California State University, Chico  
Department of Physics  
Spring 2017

Course: PHYS 202A General Physics, Sections 01, 02, 03, 04, 05

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Chris Gaffney (C.G.)

Learning assistants: Kelsey Haigh, Lynda Klein, TBA

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Chris Gaffney: cgaffney@csuchico.edu

Room & Time:  
Discussion:  
Section 01, (D.B.): MWF 8:00 – 8:50 a.m.    ARTS 111

Labs:  
Section 02: Monday (M.T.) 11:00 am – 1:50 pm    PHSC 104  
Section 03: Monday (T.H.) 2:00 – 4:50 pm    PHSC 104  
Section 04: Monday (C.G.) 5:00 – 7:50pm    PHSC 104  
Section 05: Tuesday (T.H.) 8:00 – 10:50 am    PHSC 104

Office & hours:  
David Brookes PHSC 120:  
* TBA  
* Thursday 1pm – 5pm, fourth floor of the library in the corner by the windows by the open tables and whiteboards.

Mahendra Thapa: PHSC 233  
Tucker Hartland: PHSC 233  
* Monday 10am – 11am  
* Wednesday 3pm – 4pm  
* Thursday 10am – 12pm

Chris Gaffney: AYRS 116  
(office hour location to TBD)  
*Monday 12-1  
*Wednesday 10-11, 12-1  
*Friday 10-11, 12-1

Textbook: The textbook for this course is College Physics by Etkina, Gentile & Van Heuvelen. There will be online homework problems every week from physics. I may use learning catalytics during class-time. The 202A Lab Manual can be purchased at our first lab meeting or from PHSC room 110 for $10.
Course Description

This course will be very different from the regular sciences classes you may have had in the past. Discussion and lab are fully integrated with each other with very little formal lecturing. Can you learn to play tennis by only watching somebody else play? No? Then why would physics be any different? The best way to learn physics is by doing and practicing physics. In my class you will have the opportunity to do what research physicists do. There is a lot of hard work involved, both inside the class and outside of class-time. And you are expected to do all the work! Everyone who is willing to learn and put in the effort to work on all aspects of the class has a good chance to succeed in the class.

This course will emphasize the essential connection between theory and experiment. We will be spending time investigating phenomena, developing models that explain those phenomena (this involves proposing hypotheses, testing hypotheses by predicting the outcome of a suggested testing experiment using the proposed hypothesis to make the prediction), and learning to apply the physical ideas we’ve developed to real world situations. You are responsible for your own learning. You will have to think, and perform hands-on tasks during discussion and lab. We will guide you through those activities and provide you with constructive feedback to help you learn. For most activities, you will work in a group of four. The lab portion of the course is integrated into the class activities since experimentation is an integral part of how physicists generate their knowledge and understanding of the world. Please refer to the Course Strategy Guide to get a better picture of what the course is all about.

