We must raise the courage of those timid people who dare invent nothing in physics, and confound the insolence of those rash persons who produce novelty in theology.

-Blaise Pascal (1647)

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Course summary

Classroom discussion (Room S151) Monday, Wednesday, and Friday 8:00-8:50 a.m. 25% wgt.
Homework assignments Due Monday 4:00 p.m. 25% wgt.
Quiz 1 Week 5 10% wgt.
Quiz 2 Week 11 10% wgt.
Final Week 16 30% wgt.

Course Grading Scale

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<th>Grade</th>
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<td>A</td>
<td>93-100%</td>
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<td>AB</td>
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Introduction and course objectives

Suppose that your local newspaper reports that Norway is ahead of Sweden in ranking, based on medals won, at the 2008 summer Olympics in Beijing. Norway has won a gold, a silver and two bronze medals; Sweden has one three silver and two bronze medals. What would you conclude: is this story true or false? How do you know?

Or suppose that you were listening to a political candidate on the radio, and he were to claim that it is morally wrong for North Korea to possess nuclear weapons. What would you conclude: is this claim true or false? How do you know?

These two questions: Is this true? and How do I know? are two of the most important questions that one can ask. How we answer them, and whether we even choose to ask them, has far reaching implications on how we conduct our lives. The primary objectives of this course are to develop in you

(i) the habit of asking such questions, particularly in the context of natural science, and

(ii) the ability to answer them for yourself.

You will be learning a great deal of physics in this course, but developing these two skills will serve you more in life than memorizing any number of scientific formulas or theories. These skills constitute important intellectual virtues (i.e. good habits), which will be very valuable in your future study of natural science, theology, political science, journalism, or any other discipline.
In addition to the primary objectives, the secondary objectives of this course are to develop in you:

(i) the ability to use scientific concepts (e.g. the principle of inertia) to analyze unfamiliar problems
(ii) improved vocabulary and reading comprehension skills
(iii) improved verbal and written communication skills (grammar, logic and rhetoric)
(iv) improved mathematical skills (algebra and geometry)

Our class discussion, laboratory and homework assignments are designed to address these objectives.

Studying great scientific works

In order to meet our course objectives, we will be reading and analyzing great scientific works. Great scientific works are distinguished from other scientific works by the fact that they have been recognized, over time, as being highly influential in shaping man’s philosophy of nature. This does not mean that everything they contain is true. In fact many great scientific works contradict one another. This is the case with both ancient and contemporary works. How do we distinguish that which is true and from that which is false?

Teaching and learning methodology

The method which we shall be employing in this course will perhaps be new to you. In many of your courses, you probably listen to a professor lecture for an extended period of time on topics covered in a textbook. In this course, the great scientific texts themselves serve as the lectures. In fact, they are some of the best scientific lectures ever written. Your first job, as a student in this class, is to read the assigned lectures before coming to class.

The time that we spend in the classroom will be devoted to understanding and analyzing the lectures. As the discussion leader, I will primarily be asking you questions regarding specific ideas which are found in the lectures. For instance, I may ask, “What does the author mean by the term planet.” Or I may ask, “Is it true that the planets move in circles around the sun?” And if so, “How do you know?” Your second job will be to try, as a group, to answer these questions.

Typically, different students will present different ideas. You should consider these different ideas and weigh the evidence for each. Some ideas will turn out to be problematic, and will be either refined or rejected altogether by the group. This should not be thought of as failure, but as the primary method by which we can approach the truth. In fact, this method is precisely the method used by scientists themselves in order to discover and evaluate competing theories.

Guidelines for participating in classroom discussion

Here are some guidelines\(^1\) which will allow us to have focused, fruitful and enjoyable discussions.

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\(^1\) These guidelines were adapted from “What’s the Matter?” published by the Great Books Foundation.
• **Read the assigned lecture before participating in the discussion.** This ensures that all participants are equally prepared to talk about the ideas in the work, and helps prevent talk that would distract the group from its purpose.

• **Support your ideas with evidence from the text.** This keeps the discussion focused on understanding the selection and enables the group to weigh textual support for different answers and to choose intelligently among them.

