PHYS 1220: Physics II **Spring 2020**

Instructor:	Prof. Daniel Dale	Mr. Nathan Magno	Mr. Alex Schultz	Mr. Jesse Jones
Office:	Physical Sci. 214	Physical Sci. 107	n/a	n/a
Office hours:	MW 12:00-13:00	MWF 11:00-12:00	n/a	n/a
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Class: MWF 1:10-2:50 in Enzi STEM 195
Materials: *University Physics Volume 2* from OpenStax
Web page: http://physics.uwyo.edu/~ddale/teach/19_20
Prerequisite: MATH 2205 Calculus II
USP: This course satisfies the PN category of the University Studies Program

Course Content
I am excited to teach you! This course is intended to be an introduction to electricity, magnetism, and thermodynamics. These phenomena dominate our modern world and have wide-ranging applications; physics is the foundation which underlies disciplines as diverse as astronomy, biology, chemistry, electronics, engineering, geology, medicine, and meteorology. We will approach the material from both theoretical and applied approaches, and cover topics ranging from the infinitesimally small (the electric field of an electron) to the extremely large (the magnetic field of the entire Earth).

Class Meetings
This course will be taught in the studio style, whereby lecture, lab, and discussion are all folded together. I love this style since it has been shown to improve student learning. It also gives me the opportunity to make deeper connections with each of you.

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 help you achieve these goals by prompting you (via text) with questions to contemplate before class. I will avoid presenting the same examples in your text. Instead, class meetings will address the difficult points in the text as well as help 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.

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 class, it is your responsibility to let me know well in advance of your absence.

Labs will be carried out in teams but each student must write their own lab report. Guidelines and an example report are provided on the course website. 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 class meetings 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. Exams will be closed book and closed notes, although you will be allowed to bring a calculator. Relevant formulas will be provided, so you need not memorize equations. Practice exams will be available. *No make-up exams will be given.*

Partial credit: The multiple-choice format can suffer from its “all or nothing” nature. You may earn partial credit on a multiple-choice exam problem by selecting two or three of the possible answers. For example, if you answer both A and C on a question that has the possible choices of A,B,C,D, you will earn half credit 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:

Exam 1 – Thursday Feb 27	17:00-19:00 Ch 01-04 in CR 306
Exam 2 – Thursday Apr 02	17:00-19:00 Ch 05-08 in CR 306
Exam 3 – Wednesday May 13	13:15-15:15 Ch 09-13 in STEM 195

Homework

To truly learn physics, it is absolutely critical to attempt to solve lots of quantitative problems. Diligently paying attention in lecture is simply not enough. Try doing many of the problems found at the end of each chapter in the text.

Students are encouraged to work together, but each student must submit their own work. 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 group members 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 turned in on time and be legible with the logic easy to follow.

Grading (Subject to revision):

Exams:	65%
Attendance/Participation:	5%
Homework:	10%
Lab:	20%
	100%

Historically, the average grade in my physics courses has been equivalent to a B-. Note that grades only reflect performance over a short period; grades are not a holistic reflection of you. Because of the limited scope of this class, 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.

In-class polling

We will discuss and vote on conceptual questions using phones or laptops. Please bring your cell phone or laptop to each class meeting. You won’t need to create an account or register yourself; you can join each polling session via pollev.com/danieldale559 or by texting danieldale559 to 37607.

Additional help

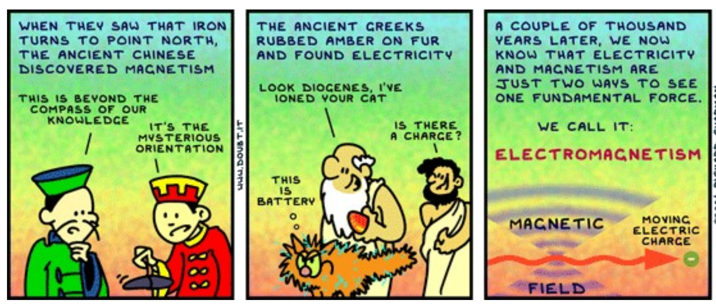
The STEP program in Cole Library provides tutoring help for PHYS 1220 (uwyo.edu/step), anytime between 5:00-9:00 pm SMTWR. Additional tutors are available nearly all day every weekday in EN1070: uwyo.edu/ceas/resources/current-students/tutoring.html.

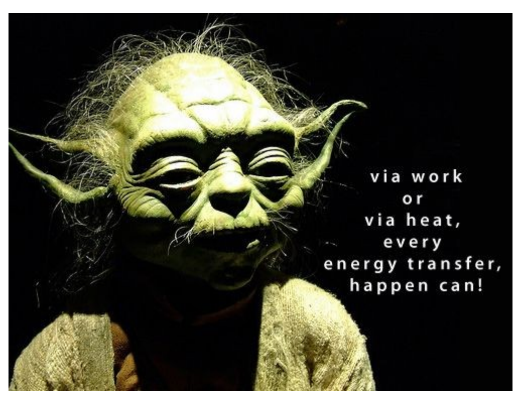
What you should expect from me:

- To teach 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 active/group learning. Research on how people learn physics STRONGLY indicates that lecture alone is NOT an effective way to learn.
- To provide numerous demonstrations given that students learn in a variety of ways.
- To expeditiously grade and return the exams to you.