Learning Goals of the course

1. To be successful in this course and to be prepared for your future career.
2. To understand some fundamental ideas of physics. This includes
   a) reconciling every day experiences with the material learned in the course;
   b) making sure that new ideas make sense;
   c) connecting what is learned in class today to what was learned previously;
   d) linking concepts and applying ideas instead of memorizing facts;
   e) using and coordinating a variety of representations (linguistic, mathematical, pictorial and graphical) to achieve a deeper understanding, and
   f) communicating ideas to others.
3. To learn the processes and tools of science. This includes
   a) becoming familiar with how physics develops - where decisions are made on the basis of evidence and conjecture, as opposed to a collection of true ideas/unchanging facts that scientists somehow devise;
   b) learning to evaluate ideas and information using evidence and scientific strategies to build arguments;
   c) learning to formulate physics questions, design plans to answer them and be able to conduct investigations;
   d) learning the art of experimentation and how to collaborate with your peers.
4. To learn that physics IS NOT about memorizing equations and plugging in numbers to get the right answer. It is about observing, explaining, and representing the physical world. It is about doing physics, not about getting the right numerical answer.
<table>
<thead>
<tr>
<th>Wk</th>
<th>Monday</th>
<th>Lab</th>
<th>Wednesday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 23 Introduction to the class</td>
<td>Force and motion</td>
<td>Jan 25 N2 and motion</td>
<td>Jan 27 1-d motion (constant v)</td>
</tr>
<tr>
<td>2</td>
<td>Jan 30 1-d motion constantly changing v</td>
<td>Scientific abilities</td>
<td>Feb 01 1-d motion, equations of motion</td>
<td>Feb 03 Exam 1 HW1 due</td>
</tr>
<tr>
<td>3</td>
<td>Feb 06 1-d motion, coordinate systems + real-life problem</td>
<td>Motion in 1 dimension (testing)</td>
<td>Feb 08 2-d motion (obs. &amp; test, vectors)</td>
<td>Feb 10 2-d motion Applications HW2, HW1 redos due</td>
</tr>
<tr>
<td>4</td>
<td>Feb 13 TBA</td>
<td>Ball into the bin (application)</td>
<td>Feb 15 Newton (develop N2)</td>
<td>Feb 17 Exam 2 HW3, HW2 redos due</td>
</tr>
<tr>
<td>5</td>
<td>Feb 20 Newton (Surfaces, strings)</td>
<td>Interactions (Observe and test)</td>
<td>Feb 22 Newton (do it all on a slope)</td>
<td>Feb 24 Newton (2-body systems) HW4, HW3 redos due</td>
</tr>
<tr>
<td>6</td>
<td>Feb 27 Newton Friction and Applications</td>
<td>Application of Newton</td>
<td>Mar 01 Newton Applications</td>
<td>Mar 03 Exam 3 HW5, HW4 redos due</td>
</tr>
<tr>
<td>7</td>
<td>Mar 06 Circular</td>
<td>Circular motion</td>
<td>Mar 08 Circular (put together)</td>
<td>Mar 10 Circular Applications HW6, HW5 redos due</td>
</tr>
<tr>
<td>8</td>
<td>Spring break</td>
<td>No Lab</td>
<td>Spring break</td>
<td>Spring break</td>
</tr>
<tr>
<td>9</td>
<td>Mar 20 Torque &amp; Statics</td>
<td>Statics</td>
<td>Mar 22 Torque &amp; Statics</td>
<td>Mar 24 Exam 4 HW7, HW6 redos due</td>
</tr>
<tr>
<td>10</td>
<td>Mar 27 Torque &amp; Statics</td>
<td>Inventing a new quantity</td>
<td>Mar 29 Momentum, introduce systems viewpoint.</td>
<td>Cesar Chavez day, no class</td>
</tr>
<tr>
<td>11</td>
<td>Apr 03 Momentum</td>
<td>Intro to energy</td>
<td>Apr 05 Momentum</td>
<td>Apr 07 Exam 5 HW8, HW7 redos due</td>
</tr>
<tr>
<td>12</td>
<td>Apr 10 Energy</td>
<td>Physics of toys</td>
<td>Apr 12 Energy</td>
<td>Apr 14 Energy HW9, HW8 redos due</td>
</tr>
<tr>
<td>13</td>
<td>Apr 17 Energy</td>
<td>Measuring kinetic friction</td>
<td>Apr 19 Vibrations</td>
<td>Apr 21 Exam 6 HW10, HW9 redos due</td>
</tr>
<tr>
<td>14</td>
<td>Apr 24 Vibrations</td>
<td>Vibrations</td>
<td>Apr 26 Vibrations</td>
<td>Apr 28 Vibrations HW11, HW10 redos due</td>
</tr>
<tr>
<td>15</td>
<td>May 01 Wave observations</td>
<td>Mechanical waves</td>
<td>May 03 Waves reflections, wave equation?</td>
<td>May 05 Exam 7 HW12, HW11 redos due</td>
</tr>
<tr>
<td>16</td>
<td>May 08 Standing waves</td>
<td>Standing waves</td>
<td>May 10 Standing waves putting it together</td>
<td>May 12 Exam 7 redo HW12 redos due</td>
</tr>
<tr>
<td>17</td>
<td>Exam week: Final exam time TBA</td>
<td>NO LAB</td>
<td></td>
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</table>
Class Activities and How They are Graded

