West Chester University

Department of Physics

Physics 100 – Elements of Physical Science

Section 01 - Special Topics: The Energy Crisis

Meeting Times: MWF 9:00 - 9:50 am

Meeting Place: Merion Science Center 109

Instructor: Jeffrey J. Sudol (Dr. Jeff)

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Office Hours: W1-3, R3-4, F1-3

Course Description and Course Goals*

This is a Special Topics section of Physics 100 – Elements of Physical Science offering you the opportunity to develop a deep understanding of the meaning of the term "energy." By the end of this course, you will be able to use the principles of physics to evaluate the energy costs of a wide variety of everyday human activities and to evaluate a variety of popular claims regarding energy costs and savings on a variety of scales. The content areas of this course include kinematics, dynamics, thermodynamics, electricity and magnetism, quantum mechanics, and nuclear physics.

Required Course Materials

- ✓ *Physics: A Conceptual World View*, Kirkpatrick, 7th edition (2010).
- ✓ a scientific calculator

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*The course goals include but are not limited to the following University goals for a general education science course:

1. Ability to communicate effectively.
2. Ability to employ quantitative concepts and mathematical models.
3. Ability to think critically and analytically.

Attendance Policy

Attendance is required.

Website

This course has a D2L website associated with it. I will post all of the course documents and announcements on the D2L website on a regular basis. Please check D2L at least once a day for updates.

Electronic Equipment in the Classroom (Unplug)

I do not permit the use of cell phones, cameras, voice recorders, computers, or similar electronic equipment in the classroom unless you need to use such a device to accommodate for a disability, in which case you should schedule a meeting with me to discuss the use of the device as soon as possible. Calculators are allowed, of course, and it is acceptable to use a cell phone as a calculator. The spirit of the rule is that the classroom should be an electronic free zone where we tune out the distractions of the world and focus on learning physics. The classroom is a place of dialogue, and the electronic gadgets of our modern culture are not necessary for that dialogue to take place.

Pedagogical Notes

Let's talk about door knobs.

Consider the door knob. If you go to a hardware store looking for a door knob, you are likely to find a hundred different varieties. Door knobs come in different shapes and sizes and colors and styles, but you expect all of them to work the same way. You have in your head a "mental model" about how doorknobs work. You grab the door knob, turn the knob to the right (clockwise), the latch moves free of the catch, and the door is free to open. Despite all of the varieties of doorknobs out there, all of them function in the same way, more or less. So, instead of having to learn to recognize all of the varieties of doorknobs in the world and how each particular doorknob works, you need only this one mental model of how a doorknob works in order to open doors without having to stop and think about how to open a door each time you encounter one. That is, until you go to Japan. You reach for the handle, you turn to the right, and nothing happens. That's because doorknobs in Japan turn to the left.

I will admit that I do not actually know if door knobs turn to the left in Japan, but I want to illustrate the point that sometimes your expectation of how things should work is inconsistent with how things do in fact work because your mental model is either incomplete or broken. That particular moment, when your expectation (the door is

open) and reality (the door is not open) are in conflict, is quite powerful. It is in that moment that your brain is prepared to change its mental model of the world.

This whole thing about door knobs is highly simplified, but the point is this. You have in your head "mental models" about how things work that are often broken or incomplete. You have many "misconceptions" about how things work, especially when it comes to "physics." It's ok. It's expected. It's "human nature."

I have designed this course to expose and challenge your existing mental models and to help you change them and build more robust and accurate mental models. I want you to know right now that there is no "natural talent" for physics. Anyone who is good at doing physics has had to go through the same process that you will go through: challenging and advancing their mental models about how the world works.

For a cogent discussion about "mental models," I recommend *The Implications of Cognitive Studies for Teaching Physics* by E.F. Redish, available at the following website: http://www.physics.umd.edu/perg/papers/redish/cogsci.html.

Assessment

Your "grade" in this course will be based on your performance in the following categories of assessment with the following weights.

