homework if it is turned in <24 hours late; no credit will be given if the online homework is more than 24 hours late.

MasteringPhysics.com advice and information:

- The procedures for self-registration are explained at www.masteringphysics.com. Your access code is inside the student access kit that comes with the text (please see us if you do not have the kit). The course ID is RBDDJT1210SPRING2010. You may choose your login and password.
- Never use the browser's “back” button. Use the links provided.
- You will be able to submit each answer up to three times, and full credit can be earned even on the third attempt (however, no credit will be awarded if you do not initially answer correctly on a two-part multiple-choice problem; partial credit only will be awarded if you initially answer wrong on a three-part multiple-choice problem, etc).

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- Some problems have multiple components. Click “submit” after answering each component, and click “submit item” after you are finished with all components.
- Many problems have hints to help you along the way. You will not be penalized for looking at the hints.
- Some of the parameters in a given problem may be randomized, such that different students will work with different numbers in the problem statement.
- There is a 2% tolerance for numerical answers; e.g., you can be off by 1.8% and still receive full credit.
- Solutions to the assignments will be posted on the course website. The login and password for this website are “physi” and “solns”.

Grading (Subject to revision):

Exams:	60%
Attendance:	05%
Online homework:	15%
Written homework:	05%
<u>Lab:</u>	15%
	100%

The typical grade in Physics I is a B-, which converts to a B since UW does not use pluses or minuses in its grading scheme. Note that grades only reflect performance over a short period; grades are not a holistic reflection of you. Because of the limited scope of Physics I, your grade cannot possibly represent your full range of abilities in communication, writing, enthusiasm, logic, creativity, perseverance, entrepreneurial spirit, and a host of other talents that will be important to reaching your career and life goals.

Buy and register your class response keypad

Every day we will make use of the Classroom Response System (CPS); each student must have a numeric keypad. To get and initialize your keypad:

1. Buy your keypad at the bookstore.
2. Register at www.einstruction.com (under the "Students" tab), using the Class Key e46229m84 for the 10:00 section and s21957c46 for the 2:00 section.
3. Bring your keypad to each class meeting.

Academic Honesty

The University of Wyoming is built upon a strong foundation of integrity, respect and trust. All members of the university community have a responsibility to be honest and the right to expect honesty from others. Any form of academic dishonesty is unacceptable to our community and will not be tolerated. Suspected violations of standards of academic honesty should be reported to the instructor, department head, or dean.

Special accommodations

If you have a physical, learning, or psychological disability and require accommodations, please let the instructor know as soon as possible. You must register with, and provide documentation of your disability to, University Disability Support Services in SEO, room 330 Knight Hall. 766-6189, TTY: 766-3073

Additional help

Tutors are available MTWR from 7-9 pm in Engineering Room 1070; see wwweng.uwyo.edu/societies/tbp/tutoring/. “Physics at Night” help sessions will also be held six hours each week in Physical Sciences Room 234, generally MTW from 7-9 pm.

Expectations

Consider reading “A&S Students and Teachers—Working Together” found at uwadmnweb.uwyo.edu/a&s/Current/default.asp. This useful set of guidelines was written by a faculty and student committee. It is a concise attempt to inform students of instructor expectations as well as what students may expect of teachers and advisors.

What you should expect from us:

- To teach fundamental physics in a clear, organized manner to help you become competent and confident problem solvers. At the expense of skipping some of the later topics, we will reserve the option of slowing down the pace of the course according to the students' needs.
- To administer multiple feedback questionnaires, to better gauge your perceptions of the course and attend to your recommendations for my instruction.
- To encourage group learning in lecture with frequent conceptual questions to be discussed in groups. Research on how people learn physics STRONGLY indicates that lecture alone is NOT an effective way to learn. Effective learning requires interaction with the instructor and classmates.
- To incorporate demonstrations into lectures, given that students learn in a variety of ways.
- To expeditiously grade and return the exams to you. We plan to return exams the day after the exam.

What we expect from you:

- To attend and participate in each lecture, laboratory, and discussion session. It is your responsibility to obtain and understand the material presented, even if you are not in attendance due to illness or a University-sponsored activity.
- To work both independently and in groups of your peers who can help you understand the course material. If you need help finding a study group of classmates, we will help connect you.
- To take each exam at the scheduled time. If you have a scheduling conflict due to a University-sponsored activity, it is your responsibility to inform the instructor well before the date of the exam.
- To make a good effort and to be prompt in completing assignments and labs.
- To typically spend 12-15 hours per week to learn the material. If you are spending more time than this, please see the instructor so that we can ensure that you spend your time efficiently.
- To work as many problems as you can beyond the assigned homework. As with everything in life, practice, practice, practice, ...