What I expect from you:

- To attend and participate in each class session. It is your responsibility to obtain and understand the material presented, even if you are not in attendance.
- To work both independently and in groups of your peers who can help you understand the course material. I can connect you with a study group, if desired.
- To take exams at scheduled times. It is your responsibility to inform me of conflicts 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 on the class. If you are spending more time than this, please see me so that I 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, …
- Check your UW email





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Tentative Class Schedule

Week	Chapter	Lab	Notes
01/27/20	Ch 01	Lab 01: specific heat	Jan 27 Chocolate Cake Day
02/03/20	Ch 02		Feb 02 Groundhog Day
02/10/20	Ch 03	Lab 02: Ideal Gas Law	Feb 09 Toothache Day
02/17/20	Ch03 & Ch 04		Feb 17 Cabbage Day
02/24/20	Ch 05	Lab 03: applied & induced charge distributions	Exam 1 Feb 27 @ 5:00 p.m.; ch. 01-04 Feb 23 Dog Biscuit Appreciation Day
03/02/20	Ch 06		Mar 04 Pound Cake Day
03/09/20	Ch 07		Mar 10 Middle Name Pride Day
03/16/20	Spring Break!	Spring Break!	Mar 20 Extraterrestrial Abduction Day
03/23/20	Ch 08	Lab 04: capacitance	Mar 23 Melba Toast Day
03/30/20	Ch 09		Exam 2 Apr 02 @ 5:00 p.m.; ch. 05-08 Mar 28 Something on a Stick Day
04/06/20	Ch 10	Lab 05: RC circuits	April 7 Beer Day
04/13/20	Ch 11		Apr 14 Look up at the Sky Day
04/20/20	Ch 11, 12		Apr 18 Animal Crackers Day
04/27/20	Ch 12, 13	Lab 06: magnetic fields	Apr 30 Bubble Tea Day
05/04/20	Ch 13		May 04 Star Wars Day
05/11/20	Finals Week		Exam 3 May 13 @ 1:15; ch. 9-13

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**

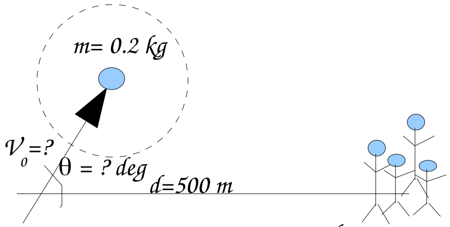
A. Use dimensional analysis to check the units of your solution equation.
B. Insert numerical values into your equation and evaluate a solution.
C. Check that the answer contains both a numerical value and correct units (e.g., m/s)
D. Evaluate whether your answer is reasonable (not too small or large?)

<u>Example problem:</u> The Smith family is at the fireworks show and chooses to sit 500 m away from the launch site. A shell with a 9 s fuse is launched directly at the Smiths at an elevation angle of θ degrees from the horizon with an initial velocity of V in units of m/s. The mass of an individual shell is 0.2 kg. For what combination of launch angles and velocities are the Smiths in danger of a direct hit? Consider the shell to be in a ballistic trajectory and neglect 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

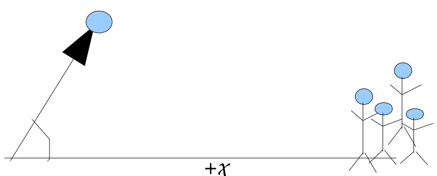
launch angle = ? degrees

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.*

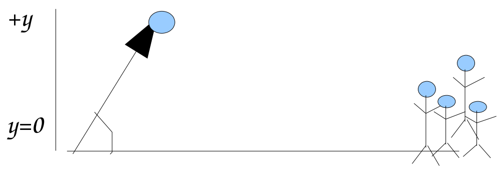
2. Set up the Physics (e.g., 3 of 10 points)

Diagram axes and define variables



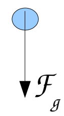
$x=0$

$t_0=0$ s	$t_f=9$ s
$x_0=0$ m	$x_f=?$ m
$v_{0x}=40\cos(\theta)$ 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
$v_{0y}=v_0\sin(\theta)$ 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: $x_f=x_0+v_0\Delta t+1/2\,at^2$

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) $x_f=x_0+v_{0x}\Delta t+1/2\,a_x\Delta t^2$ *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 θ and put into 2)
solve for v_0, then put v_0 and solve either equation for θ

Solve for target variables

$\theta = \arccos[(x_f - x_0)/(v_0 \Delta t)]$ *(solve for θ; 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*