

# **NATURAL SCIENCE I: ENERGY AND THE ENVIRONMENT**

V55.0203  
Spring 2005

Mondays and Wednesdays  
2:00 – 3:15 p.m.  
Silver 207

## **Professor Trace Jordan**

Morse Academic Plan  
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Office Hours: By Appointment



## **1. Course Description**

This course explores the scientific foundations of current environmental issues and their challenges for public policy. The syllabus is divided into sections that each examines a current environmental theme in depth. The first sections investigate the composition of the atmosphere and the chemical processes that cause air pollution, ozone depletion, and global warming. Moving to the study of water, the course explores the properties of this unique solvent, the effect of various aqueous pollutants, and the origin of acid rain. The course concludes with a discussion of the energetics of chemical reactions, our continuing reliance on fossil fuels, and the potential of alternative energy sources. The laboratory experiments are closely integrated with the lecture topics and provide hands-on explorations of central course themes. Throughout the course we also examine how scientific studies of the environment are intimately connected with political, economic and policy concerns.

## **2. Course Objectives**

Throughout the course we will develop the following learning objectives:

- Acquire knowledge of foundational concepts, processes, and terminology in chemistry.
- Develop skills in problem solving and use of quantitative reasoning.
- Understand the methods of scientific investigation, including the roles of experiments and computer simulations.
- Critically evaluate new advances in our understanding of environmental science as reported by news media.
- Address the complex economic, political, and policy aspects of environmental issues.

## **3. Course Texts**

There are two required texts for the course that are available in the NYU Bookstore:

Conrad Stanitski et al., *Chemistry in Context: Applying Chemistry to Society*, 4<sup>th</sup> Edition (Boston: McGraw Hill, 2003)

T. Jordan, Esther K. Nemethy, and Susan L. Price, *Laboratory Manual for Energy and the Environment*.

The NYU Bookstore sells these texts as a shrink-wrapped bundle to reduce overall cost. If you need only the laboratory manual then you can ask the bookstore to split the bundle.

Several of the laboratory sessions will require you to use chemicals that are potentially damaging to your eyes. **GOGGLES ARE ABSOLUTELY REQUIRED DURING THESE LABS.** Goggles will be available for purchase at the first laboratory session for a cost of \$5.