Homework and Participation	10%
Regular Exams	70%
Final Exam	20%

I assign letter grades according to the following scale, rounding appropriately.

93 - 100	A
90 - 92	A-
87 - 89	B+
83 - 86	B
80 - 82	B-
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.	
and so on...	

I do not norm-reference (or scale) grades.

I also reserve the right to introduce different forms of assessment as needed and to alter the weight of each of the categories of assessment in the event of some unforeseen circumstance.

Categories of Assessment

Homework

I will assign homework on a regular basis to advance the discussion in lecture or to provide you with the opportunity to rehearse the factual knowledge, conceptual knowledge, and procedural knowledge presented during lecture. I will collect homework on occasion, with an advance notice of at least one lecture. I will score homework using the following scale.

- **Score 2:** Your work is complete, correct, and well organized. Any omissions, errors, or lapses in organization do not require a careful review of your work for me to make sense of it. Your work meets my expectations.

- **Score 1:** Your work contains significant errors or omissions, or your work is poorly organized to the point that I cannot make sense of it without careful review. Your work does not meet my expectations. Visit me during my office hours or schedule an appointment as soon as possible to develop strategies to improve.

- **Score 0:** It appears that you made no meaningful attempt to address the homework questions, or I cannot make sense of your work even with careful review.

- **Score 3:** Your work is exemplary and exceeds my expectations.

Note that a score of a "2" does not represent a grade of 67%. Similarly, a score of a "1" does not represent a grade of 33%. You accumulate points. If you receive two points on every homework assignment, you can expect to receive 100% of the points assigned to the "Homework" category toward your final grade for the course. Likewise, if you receive zero points on every homework assignment, you can expect to receive 0% of the points assigned to "Homework" toward your final grade for the course. Your Homework score is based on how many points you accumulate with respect to a target score, which is based on two points for each homework assignment scored.

The following criteria apply to your solutions to mathematical problems.

1. Your solution to any problem must be legible and well organized.

2. Your solution must be logically complete. You must state all assumptions that are not explicitly stated in the problem statement but required to solve the problem. You must start the solution to a problem with the most abstract and general rule(s) applicable to the problem. You must also include narrative to support your mathematical arguments.

3. When solving for an unknown, you must (1) state the equation you are using to solve for the unknown, (2) show the substitution of the known values into the equation, and (3) show all of the significant steps in the solution for the unknown (that's at least three lines). You must use subscripts to distinguish variables from one another, and the subscripts should connect to the problem in meaningful ways.

4. You must be honest. If you are "stuck" on a problem, consult with me or your classmates. In your solution, note precisely where you got stuck and how you got unstuck, who helped you, and what you learned in the process.

5. Your solution must be yours. I have no objection to you working with your classmates on a problem, in fact, I encourage it, but your solution should be distinguishable from those of your classmates. If you do work with your classmates on a problem, make a note of it on your solution. Give credit where credit is due.

Participation

I employ a variety of interactive engagement techniques in class. I call on students to answer questions at random using name cards. If you are present, and your response to the question represents a meaningful attempt to answer the question, I will make such a note on your name card. If you are not present, or your response to the question indicates that you did not make a meaningful attempt to answer the question, I will make such a note on your name card. These notes will be factored into your homework and participation score at the end of the semester.

Exams

Regular exams are those exams that occur in lecture during the course of the semester. **At the end of the semester, I will drop your lowest regular exam score and average the remaining exam scores.** The final exam is cumulative, and it counts.

It sounds nice, but here's the catch!

Except for University sanctioned events (see below), there are no excused absences. There are no makeup exams, and you cannot take an exam early or late.

What does this mean? It means that if you miss a regular exam, you receive a score of a zero on that exam, regardless of the reason for missing the exam. I drop the lowest exam score, so you can miss one regular exam, and it will not affect your final grade. I recommend, however, that if you miss an exam, you make arrangements with me to take the exam as it will serve to test your knowledge of physics and prepare you for the final exam, which is cumulative, and it counts.