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Tentative Class Schedule

Week	M	W	F	Lab Experiment	Notes
Jan 11-Jan 15	Intro	2:1-2	2:3-4		Assignment #0 (just for practice) is due Jan 15 Also read Chapter 1
Jan 18-Jan 22	No Class	2:5-6	3:1-2	0	Martin Luther King Day Jan 18
Jan 25- Jan 29	3:3-4	3:5	4:1-2	1	
Feb 01-Feb 05	4:3-4	4:5-6	5:1-2	2	
Feb 08-Feb 12	5:3-4	5:5	6:1	3	
Feb 15-Feb 19	6:2-3	6:4	7:1	4	Exam 1 Feb 18 @ 5-7 p.m. in CR 310; ch. 1-5
Feb 22-Feb 26	7:2-3	7:4-5	8:1	5	
Mar 01-Mar 05	8:2-3	8:4-5	9:1-2	6	
Mar 08-Mar 12	9:3-4	9:5-6	10:1-2	7	
Mar 15-Mar 19	No Class	No Class	No Class		Spring Break
Mar 22-Mar 26	10:3-4	10:5-6	12:1-2	8	
Mar 29-Apr 02	12:3-4	12:5-8	No Class		Exam 2 Apr 01 @ 5-7 p.m. in CR 310; ch. 6-10 Easter Break Apr 02
Apr 05-Apr 09	13:1-3	13:4-6	13:7-8	9	
Apr 12-Apr 16	14:1-2	14:3-4	14:5-6	10	
Apr 19-Apr 23	15:1-3	15:4-5	15:6-8	11	
Apr 26-Apr 30	16:1-2	16:3-5	16:6-9	12	
May 03-May 07	Finals Week	Finals Week	Finals Week		Exam 3 May 03 @ 10:15-12:15; ch. 12-16

Using a Problem-Solving Strategy

(Adapted from Reif 1995; Heller & Heller 1995; Young & Freedman text)

1. Identify the Problem

- A. Draw a sketch or sketches of the situation
- B. Label the known and unknown quantities associated with the problem.
- C. State the problem to be solved, indicating the final target quantity you seek.
- D. Describe a general approach to the problem. Include fundamental physics principles.

2. Set up the Physics

- A. Draw diagrams of the system including a coordinate axis and positions for all objects at any initial and final times.
- B. Draw diagrams of individual components with labels for all variables and forces.
- C. Identify target variables
- D. Identify all the equations that are relevant to the problem.

3. Solve the Problem

- A. Find an equation with your target unknown variable
- B. Count the number of unknown variables, including your target variable
- C. Count the number of equations containing unknown variables. Hopefully you have as many equations as unknown variables. If not, return to Step 2.
- D. Solve the system of equations SYMBOLICALLY for the target variable.

4. Evaluate your Result

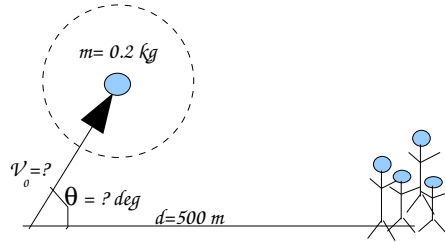
- A. Use dimensional analysis to check the units of your solution equation.
- B. Insert numerical values into your equation and evaluate a solution.
- C. Check that the answer contains both a numerical value and correct units (e.g., m/s)
- D. Evaluate whether your answer is reasonable (not too small or large?)

