Wabash College Departments of Chemistry and Physics

DV1-178 Energy

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Discussion Times: TTH 8:00 am – 11:00 am
Lab Times: Same as Class

Room: Hays 321

Introduction

With concerns for global warming and the energy crisis, alternative and renewable energy resources are becoming more important. This non-majors course will investigate several different forms of physical and chemical energy. For each energy resource we will consider the following questions: What is it? How is it generated? How is it stored? And how is it used? We will study and apply the impact and importance of energy conservation as an energy resource. This course counts toward the laboratory science requirement and will include lab activities such as: making a wind turbine, constructing a solar cell, and distilling ethanol fuel.

The goals for this course are to:

1. Develop a correct conceptual understanding of the various forms of energy, how it is produced, and how it is used;
2. Quantitatively analyze the production and usage of energy in your home, the College, and the world; and,
3. Apply your understanding of energy to real problems both in the lab and in your life.

Course Format and Procedure

The course consists of two, three-hour combined lecture and lab classes per week. You will need to bring a calculator to every class. We will be doing a number of calcuations and estimates both in class as well as in lab.

Textbook and Reading

A readings book must be purchased from the bookstore. Prior to each discussion period, you will be responsible for reading a number of sections and answering questions on a Moodle **Reading Quiz**.

Moodle Reading Quizzes

There will be a reading quiz posted on Moodle at 12 pm the day before every discussion period. You are responsible for completing the quiz before the discussion period starts– the quiz will become unavailable at 8 am on the class day. They will generally consist of four multiple-choice questions, each worth 10 points.

> **Due to the way that Moodle functions, if you do not complete a Reading Quiz on time, you will receive a zero score and loose access to that quiz for future study and review.**

The purpose of the reading quiz is two-fold: first of all, it provides motivation to you to read the material *prior* to the discussion. This is vital, as those students that do not read the material, will not be able to participate constructively in the class discussion. The second purpose is that it prompts you to be thinking about the material before class. If you read the material a few days before, it can slip into the back of your mind. The reading quiz helps to bring that material back to the front.

Class Periods

The class periods will be a combination of discussions about the reading materials, as well as lab exercises and activities. We will be moving back and forth between discussion and lab on a regular basis. We will be using a classroom response system. You will need to purchase an iClicker from the bookstore for use in this class. These will be used to track attendance, as well as to give you extra credit! Each correct answer in class will be worth 2 points extra credit on your reading quiz grade (up to 10 points).

> **Attendance:** Attending class is mandatory. Each unexcused absence will dock 10% off of your final grade. No exceptions. If you have more than two unexcused absences, you will fail the class. Excused absences (with a letter signed by the Dean) will be made up by a 5 page research paper presented on the material missed that class period.

Homework

Quantitative Homework will be due at the beginning of the class period every Thursday. There will be a number of problems assigned from a variety of sources. The assignments will be posted on Moodle a week or two ahead of the due date. You are responsible for printing out the assignment and completing the problems.

> **Late Homework Policy:** It is essential to keep up with the homework. Science takes time to learn—you can't do it all the night before the exam. To give incentive for turning in the homework on time, we will use the following scheme: If you have not made prior arrangements with us (if you are ill, please send an email or leave a voice mail message),
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> - 10% of the total points will be deducted if turned in late but on the same day assignment was due.
> - If more than one day late, 10% of the total points will be deducted for each day late up to 100%. Example: If you turn Tuesday's assignment in on Friday, 40% of the total points will be deducted from your score.

If you are stuck on a homework problem, you may discuss the problem with classmates. However, the written solutions must be your own. Representing someone else's work as yours is cheating and will be treated as such.

Projects

There will also be a weekly project due every Tuesday. These projects will cover a wide variety of topics based on material covered during the course of the semester. The projects might take a week or so to complete, depending on the type of project, so plan ahead. The same late policy applies to the projects. Many projects will be completed by contributing to the class Project Wiki. With the exception of a few weeks, there will be a flexible schedule for the completion of these projects. The Project Wiki has a list of projects as well as a sign-up sheet for those projects that require the use of equipment. Each project page has a description of the goals for the project and some ideas for how to do the project. The Wiki records all edits and you must have a project completed prior to class on Tuesday. (Note that you may, if you choose, work ahead on the projects. In this case, we will grade one of the completed projects each week. You may let us know which one you want us to grade on any given week.) Projects will be graded based on your completion of the project goals, the quality of the work on the project, and the quality of your entry in the Wiki.

> **All homeworks and projects must be completed to pass this class!** Even if the assignment is so late that you will receive 0 points, you must still turn it in. You will receive an incomplete in the class if all homeworks are not turned in.

Exams

- **Number of Exams**: There will be a total of three exams: 2 in-class exams and a final exam. The final exam will consist of the material from the final section (1/2 of the exam) and a comprehensive coverage of the semester (1/2 of the exam).
- **Purpose:** To measure how far you have come in meeting the course objectives. If you cannot work the problems, you don't understand the material.
- **Format:** All exams will be closed book/notebook.
- Unexcused absences for any of the exams will lead to a zero exam score. For an absence to be excused, arrangements must be made in advance with the instructor.
- Each exam will cover concepts and techniques learned in the labs.
- The final exam will be comprehensive and is scheduled for Wednesday, April 30 at 1:30 PM.