• **Discuss the ideas in the selection, and try to understand them fully before exploring issues that go beyond the selection.** Reflecting on a range of ideas and the evidence to support them makes the exploration of related issues more productive.

• **Listen to others and respond to them directly.** Our discussion is about the give-and-take of ideas, a willingness to listen to others and to talk with them respectfully. Directing your comments and questions to other group members, not always the leader, will make the discussion livelier and more dynamic. During discussion, you may speak freely; you need not raise your hand. Nonetheless, any comment or question you make during class time must be made publicly so that others can hear it and respond.

• **Expect the leader to ask questions, rather than answer them.** The leader is a kind of chief learner, whose role is to keep discussion effective and interesting by listening and asking questions. The leader’s goal is to help the participants develop their own ideas, with everyone (the leader included) gaining a new understanding in the process. When participants hang back and wait for the leader to suggest answers, discussion falters.

### Grading of the classroom discussion

The classroom discussion will account for 20% of your semester grade. Each student will receive a weekly discussion grade which will range from 0% to 100%. What follows are a few example students and the grade each received for one particular week.

• The **100% student** is actively engaged in the classroom discussion. Although she found the assigned text difficult to understand, she wrote down some questions which came to mind while reading the text. She raises one of these questions on Wednesday during the discussion. Her ability to cite relevant points from the text in response to questions raised by the instructor and by other students is evidence that she has already studied the assigned text.

• The **80% student** is occasionally engaged in the classroom discussion. He found the assigned text difficult to understand, but did not take the time to write down any specific questions. He does, however, ask one question which comes to mind during the discussion. He speaks out in class twice during the week, but has trouble providing specific textual or rational support for his views.

• The **40% student** is not engaged in the classroom discussion. He sits silently but politely. He read the assigned text before coming to class, but has not thought enough about it to formulate any questions. He uncritically accepts whatever is said by the author, the instructor and the other students in the class.
The 0% student comes to class, but instead of presenting her views to the class publicly, she whispers them to her friends. The instructor and other students find this distracting and a bit rude.

Weekly homework assignments

Weekly homework assignments are available for download from the instructor’s personal web page. The homework assignments are based on the week’s lecture. They will typically include a combination of essay questions and numerical problems. Essays should be written or typed legibly and should display thoughtful reflection which incorporates specific points addressed in the lectures and discussion. You may work on the homework assignments with other students, but each student must hand in his or her own homework assignment by Saturday afternoon at 6 p.m. at the latest. Homework problems may be handed in earlier, but full credit should not be expected for late homework. Please refer to the Student Handbook for the College’s policies on cheating and plagiarism. Suffice it to say here that you should never copy more than one or two words of text from a web page or any other source without specifically citing the source. When citing a web page, be sure to include the URL address and the date it was accessed.

Electronic homework submission

If you choose to send your homework to me electronically, I cannot accept .docx or WordPerfect files. Be sure to convert them to a .pdf, .doc, .rtf, or plaintext document. Also, be sure to label your homework using this exact format:

PHY321_HW#_studentlastname.doc

For example, I would hand in a file with the name

PHY321_HW4_kuehn.pdf

Also, be sure to include PHY321_HW# in the subject line of your email. If you do not label your file and your email subject line properly, I will likely not grade your homework, since my mail program automatically sorts my mail according to subject.

Included with the homework problems is a list of scientific terms and concepts with which you need to be familiar. This will not only help your reading comprehension for this class, but will also help you prepare for standardized tests such as the GRE, MCAT, GMAT or LSAT. There will be a vocabulary identification section on each test in this course and on the final exam.

Final thoughts

Finally, I want to encourage you to come to me with any concerns you may have during the course of the semester, whether they be physics questions or difficulties with reading or discussion or whatever. This course is designed to stretch your mind, but not to “break” you. Reading the “classics” in any field is challenging, but very rewarding. I would very much like to help you succeed and to have fun in this class. My office hours and contact information are listed at the be-
ginning of this syllabus. Most of the time during the day when I am not in class, I will be in my research laboratory or in the machine shop in the basement of the science building. Please feel free to stop by to speak with me if you would like.

Bibliography