The way this class will be graded is somewhat unusual, so please take time to familiarize yourself with the system. Many activities in this class will be graded on a pass/fail system and you will accumulate points towards your final grade based on how many things you pass or fail. (How this works in exams, homework, labs, and journals is elaborated below.) Your grade will be determined by the number of points you accumulate through the semester.

**Exams:** You will take 7 exams through the semester. You should refer to the schedule to see when these will take place. Each exam will consist of two questions: One “core” question and one “advanced” question. Each question will test a set of scientific reasoning abilities that will be clearly labeled on the exam question. The full list of rubrics are available on blackboard. Every question will be graded pass/fail. You must show adequate evidence of competence on each of the scientific abilities listed for that question. If you don’t adequately meet all the listed criteria, your attempt is marked “fail.” Each core question you pass counts 4 points, each advanced question you pass counts 9 points. Points are not additive. In other words, if you pass both the core and advanced, you get 9 points. You may make 2 additional attempts at each individual exam to improve your points standing. The first redo occurs in the following exam slot. In other words, exam 1 redos happen in addition to exam 2 during the exam 2 timeslot. The third (and final) attempt for all 7 exams will happen during the final exam time.

**Homework:** There are 12 homeworks due. Each of the 12 homework assignments will consist of 2 written questions that must be hand-written and handed in. You will also have to do some additional problems on mastering physics. Each question (written or online) will be graded pass/fail. Each written question you pass earns you 1 point. If you do all the mastering problems correctly, you get 1 additional point. Just like exam questions, each question will test a set of scientific reasoning abilities that will be clearly labeled on the question. The full list of rubrics are available on blackboard. You must show adequate evidence of competence on each of the scientific abilities listed for that question. If you don’t adequately meet all the listed criteria, your attempt is marked “fail.”

If you want to achieve a pass on a written homework question(s) you failed, you may redo the question(s). The redone questions are due the following Friday. For example, homework 1 is due Friday week 2. The homework will be returned on Monday. The redone homework is due on Friday of week 3. You get one chance to redo and improve your homework grade.

**Homework redo guidelines:**
1. You can only redo homework questions if a) you handed in your homework on time. Late homework will be graded (up to 1 week late), but does not get an option to be redone. b) You must have attempted the question that you want to redo it. 2. Any question that you redo, must be redone from scratch. That is, the solution should be completely rewritten on a separate piece of paper. It doesn’t matter how close you were to passing. 3. The original homework must be attached behind the redo. Without the original, the redo will not be graded.

**Oral restitution for Exams and Homework**
If a particular question (exam or homework) has $n$ rubric items on it ($n$ it typically 3 to 5 items) and you achieve passes on $n-1$ of the items, but are marked “F” (fail) on one single rubric item, you may demonstrate verbally to the course instructor that you understand what you did wrong and how to do it correctly. This will take place during office hours. If you convince the instructor you understand what you did wrong/missed and how you’d fix it, your grade will be changed to a “pass”. In participating in this, you agree to abide by the instructor’s final decision.

