Physics in Perspective Spring 2007

Instructor: Gay Stewart
Meeting times still TBD
Textbook: *Physics: the human adventure,* by G. Holton and S. G. Brush (Rutgers University Press, 2001)

Tentative syllabus: The course will consist of three parts. The first two may be thought of as "case studies" in the history of physics: they are devoted to the development of the atomic theory of matter, and the evolution of our understanding of the nature of light. The third part of the course will use these and other examples to explore a number of questions in the history and the philosophy of science, such as: how theories develop and "facts" become established; scientific knowledge versus other forms of knowledge; science versus pseudoscience; and the ways in which developments in science have influenced (or been influenced by) the world of ideas.

The material for the first part will be based primarily (though not exclusively) on chapters 19, 15, 20, 17, 22, and 18, to be covered roughly in this order. The material for the second part will be based primarily on chapters 3, 23, 25 and 26. For the third part, chapters 3, 12, 13, 14 and 33 will provide a starting point for discussion; other sources will be introduced as needed.

The way I would like to set it up is that each of you do the reading, marking interesting questions or comments you would like to share, then we will meet approximately once a week to discuss the material, homework to be due immediately after the discussion. (Come with it as done as you can, and clear up any questions, then turn it in. No doing it in discussion!)

Grading: There will be three exams OR lesson plans, including the final (which will not be cumulative). If you choose to do tests rather than develop lesson plans, the textbook and class notes will be allowed at exam time. Homework will be assigned almost every week. Both the homework and the exams will be slightly different for BA and BS students.

Each of the three exams/lesson plans will count as 27% of your grade, with the homework making up the remaining 19%. The course grading scale will be:
A:85-100% B: 70-84% C: 55-69% D: 40-54% F: below 40% Frankly, I do not want to see anything below an A or, at worst, B.

Homework for part one of the course:

Physics in Perspective First Homework Assignment due Tuesday, January 30, 2007

1. Assume that the density of air is constant and equal to 1.29 kg/m^3. (a) What is the difference in atmospheric pressure at the top and at the bottom of a mountain 2,000 feet tall? (b) By what distance would the liquid fall in a mercury thermometer as it is carried from the bottom to the top of such a mountain?

2. The pressure at the center of a tornado is 0.4 atm. If the tornado suddenly passes over a house, what is the net force on a window pane whose dimensions are 1.2 m x 1.4 m? Assume that the house is airtight and that the pressure inside is 1 atm.

Physics in Perspective Second Homework Assignment due Tuesday, February 6, 2007

1) Explain the difference(s) between phlogiston and caloric.

2) Give a brief history (1/2 page to 1 page) of the discovery of oxygen.

Physics in Perspective Third Homework Assignment due Tuesday, February 13, 2007

1. Problem 19.2: Find *r* in Eq. (19.3) for a sample of hydrogen gas weighing 2 g and filling 22.4 liters at 0 °C and 107 Pa pressure (approximately atmospheric pressure). Then determine the volume of this sample at room temperature (20°C) and a gauge pressure of 107 Pa (10 MPa). (Remember: Gauge pressure is defined as the pressure *above* atmospheric.)

2. Problem 20.2: In 1810, Dalton gave the approximate results listed in the following table for the relative densities of five gases (his terminology), each made of molecules involving only nitrogen and oxygen. He also concluded that the lightest of these gases was made of molecules containing one atom each of N and O. (a) Decide on the molecular formula for each gas on the basis of this information. (b) Confirm the law of multiple proportions for these five gases.

Substance	*Relative density*	*% Nitrogen by weight*	*% Oxygen by weight*
Nitrous gas	12.1	42.1	57.9
Nitrous oxide	17.2	59.3	40.7
Nitric acid	19.1	26.7	73.3
Oxynitric acid	26.1	19.5	80.5
Nitrous acid	31.2	32.7	67.3