**PLEASE REMEMBER TO BRING YOUR GOGGLES TO THE LABORATORY SESSIONS!**

#### 4. Lecture and Laboratory Schedule

	<i>Date</i>	<i>Lecture Topic</i>	<i>Reading</i>	<i>Laboratory Project</i>
		<b>THE AIR WE BREATHE</b>		
1	W Jan 19	What's in a Breath?	Ch. 1, pp. 1 - 9	
	<i>Jan 20/21</i>			<i>No laboratory</i>
2	M Jan 24	Components of the Atmosphere	Ch. 1, pp. 9 - 22	
3	W Jan 26	Chemical Reactions and Air Pollution	Ch. 1, pp. 23 - 41	
	<i>Jan 27/28</i>			<i>Lab 1: Properties of Air</i>
		<b>THE OZONE LAYER</b>		
4	M Jan 31	Atoms and Molecules	Ch. 2, pp. 47 - 58	
5	W Feb 2	Light and the Ozone Layer	Ch. 2, pp. 58 - 74	
	<i>Feb 3/4</i>			<i>Lab 2: Properties of Light</i>
6	M Feb 7	The Ozone Hole	Ch. 2, pp. 74 - 92	
		<b>GLOBAL WARMING</b>		
7	W Feb 9	The Earth's Climate	Ch. 3, pp. 97 - 106	
	<i>Feb 10/11</i>			<i>Lab 3: Spectroscopy</i>
8	M Feb 14	Greenhouse Gases	Ch. 3, pp. 106 - 114	
9	W Feb 16	Carbon Dioxide Emissions	Ch. 3, pp. 114 - 127	
	<i>Feb 17/18</i>			<i>Lab 4: Molecular Structure</i>
10	M Feb 21	<i>No Class – Presidents' Day</i>		
11	W Feb 23	Global Warming – Science and Policy	Ch. 3, pp. 127 - 143	
	<i>Feb 24/25</i>			<i>Review for Midterm 1</i>
	<b>M Feb 28</b>	<b>Midterm Exam 1</b>		
		<b>ENERGY AND SOCIETY</b>		
12	W Mar 2	Sources of Energy	Ch. 4, pp. 149 - 158	
	<i>Mar 3/4</i>			<i>Lab 5: Reaction Energy</i>
13	M Mar 7	Energy from Chemical Reactions	Ch. 4, pp. 158 - 164	
14	W Mar 9	Fossil Fuels	Ch. 4, pp. 164 - 191	
	<i>Mar 10/11</i>			<i>No Laboratory</i>
		<i>SPRING RECESS (March 14 – 18)</i>		
		<b>THE WATER WE DRINK</b>		
15	M Mar 21	Properties of Water	Ch. 5, pp. 197 - 212	
16	W Mar 23	Water as a Solvent	Ch. 5, pp. 212 - 221	
	<i>Mar 24/25</i>			<i>Lab 6: Ions in Solution</i>
17	M Mar 28	Water Quality	Ch. 5, pp. 221 - 238	
		<b>ACID RAIN</b>		
18	W Mar 30	Acids and Bases	Ch. 6, pp. 243 - 251	
	<i>Mar 31/Apr 1</i>			<i>Lab 7: Water Hardness</i>
19	M Apr 4	Origins of Acid Rain	Ch. 6, pp. 251 - 261	
20	W Apr 6	Effects of Acid Rain	Ch. 6, pp. 261 - 278	
	<i>Apr 7/8</i>			<i>Review for Midterm 2</i>
	<b>M Apr 11</b>	<b>Midterm Exam 2</b>		
		<b>ENERGY &amp; ELECTRON TRANSFER</b>		
21	W Apr 13	Electron transfer reactions	Ch. 8, pp. 327 - 334	
	<i>Apr 14/15</i>			<i>Lab 9: Building Batteries</i>
22	M Apr 18	Fuel Cells	Ch. 8, pp. 334 - 348	
23	W Apr 20	Energy from the Sun	Ch. 8, pp. 348 - 356	
	<i>Apr 21/22</i>			<i>Lab 10: Photovoltaic Cells</i>
		<b>CURRENT ENVIRONMENTAL ISSUES</b>		
24	M Apr 25	TBA	TBA	
25	W Apr 27	TBA	TBA	
	<i>Apr 28/29</i>			<i>Review and Evaluations</i>
26	M May 2	Course Review		

## 5. Grade Allocation

Midterm Exam 1	20 %
Midterm Exam 2	20 %
Final Exam	25 %
Laboratory	25 %
Homework	10 %

## 6. Service-Learning Seminar

In addition to the lectures and laboratory sections, a **service-learning seminar** (section 008) is also being offered this semester. This optional, two-credit seminar provides students with the opportunity to expand their environmental interests to include the local community. The service-learning activities will focus on urban environmental education for 7<sup>th</sup> graders through partnerships with Open Road of New York, a non-profit organization that administers community gardens, and the East Side Community High School on 12<sup>th</sup> Street between 1<sup>st</sup> Avenue and Avenue A. Students interested in this opportunity must be available from **12:30 – 3:00 pm on Tuesdays** to coincide with the High School class schedule.

## 7. Exam Format and Policies

The exams will contain questions covering the **lectures, readings, and laboratory projects**. Study questions for the lecture topics will be distributed regularly during the semester. The final exam will be **cumulative** and will cover topics from throughout the course. Homework assignments provide practice with some types of questions that will appear on the exams.