**Labs:** Experimentation is the heart and soul of this course. In this course experiments will serve
three scientific purposes: 1) to provide new or exploratory data that we will attempt to organize and explain, 2) to test one or more possible explanations, 3) to apply our physics knowledge to some real-world problem or scenario. The details of how experimentation in this course fits into the overall logic of scientific reasoning can be found in the course strategy guide which can be downloaded from the course blackboard website. What happens in practice is this: Every week you will be asked to design experiments to 1) gather data to explore some sort of relationship between physical quantities, 2) test one or more explanations you have developed, or 3) apply your knowledge to solve a real-world problem. Through engaging in this continually repeating process of designing experiments for specific scientific purposes, you will develop a number of scientific abilities or habits of mind These are scientific habits of mind that we believe you will find useful in ANY future scientific career that you choose to pursue. The full list of scientific abilities that we hope you’ll develop in the course is encoded in the Scientific Abilities Rubrics that are available for download on the course website, and are in your lab manual. Take a look at them, the list is long, and a lot of thought has gone into creating that list. The purpose of having you write up and hand in a lab report each week is for your lab instructor to assess how those abilities are developing and to give your feedback so that you can improve and develop those skills through the semester. We will look for evidence of those scientific abilities in other contexts such as the exams. The details of this process go as follows: Each week the lab activities will be written up and handed in as a lab report that is due at the end of the 3-hour lab period. Each group of 4 students hands in one report and will get the same grade for the report. **If you were absent for lab, you are required to make up the lab in another section and hand in your own individual report.**

The lab report will be graded on 7 preselected rubric items that are worth 3 points each and an additional 3 points for responding to the “why did we do this lab?” questions. That is a total of 24 points. You should detach the last page of the lab from one group member’s lab manual and attach it to the back of your report. On the first side you can respond to the “why did we do this lab?” questions and the grading rubric is on the back of the same sheet. Your lab instructor will mark the grades on the rubric. **Note:** Labs earn points as follows: A grade of 18/24 or higher on the rubric earns 2 points. A grade from 12/24 – 17/24 earns 1 point. 11/24 or lower earns 0 points.

As will all activities in this course, think of the lab report as a line of communication between the instructor and you. If you are able to write with coherence, with clarity, and concisely, we are better able to understand your thought process and give you effective feedback on how you can improve.

**Weekly journal:**

**Goals:** The purpose of the weekly journal is two-fold. 1. It allows you to reflect on what you have learned every week and ask questions about things you didn’t understand in a more private setting. (If you are struggling with anything in the course, question 2 is where you get to ask me. I will respond either via email or devise an in-class activity to review a difficult concept.) 2. The weekly journal allows me to gauge your learning progress and to adjust classroom activities and discussions accordingly. For example, if it becomes clear that the majority of the class have not understood a critical idea from the previous week, I will devote more class time to review and discuss that critical idea.

**How it works:** Every week you will write a journal on your learning for the week by answering the three questions listed below. The journal is submitted through the course blackboard website. Journals are due every week by midnight on Friday. The journal may be redone once, the redo is
due by midnight on Sunday.

1. Write a paragraph about what you learned this week. Include in your paragraph a discussion about how, if your friend questioned the truth of what you learned, you would convince your friend that what you learned is true.
2. Is there anything that remains unclear from this week?
3. If you were the professor, what question would you ask to determine whether your students had learned this week’s material?

**Grading:** Weekly journals are graded pass/fail. You will pass as long as you are diligent and respond to the three prompts. Remember, the weekly journal helps me to plan class activities for the week, so I need your previous week’s journal before the start of the next week. As mentioned above, journals are due by midnight on Friday and redos by midnight on Sunday.

**Discussion:** Discussion attendance is mandatory. The idea behind this course is that – by engaging in the practices of physics – you will construct scientific ideas. The emphasis is on the process. This means that you cannot miss a day and simply look up the material that was covered, you need to be actively engaged in the inquiry process. Attending and participating in the class is crucial. Every year I see a few students who think, because there is no grade for participating and coming to discussion, they don’t need to come. Invariably these students are the ones who fail the course. Don’t be that student. Miss class? You won’t pass.

**The three special rubric items**

In addition to the scientific abilities rubrics that will be used to evaluate your performance throughout the course, there are three special rubric items that will apply to almost every problem you solve, both in homework and on exams. These are listed below. Please familiarize yourself with them.