Example problem: The Smith family is at the fireworks and chooses to sit 500 meters away from the launch site. A firework with 9 second fuses are launched directly at the Smiths at an elevation angle of θ degrees from the horizon with an initial velocity of V meters per second. The mass of an individual firework is 0.2 kg. For what combination of launch angles and velocities are the Smiths in danger of a direct hit? (Consider the firework to be in ballistic trajectory and neglect force of air resistance)

Example Solution:

1. Identify the Problem (e.g., 2 of 10 points)

Picture of problem



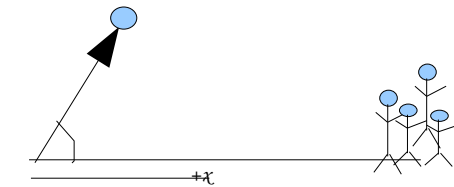
Given information: $d=500\text{ m}$ $m=0.2\text{ kg}$
 $v_0 = ?\text{ m/s}$
 time until explosion = 9 s
 launch angle = $?\text{ degrees}$

Problem to be solved: What initial velocity and angle puts fireworks at the Smiths after 9 s.

General Approach: use ballistic trajectories acting under acceleration of gravity to find path of fireworks as a function of time and see where it lands after 9 s.

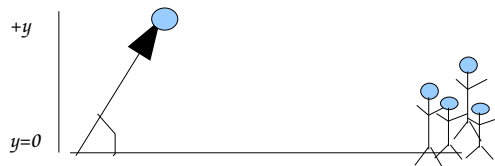
2. Set up the Physics (e.g., 3 of 10 points)

Diagram axes and define variables



$t_0 = 0\text{ s}$	$t_f = 9\text{ s}$
$x_0 = 0\text{ m}$	$x_f = ?\text{ m}$
$v_{0x} = 40 \cos(\theta)\text{ m/s}$	$v_{fx} = v_{0x}$
$a_{0x} = 0$	$a_{fx} = 0$

fireworks free-body diagram



$t_0 = 0\text{ s}$	$t_f = 9\text{ s}$
$y_0 = 0\text{ m}$	$y_f = ?\text{ m}$
$v_{0y} = v_0 \sin(\theta)\text{ m/s}$	$v_{fy} = v_{0y}$
$a_{0y} = -9.8\text{ m/s}^2$	$a_{fy} = a_{0y}$

Target variables: x_f and y_f

Relevant Equations: $x_f = x_0 + v_0 \Delta t + 1/2 a t^2$

3. Solve the Problem (e.g., 3 of 10 points)

Construct specific equations

two equations with two unknowns: θ and v_0

$$\Delta t = t_f - t_0$$

$$1) \quad x_f = x_0 + v_{0x} \Delta t + 1/2 a_x \Delta t^2 \quad \text{or} \quad x_f = x_0 + v_0 \cos \theta \Delta t + 1/2 a_x \Delta t^2$$

$$2) \quad y_f = y_0 + v_{0y} \Delta t + 1/2 a_y \Delta t^2 \quad \quad \quad y_f = y_0 + v_0 \sin \theta \Delta t + 1/2 a_y \Delta t^2$$

Outline the Solution

solve 1) for θ and put into 2)

solve for v_0 , then put v_0 and solve either equation for θ

Solve for target variables

$$\theta = \arccos[(x_f - x_0) / (v_0 \Delta t)] \quad (\text{solve for } \theta; \text{ simplify allowing that acceleration in } x \text{ direction } = 0)$$

$$y_f = y_0 + v_0 \sin(\arccos[(x_f - x_0) / (v_0 \Delta t)]) \Delta t + 1/2 a_y \Delta t^2 \quad (\text{plug in to equation 2})$$

$$= y_0 + v_0 (1 - \cos(\arccos[(x_f - x_0) / (v_0 \Delta t)])) \Delta t + 1/2 a_y \Delta t^2$$

$$= y_0 + v_0 \Delta t \cdot (x_f - x_0) + 1/2 a_y \Delta t^2 \quad (\text{simplify and solve for } v_0)$$

$$v_0 = [(y_f - y_0) + (x_f - x_0) \cdot 1/2 a_y \Delta t^2] / \Delta t$$

4. Evaluate your Solution (e.g., 2 of 10 points)

Units of solution correct?: *yes! units are in distance/time (i.e., m/s)*

Insert numerical values: $v_0 = [(y_f - y_0) + (x_f - x_0) \cdot 1/2 a_y \Delta t^2] / \Delta t = [(0) + 500 - 1/2(-9.8)9^2] / 9 = 99.6 \text{ m/s}$

$$\theta = \arccos[(x_f - x_0) / (v_0 \Delta t)] = \arccos [500 / (99.6 * 9)] = 56 \text{ degrees}$$

Answer reasonable? *yes!* Correct units? *yes! m/s for velocity and degrees for angle*