If you will miss one midterm exam because of illness, you must contact Professor Jordan by e-mail before the start of the exam and provide a doctor's note explaining your absence. **No make-up exams will be given for the course.** Instead, the final exam will count as 45% of your course total. Since the final is cumulative and the most difficult exam of the course, this option is not advisable unless extreme circumstances prevail. If you miss two midterm exams then you will be required to withdraw from the course.

**The final exam is scheduled for Monday, May 9, from 2:00 – 3:15 p.m. and no alternative date will be provided.** A make-up will be given for the final exam only under exceptional circumstances that must be discussed with Professor Jordan prior to the exam. In this case a grade of incomplete will be given for the course and the make-up will be scheduled for the Fall 2005 semester.

## 8. Homework Format and Policies

The homework assignments will contain questions that review the course material and/or questions that relate to the laboratory projects. Certain questions on the homework assignments may require you to access information on relevant web sites. Each homework assignment will contain several questions and **two will be graded**. Each assignment is worth 10 points, with 4 points for each graded question and 2 points awarded for completing all the questions. All homework must be submitted on time for full credit. Any late assignments will be penalized 1 point per day (excluding weekends). If you miss a lecture or laboratory session due to a documented absence you are still required to complete the homework assignment. Contact your laboratory instructor to arrange a suitable deadline for submitting the work.

## **9. Laboratory Sessions**

The laboratory sessions will be held in **Silver 202** and will begin on **January 27 or 28**. The laboratories will be taught by three knowledgeable graduate instructors:

**Aiming Gao**  
ag746@nyu.edu

**Nahum Shiffeldrim**  
ns706@nyu.edu

**Azaria Eisenberg**  
ase217@nyu.edu

<b><i>Lab Section</i></b>	<b><i>Day and Time</i></b>	<b><i>Instructor</i></b>
Section 2	Thursday, 11:00 a.m. – 12:40 p.m.	Aiming Gao
Section 3	Thursday, 1:00 p.m. – 2:40 p.m.	Aiming Gao
Section 4	Thursday, 3:00 p.m. – 4:40 p.m.	Nahum Shiffeldrim
Section 5	Thursday, 5:00 p.m. – 6:40 p.m.	Nahum Shiffeldrim
Section 6	Friday, 9:00 a.m. – 10:40 a.m.	Azaria Eisenberg
Section 6	Friday, 11:00 a.m. – 12:40 p.m.	Azaria Eisenberg

## **10. Laboratory Assignments and Policies**

The laboratory exercises, which include both computer modeling and hands-on experiments, have been designed to cover central topics in the lectures and to provide you with the opportunity to become skilled at molecular recognition, scientific observation, and data interpretation. Each weekly experiment is worth 50 points:

Attendance	10 points
Quiz	10 points
Lab Assignment	30 points

**You must be registered in a laboratory section** in order to receive credit for the course. The sections have a capacity of 20 students, which is determined by safety issues and availability of laboratory equipment. The section enrollment will not be increased. If you are not appropriately registered for a laboratory section by project #2 you will be required to drop the course.

### ***Attendance Credit:***

You are expected to arrive punctually for the beginning of the lab session and arriving more than **10 minutes late** will result in a loss of attendance credit for the session.

### ***Laboratory Quiz:***

Questions will be based on the description of the experiment in the laboratory manual. Arriving more than 10 minutes late for the lab will exclude you from taking the quiz.

### ***Laboratory Assignment:***

This assignment should be completed and submitted during the laboratory period by working collaboratively with your laboratory partners. Some laboratories may have a take-home component in addition to the in-lab exercises.

You will be at a disadvantage in the course if you miss any of the lab sessions. If you cannot attend a lab session because of illness, notify your lab instructor **before** the start of the session. Because of the logistics of using the laboratory room, it is not possible to attend another laboratory section other than your own or to perform make-up experiments. If you will miss a lab session due to special circumstances, including observation of a religious holiday, notify your lab instructor in advance. **Missing more than three laboratory sessions for any reason will result in receiving a score of zero for the entire laboratory component of the course.**