**Clarity:** In addition to any calculation you perform on a question, you are expected to explain your reasoning in words. This explanation should be clear enough so that someone who doesn’t know how to do the problem can understand it. If you are not sure whether your explanation is clear enough, give it to one of your classmates to see if she/he can understand what you are doing and why you did it that way without putting in too much effort.

**Representation and representational consistency:** To solve a problem you must generate a minimum of two representations and one of them MUST be diagrammatic. (Diagrammatic representations include a picture, a graph, a force diagram, a bar chart). Generally the second representation is either mathematical equations, and/or verbal explanation. These representations need to be consistent with each other. You are expected to check whether the representations are consistent. If they are not, double check. That means you have made a mistake somewhere.

**Evaluation:** Evaluate your answer to each homework problem. You could choose one or more than one of the most suitable methods to evaluate the answer you get. The possibilities include but are not limited to:

1. Order of magnitude and common sense (is the final number physically reasonable, or reasonable to within a factor of 10?)
2. Limiting case, special case, or comparing with a known trend,
3. Dimensional analysis (checking the units),
4. Compare with another independent solution method,
5. Reducing a complicated solution to a known case.

Every time you perform a calculation and arrive at an answer, you are expected to write: “This answer is/is not reasonable because...”
Description of the 3 rubric items for problem grading

<table>
<thead>
<tr>
<th>Rubric item</th>
<th>Criteria for “Adequate” (pass)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Is able to clearly explain his/her reasoning in words. (“clarity”)</strong></td>
<td>Student explains what he/she is doing and why. Explanation is clear, sufficiently detailed, and easy to follow.</td>
</tr>
<tr>
<td><strong>Is able to construct two problem representations and evaluate the consistency of two different problem representations</strong></td>
<td>Two or more representations are constructed according to accepted standards learned in class, and the representations are consistent with each other. Student is able to explain in words how he/she checked that each representation is consistent with the other.</td>
</tr>
<tr>
<td><strong>Is able to evaluate the reasonableness of a result.</strong></td>
<td>Evaluates reasonableness of a solution using at least one of the five listed techniques.</td>
</tr>
</tbody>
</table>

Summary of class activities and how they’re graded

<table>
<thead>
<tr>
<th>Item</th>
<th>#</th>
<th>Description and Grading Scheme</th>
<th>Can it be redone?</th>
<th>Pnts per item</th>
<th>Max Pnts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>12</td>
<td>2 written questions, graded pass/fail on a set of rubric items, 1 point for each question you pass. A set of additional questions on mastering physics. Completing all additional questions = 1 point.</td>
<td>Yes. 1 redo (for written questions), due 1 week after first attempt.</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>Journals</td>
<td>14</td>
<td>Respond adequately to 3 reflection prompts. Graded pass/fail, 1 or 0 points total.</td>
<td>Yes. 1 redo. Journal due Friday midnight. Retries due Sunday midnight.</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>Exams</td>
<td>7</td>
<td>Core and Advanced, graded pass/fail on a set of rubric items. Each core worth 4 pnts, each adv. worth 9 pnts. (Note, “adv” replaces “core,” scores not additive.)</td>
<td>Yes. 2 additional attempts. 2nd try during designated “redo” time, 3rd and final attempt in final exam slot.</td>
<td>4 /9</td>
<td>63</td>
</tr>
<tr>
<td>Labs</td>
<td>15</td>
<td>Graded on 8 0-3 scale rubric items. 18/24 or greater = 2 pnts, 12/24-17/24 = 1 pnt. Less than 12/24 = 0</td>
<td>No. All group members get same grade unless eval. procedure is implemented.</td>
<td>2</td>
<td>30</td>
</tr>
</tbody>
</table>

Max possible points = 143

Bonus points: 2 bonus points for the lab section with the highest overall average course grade. Another 2 bonus points for ANY lab section who can get their average section grade (overall course grade) to 112 points (a B) or higher.

