# PHYS 1210/1310: Engineering/College Physics I


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| | |
|---|---|
| Lecture: | MWF 12:00-12:50 (Michalak's section is taught MWF 9:00-9:50 in Ag 1032) |
| Materials: | Sears & Zemansky's *University Physics*, 12th edition, by Young & Freedman |
| | *RealTime Physics* by Sokoloff, Thornton, & Laws (Module 1: Mechanics) |
| | Online homework access via bookstore or www.masteringphysics.com |
| | Student Response Handset available from the bookstore |
| Web page: | physics.uwyo.edu/Classes/PHYS1210 |

Labs: (Physical Sciences 133)

| | |
|---|---|
| 1210-10 M | 15:10 – 17:00 |
| 1210-11 T | 13:10 – 15:00 |
| 1210-12 W | 15:10 – 17:00 |
| 1210-13 R | 09:00 – 10:50 |
| 1310-10 R | 15:10 – 17:00 |

Discussion Sections:

| | | |
|---|---|---|
| 1210-20 M | 13:10 – 14:00 | EN 4045 |
| 1210-21 T | 10:00 – 10:50 | AS 401 |
| 1210-22 T | 16:10 – 17:00 | CR 113 |
| 1210-23 R | 13:10 – 14:00 | CR 209 |
| 1210-24 W | 13:10 – 14:00 | EN 1055 |
| 1310-20 R | 11:00 – 11:50 | CR 215 |

**Course Content**

I am excited to teach you! This course is an introduction to the fundamental physical forces that shape our universe, including mechanics, gravity, and heat. 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. *Calculus I is a co- or pre-requisite!*

**Lecture**

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. I 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 the big picture." 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.

**Discussion Sessions**

Whereas the lectures will focus more on general concepts, the discussion sessions will provide opportunities to review specific problems and collaboratively work with your peers. Discussion attendance is in your best interest because we will use discussion session questions on the exams.

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**Laboratory**
Participation in each laboratory is essential for the successful completion of this course. If you must miss a lab, it is your responsibility to contact your lab instructor well before the date of your absence so that you may attend another lab section that week.

Each lab is worth 20 points. Labs will consist of a **pre-lab homework** (4 points) *to be completed before you come to lab*. The **lab report** itself must be completed in lab and turned in at the end of lab (10 points). There is also a p**ost-lab homework** (6 points) which must be completed during the week and turned in at the beginning of the next lab. Late pre-labs, labs, or post-labs will automatically lose 2 points. 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.

**Grading:**
The average grade in my introductory physics courses has historically been a B-; *the median grade has been a B* since the UW grading system does not involve pluses or minuses.

Subject to revision:

| | | |
|---|---|---|
| Exams: | Three | 60% |
| Quizzes | best 10 of 12 | 03% |
| Homeworks: | best 11 of 13 | 23% |
| Labs: | all 12 are required | 14% |
| | | 100% |

Note that your grade will only reflect your performance over a few months in physics; your grade is not a holistic reflection of you. Because of the limited scope of this course, 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 goals in your career and life.

**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 and a single sheet of paper (8½"x11") with notes *written* on both sides. 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 September 27 | 17:00-19:00 | Ch 01-05, in CR 310 |
| Exam 2 – Thursday November 01 | 17:00-19:00 | Ch 06-12, in CR 310 |
| Exam 3 – Monday December 10 | 10:15-12:15 | Ch 13-19 |

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**Homework**

Assignments will be posted and graded online (see below). A typical assignment might include eight online plus two additional written problems drawn from the text. 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 <20 hours late; no credit will be given if the online homework is more than 20 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 me if you do not have the kit). The course ID is DD1210F07. 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).
- 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 at physics.uwyo.edu/Classes/PHYS1210 . The login and password for this website are "physi" and "solns".

Additional help for MasteringPhysics can be obtained through a document provided by the publishers. You can also access this at the course website.

**Buy and register your class response keypad**

In-class quizzes and daily interaction will make use of the Classroom Response System (CPS) which requires each student to 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 G29795B177.
3. Bring your keypad to each lecture.

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**Academic Honesty**
Academic honesty develops trust and respect between faculty and students, ensures fair and effective grading, and creates an environment that fosters learning. Although you are encouraged to study together with other students, any assignments, exams, and lab submissions must be your own work unless you have been directed by your instructor to work together. Academic dishonesty is defined in University Regulation 802, Revision 2 as "*an act attempted or performed which misrepresents one's involvement in an academic task in any way, or permits another student to misrepresent the latter's involvement in an academic task by assisting the misrepresentation.*" There is a well-defined procedure to judge such cases, and serious penalties may be assessed.

**Special accommodations**
If you have a disability that will require special accommodations, please provide instructors with this documentation during the first week of class. You should register with Disability Support Services (766-6189; udss@uwyo.edu).

**Additional help**
Except for finals week, tutors are available every MTWR evening from 7-9 pm in the Engineering Bldg (Rm 1045; wwweng.uwyo.edu/societies/tbp/tutoring/). "Physics at Night" help sessions will also be held six hours each week in Physics 234, generally Monday-Wednesday evenings from 7-9 pm.