Grading

- Course grades will be determined by your total point score as follows:

Reading Quizzes	5%
Homework	15%
Projects	20%
Laboratory	20%
2 one-hour exams (10%each)	20%
Final Exam	20%

- In addition, **To pass this course, all homeworks and labs must be completed before the final exam, and the average score of all exams must be $> 52\%$** irrespective of your homework and lab scores.
- Your overall course grade is impossible to determine until the end of the semester when all of the points are counted. If you wish to measure your performance, compare your scores to the class distribution which will provided after each exam. If your scores are much below the averages, you should consider getting help. Don't wait until it's too late!!
- Anyone who receives 90% of the total points will receive at least an A−, 80% will receive at least a B−, etc.

Getting Help

The QSC is one resource for getting help. The tutors should know much of this material and should be able to help you figure out how to do the quantitative homework. However, you should always attempt the homework yourself before seeking help.

Academic Support Services:

Students with disabilities, whether physical, learning, or psychological, who believe they may need accommodations in this class, are encouraged to contact Academic Support Services as soon as possible to ensure that such accommodations are implemented in a timely fashion. Please meet with Julia Rosenberg (ext. 6024) to verify your eligibility for any classroom accommodations and for academic assistance related to your disability. You may also discuss your disability with the professor if you wish. All discussions will remain confidential. If you have a hidden or visible disability which may require classroom or test accommodations, please see me as soon as possible during a scheduled office hour. If you have not already done so, please visit Academic Support Services (Armory 101) which is responsible for coordinating accommodations and services for students with disabilities.

Schedule

Note: D = Discussion Topic, L = Laboratory, R = Reading

Tuesday	Thursday
Jan 8th	10th **1** D: Intro to Energy L: Concept Map and Lab Intro
15th **2** D: Types of Energy L: Energy Perspective and Efficiency R: Hobson 17.1-2, 17.6-7	17th **3** D: Atomic Model and Motion L: Motion R: Hobson 2.1-3, 3.3-6
22nd **4** D: Force and Work L: Work-Energy R: Hobson 6.1-5	24th **5** D: Conservation of Energy and Power L: Power R: Hobson 6.6-7
29th **6** D: Charge and Current L: Circuits R: Griffith Chapter 13	31st **7** D: Magnetic Fields L: Field Strength R: Griffith 14.1-3
Feb 5th **8** D: Electromagnetic Forces L: Motors R: Bloomfield Section 12.4	7th **9** D: Electromagnetic Induction L: Generators R: Hewitt Chapter 24
12th **10** **Exam I** L: Wind Energy R: Hinrichs Section 12E	14th **11** D: Solar Energy L: Windmill Contest R: Hewitt Chapter 15
19th **12** D: Global Warming L: Passive Solar Buildings R: Hobson Section 9.6	21st **13** D: Light and Energy L: Basic Light Properties R: Griffith 16.1-2
26th **14** D: Light and Atomic Interactions L: Molecular Spectroscopy R: Chem Act. 16 pp. 137-140	28th **15** D: Semiconductors L: Solar Cells R: Hinrichs Section 12A
Mar 4th **Spring Recess**	6th **Spring Recess**
11th **16** D: Nuclear Decays L: Radioactivity R: Tro pp. 611-622	13th **17** D: Fission and Fusion L: Radioactivity 2 R: Tro pp. 625-629
18th **18** **Exam II** D: Classical Fuels R: Gilbert pp. 511-517, 562-569	20th **19** D: Thermochemistry L: Thermochemistry R: Gilbert pp. 518-530

Revised Div 1 178 Course Schedule

March 11th D: Nuclear Decays L: Radioactivity R: Tro pp. 611-622	13th D: Fission and Fusion L: Windmill optimization contest R: Tro pp 625-629
18th **EXAM II** D: Classical Fuels and energy sources R: Gilbert pp. 511-517	20th D: Redox Reactions L: Hydrogen generation R: Baird pp. 449-452, 468-472
25th D: Hydrogen Storage and Gas Laws L: Gas Laws R: Tro 355-379	27th: D: Energy Storage L: Batteries R: Baird 453-466
April 1st D: Bond Energy L: Organic structures R Gilbert 531-541, 562-569	April 3rd D: Organic functional groups and alcohols L: Start ethanol synthesis R: Baird 207-213, 220-225
April 8th Field trip or discussion of cost effectiveness of ethanol as a fuel R: C&EN article	10th D: Separations L: Distilling ethanol R: Baird 35-45;
15th D: Biomolecules L: Biodiesel synthesis R: Timberlake pp 661-668	17th D: Biodiesel L: Biodiesel purification R: Biodiesel lab handout
22nd D: Thermochemistry L: Thermochemistry R: Gilbert 518-530	24th D: Energy Policy and course wrapup L: Energy from fuels you made