**Final Grades:**

<table>
<thead>
<tr>
<th>Final Grade</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>&lt;78</td>
</tr>
<tr>
<td>D</td>
<td>78-79</td>
</tr>
<tr>
<td>D+</td>
<td>80-85</td>
</tr>
<tr>
<td>C-</td>
<td>86-91</td>
</tr>
<tr>
<td>C</td>
<td>92-97</td>
</tr>
<tr>
<td>C+</td>
<td>98-105</td>
</tr>
<tr>
<td>B-</td>
<td>106-111</td>
</tr>
<tr>
<td>B</td>
<td>112-117</td>
</tr>
<tr>
<td>B+</td>
<td>118-123</td>
</tr>
<tr>
<td>A-</td>
<td>124-129</td>
</tr>
<tr>
<td>A</td>
<td>130</td>
</tr>
</tbody>
</table>
NOTE: This is an absolute scale, not a relative one. That means EVERY student can get an A if they so choose. There is NO CURVE. I believe grading on a curve is a crime against learning because it rewards/punishes you based on how much better/worse you did relative to your peers. In this class, the goal is for you to master scientific reasoning and to learn. The grading scheme is designed to reward real, deep learning and understanding.

Blackboard Learn
You can access the course website through “learn.csuchico.edu” All course information, homework, grades, and additional resources will be posted there. For example, every week I will post feedback help for exam and homework questions that you struggled with. I simply cannot write detailed feedback on the paper of every member of a class of 96 students. If you don’t go to blackboard, you won’t see that feedback and you’ll never learn what you are doing wrong or how to improve. The resources to help you learn will be there. Please make use of them!

Communication between the instructors and you
There is an open line of communication between the instructors and you. You can knock on our office doors any time and, if we are there, we will talk with you. You can send email and we will respond within 24 hours. One of the biggest reasons that students don’t succeed is because they leave it too late to come and talk with the instructors. We understand that many of you have busy and challenging lives. Some of you are working to pay your way through college. Some of you have children. If you have challenges like this that are making it difficult to complete assignments or you are simply struggling in the course, come and talk with us. We can figure out a way to adapt so that you have the best possible chance to succeed.

Communication with your peers
If your friends told you “physics is difficult,” they probably didn’t lie to you. However, physics can be enjoyable too. How to make the transition from difficult to enjoyable? The answer is simple: good communication with your peers, and hard work. Typically, the students who get A’s in my course are the ones who get together with other class members and work on homework together in a productive way (i.e., not copying each other) through discussing and resolving difficulties and things that are unclear. If you have studied the grading criteria above, you should realize: THERE IS NO CURVE in this class. That means everyone can potentially get an A; and helping others benefits your own learning because there is no better way to learn physics than try to teach it to someone else. Everything we do in this course is designed to encourage you to collaborate with each other. We cannot give sufficient individualized attention to 96 students. That is why you need to collaborate with each other to succeed.

Conduct
While collaboration and communication are essential to succeeding in this course, external communication on exams or plagiarizing the homework of another (i.e., verbatim copying) constitutes cheating and will result in failure of this course and further disciplinary action if judged appropriate.

Americans with Disabilities Act
If you need course adaptations or accommodations because of a disability or chronic illness, or if you need to make special arrangements in case the building must be evacuated, please e-mail me as soon as possible, or see me during office hours. Please also contact Accessibility Resource Center (ARC) for approving and coordinating reasonable accommodations and services for students with disabilities.

**Accessibility Resource Center (ARC)**
530-898-5959
Student Services Center 170
arcdept@csuchico.edu

**Dropping the Course**
You may drop without obtaining permission until Friday, February 3. From February 3 to February 17, you must obtain permission from the instructor to drop. After Friday, February 17, you will need a “serious and compelling” reason to drop. Your request must be approved by the Department Chair and the College Dean.