***What you should expect from me:***
- 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, I 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. I plan to return exams the day after the exam.

***What I 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, I 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 - Your road map to learning the physics of mechanics and heat!

| Week | M | W | F | Lab Experiment | Notes |
|---|---|---|---|---|---|
| Aug 27-Aug 31 | Intro | 2:1-2 | 2:3-4 | no lab<br>no discussion | Assignment #0 (just for practice) is due Aug 31 |
| Sep 03-Sep 07 | No Class | 2:5-6 | 3:1-2 | 0 | Assignment #1 is due Sep 05<br>(Monday labs & discussions find a T,W,Th slot this week) |
| Sep 10- Sep 14 | 3:3-4 | 3:5-6 | 4:1-3 | 1 | Assignment #2 is due Sep 12 |
| Sep 17-Sep 21 | 4:4-6 | 5:1-2 | 5:3-4 | 2 | Assignment #3 is due Sep 19 |
| Sep 24-Sep 28 | 5:5 | 6:1-2 | 6:3-4 | 3 | Assignment #4 is due Sep 26<br>Exam 1 Thursday Sep 27 @ 5-7 p.m. in CR 310; ch. 1-5 |
| Oct 01-Oct 05 | 7:1-2 | 7:3-4 | 7:5 | 4 | Assignment #5 is due Oct 03 |
| Oct 08-Oct 12 | 8:1-2 | 8:3-4 | 8:5 | 5 | Assignment #6 is due Oct 10 |
| Oct 15-Oct 19 | 9:1-3 | 9:4-5 | 10:1-2 | 6 | Assignment #7 is due Oct 17 |
| Oct 22-Oct 26 | 10:3-4 | 10:5-6 | 12:1-3 | 7 | Assignment #8 is due Oct 24 |
| Oct 29-Nov 02 | 12:4-5 | 13:1-3 | 13:4-6 | 8 | Assignment #9 is due Oct 31<br>Exam 2 Thursday Nov 01 @ 5-7 p.m. in CR 310; ch. 6-12 |
| Nov 05-Nov 09 | 13:7-8 | 14:1-2 | 14:3-4 | 9 | Assignment #10 is due Nov 07 |
| Nov 12-Nov 16 | 14:5 | 17:1-2 | 17:3-4 | 10 | Assignment #11 is due Nov 14 |
| Nov 19-Nov 23 | 17:5-6 | No Class | No Class | No lab | |
| Nov 26-Nov 30 | 18:1-2 | 18:3-4 | 18:5-6 | 11 | Assignment #12 is due Nov 28 |
| Dec 03-Dec 07 | 19:1-3 | 19:4-6 | 19:7-8 | 12 | Assignment #13 is due Dec 07 |
| Dec10-Dec 14 | Finals Week | Finals Week | Finals Week | no lab | Exam 3 Monday Dec 10 @ 10:15-12:15; ch. 13-19 |

# 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.

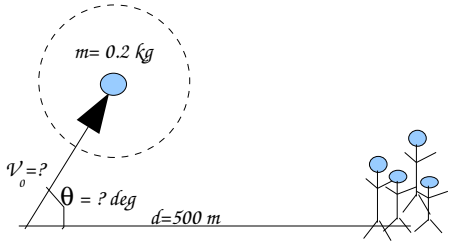
4. **Evaluate your Result**
- A. Use dimensional analysis to check the units of your solution equation.
- B. Insert numerical values into your equation and evaluate a solution.
- C. Check that the answer contains both a numerical value and correct units (e.g., m/s)
- D. Evaluate whether your answer is 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 $\theta$ 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



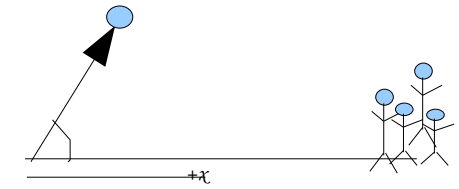

Given information: *d=500 m* *m=0.2 kg*
$v_0$ = ? m/s
*time until explosion = 9 s*
*launch angle = ? degrees*

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

General Approach: *use ballistic trajectories acting under acceleration of gravity to find path of firework 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 s  $t_f$=9 s
$x_0$=0 m  $x_f$=? m
$v_{0x}$=40 cos(θ) m/s  $v_{fx}$=$v_{0x}$
$a_{0x}$=0  $a_{fx}$=0


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

*firework free-body diagram*


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:* $\theta$ *and* $v_0$

$\Delta t = t_f - t_0$

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

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

Outline the Solution

*solve 1) for* $\theta$ *and put into 2)*

*solve for* $v_0$, *then put* $v_0$ *and solve either equation for* $\theta$

Solve for target variables

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

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

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

$= y_0 + v_0 \Delta t - (x_f - x_0) + 1/2\, a_y \Delta t^2$ *(simplify and solve for* $v_0$*)*

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

## 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: $v_0 = [(y_f - y_0) + (x_f - x_0) - 1/2\, a_y \Delta t^2]/\Delta t = [(0) + 500 - 1/2(-9.8)9^2]/9 = 99.6$ m/s

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

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