I do this for the following reason. It takes me about eight hours to write an exam. The exams are exquisitely crafted to test the objectives of the course. The exam scores therefore represent an accurate assessment of how well the students (and I) have met the objectives of the course (we are a team). If I were to allow students to take exams at different times, I would have to write multiple exams to preserve the integrity of each exam (this follows from a professional code of ethics; it's nothing personal), and I would have to do so in a way that all of the exams test the same objectives equally well. So, "makeup exams" represent a huge time sink, and the education system does not afford me the luxury of time to sink.

Finally, exams are not a learning tool. Exams represent summative assessment. (If you are unfamiliar with the concept, an internet search for "formative vs. summative assessment" will enlighten you.) I keep all exams in my office, and exams are only available for review up until the next exam. In other words, after each exam, all previous exams will no longer be accessible to you for review. The reproduction of any exam question in any manner represents a violation of academic integrity.

Disability Statement

If you require special accommodations because of a disability, please meet with me as soon as possible to discuss your needs. Supporting documentation is required.

Academic Integrity Statement

If you commit a violation of academic integrity, you will receive zero credit for the entire course. This is not negotiable. For more information regarding violations of academic integrity, consult the Undergraduate Catalog.

University Sanctioned Events

If you will be participating in a University-sanctioned event that occurs at the same time as an exam (the exam dates on the schedule will not change), you must notify me prior to the exam. Documentation supporting your participation in this event is required. We will then make arrangements for you to take the exam either prior to or at the scheduled exam time through a proctor. For more information on University Sanctioned Events, consult the Undergraduate Catalog.

Intellectual Property

All of the course materials, such as the PowerPoint lectures, worksheets, and exams, are the intellectual property of either the instructor or another author. Your use of these materials is restricted to your own studies for the duration of this course. It is illegal for you to distribute copies of these materials to anyone in any format.

Course Schedule

	Date	Topic
M	Jan. 28	Introduction
W	Jan. 30	Human Activities that Consume Energy
F	Feb. 01	The Energy Costs of Human Activities
M	Feb. 04	Kinematics
W	Feb. 06	Kinematics
F	Feb. 08	Dynamics
M	Feb. 11	Dynamics
W	Feb. 13	Dynamics
F	Feb. 15	Dynamics
M	Feb. 18	Dynamics
W	Feb. 20	Dynamics
F	Feb. 22	Dynamics
M	Feb. 25	**Exam I**
W	Feb. 27	Thermodynamics
F	Mar. 01	Thermodynamics
M	Mar. 04	Thermodynamics
W	Mar. 06	Thermodynamics
F	Mar. 08	Thermodynamics
M	Mar. 11	Thermodynamics
W	Mar. 13	Thermodynamics
F	Mar. 15	**Exam II**
M	Mar. 18	*No Classes - Spring Break*
W	Mar. 20	*No Classes - Spring Break*
F	Mar. 22	*No Classes - Spring Break*

	Date	Topic
M	Mar. 25	Electricity
W	Mar. 27	Electricity
F	Mar. 29	Electricity
M	Apr. 01	Electricity
W	Apr. 03	Electricity
F	Apr. 05	Electricity
M	Apr. 08	Magnetism
W	Apr. 10	Magnetism
F	Apr. 12	Magnetism
M	Apr. 15	**Exam III**
W	Apr. 17	Quantum Mechanics
F	Apr. 19	Quantum Mechanics
M	Apr. 22	Nuclear Physics
W	Apr. 24	Nuclear Physics
F	Apr. 26	Nuclear Physics
M	Apr. 29	Nuclear Physics
W	May 01	Nuclear Physics
F	May 03	Complex Systems
M	May 06	Complex Systems
W	May 08	**Exam IV**
F	May 10	The Future
M	May 13	**8:00 - 10:00 am, Final Exam**