

**Piedmont Project – May 2007**

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**Division of Natural Science and Mathematics, Department of Chemistry**

Course: Introductory Chemistry with Laboratory for Non-science Majors (CHEM 100Z)

Sustainability project title: “Ground-level ozone in Newton County, Georgia: a problem-based case study for non-science majors”

Summary:

This class will use the problem of ground-level ozone detection in Newton County, Georgia (where Oxford College is located) as the central theme for the entire course. A case study will be introduced on the first day of class to introduce the idea of ground-level ozone. From this case study, students will generate a number of fundamental questions that need to be answered in order to resolve the case. These questions will in effect become the disciplinary learning goals for the entire semester; the chemistry that is covered will provide the students with the necessary tools to answer the original questions developed from the case.

Once these disciplinary goals are addressed, the students will then actually construct ground-level ozone detectors, design a detection protocol, and determine the concentration of ozone at selected sites in Newton County. The students will conduct this data collection with students from a local middle school, with the Oxford students acting as the research mentors. Once the data is collected and analyzed, students in my class will prepare final reports that will be submitted to a local environmental agency called Keep Covington/Newton Beautiful. The final part of the project will require the students in my class to craft a letter that will be sent to a local government official in Newton County. This will be a community-drafted letter. To achieve this, each research group in class will write a letter, and then the class will vote on the letter that is to be sent to Newton County. The final editing of the letter will be based on student input from the entire class.

Timeline:

Weeks 1-11:

- introduce problem of ground-level ozone in Newton County
- identify fundamental questions that need to be answered
- learn chemistry skills required to address these questions

Weeks 12-15:

- design ozone detection protocol
- construct ground-level ozone detectors
- collect ozone data at selected sites in Newton County with local middle school students
- analyze data and write final reports
- construct class action letter

**Course Syllabus**  
**Chemistry 100Z – TPSL**  
**Fall 2007**  
**Oxford College of Emory University**

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Class Meets MWF, 11:45-1:40, Room 207 Pierce

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### **What is a Liberal Arts Education?**

A liberal arts education is an interdisciplinary education including courses in humanities, natural sciences, social sciences, and physical education.

### **Why Pursue a Liberal Arts Education?**

This course aims to use chemistry as a springboard into a liberal arts education by helping YOU develop your human capacities, that is the “qualities, capacities, domains, and/or dispositions native to us as human beings that allow education to occur in the first place.”\* Marshall Gregory, Ice Professor of English, Liberal Education, and Pedagogy at Butler University, breaks down these capacities into eight categories:

- 1) Language
- 2) Reason
- 3) Imagination
- 4) Introspection
- 5) Aesthetic Responsiveness
- 6) Moral and Ethical Deliberation
- 7) Sociability
- 8) Physicality

One may see the goal of a liberal arts education as the advanced development of all of these human capacities. By doing so, YOU will be better equipped to live an “autonomous, socially responsible, intellectually perspicuous, and morally defensible life.”<sup>1</sup>

<sup>1</sup>Marshall Gregory, “Forgetting, Learning, and Living: A Pedagogical Theory of How Education Makes a Difference Even Though We Forget Most of What We Learn” 2006.

## Course Description

Chemistry 100Z is the first course in a two-semester sequence for General Chemistry. This class fulfills the introductory chemistry requirement for pre-nursing students. It can also be taken by non-science majors to complete their laboratory science general education requirement. The topics covered in CHEM 100Z include: 1) experimental design and measurement; 2) fundamental properties of matter; 3) states of matter and the properties of gases; 4) aqueous solutions; 5) chemical reactions; 6) energy; and 7) environmental sustainability.

\*Note: If you have taken and passed CHEM 141, you cannot receive credit for CHEM 100Z.

A unique feature of this course is the Theory-Practice-Service-Learning (TPSL) format. A TPSL component can deepen our understanding of the subject we are studying and develop our ability to reflect on, “practice,” and apply to a real life situation what we are learning in the classroom. Simply memorizing disciplinary information and reciting it in on an exam does not necessarily demonstrate deep understanding of the material, nor does it prepare you for real life experiences. Therefore you will be required to reflect on what you are learning by mentoring middle school students in our ground-level ozone detection study. In addition, you will have to opportunity to work for a local environmental agency called Keep Covington/Newton Beautiful. More detailed information about the TPSL component and the ground-level ozone study is given below.

## Course Goals

The general goal of CHEM 100Z is to provide an introduction to the study of matter and the various changes it can undergo and to demonstrate how/why the study of chemistry is relevant to YOUR life. In the course of completing this goal, the various concepts of chemistry that are discussed will aid in developing your human capacities and contribute to your liberal arts education. More specifically, by completing the ground-level ozone study, you will begin to develop problem solving and critical thinking skills, become better acquainted with experimental design (including data collection and analysis), and practice effective communication (both orally and written).

## Materials and Resources

- Textbook (optional): Introduction to General, Organic, and Biochemistry, 8<sup>th</sup> edition, Bettelheim/Brown/March
- Student study guide and solutions manual (accompaniment to textbook; optional)
- Carbon-copy lab notebook (required)
- Safety Glasses (required)
- Non-graphing scientific calculator (required)
- Blackboard Class Conference (<https://classes.emory.edu/webapps/portal/frameset.jsp>)
- Oxford College CHEM 100Z Ozone Study website (TBD)
- Oxford College CHEM 100Z Ozone Study blog (<http://oxfordchemistry10100.blogspot.com/>)

## Attendance

Since laboratory experiments, case studies, and other in-class activities will be completed in each class session, attendance is required. You will be allowed to miss three class periods during the course of the semester, regardless of the reason for absence. However, every absence after the third will result in the loss of 3 points from your final grade. For example:

You end up with a 91/A- in the course. However, you missed 5 class periods during the semester. Since you had 2 absences over the limit, you will lose 6 points from your grade, resulting in an 85/B.

## Grading

Your grade will be broken down into the following categories:

Readings/Case Studies /Tutorials/Reflective Statements	5%
Sustainability Blog Posting	5%
Exam 1 (Unit 1 and 2)	15%
Exam 2 (Unit 3 and 4)	15%
Exam 3 (Unit 5 and 6)	15%
Laboratories	10%
TPSL - Ozone Detection Project	
Talk	5%
Paper	15%
Final Exam (cumulative) <sup>1</sup>	15%
Community Service Extra Credit <sup>2</sup>	

<sup>1</sup>Your final exam can be used to replace your lowest exam grade. If you miss one exam due to absence, your final exam grade will replace that exam grade, so you will not be able to drop any of the other exam grades.

<sup>2</sup>If you accumulate 8 hours of volunteer service with Keep Covington/Newton Beautiful, you will have 3 points added to your final grade (e.g., if you end up with an 87/B+ for the course and accumulate 8 volunteer hours, you will receive a final grade of 90/A-).

### Readings/Case Studies/Tutorials/Reflective Statements

- readings/case studies: Grades for these assignments will be based on the evaluation of short written responses to assigned questions.
- online-tutorials: Grades will be based on completion of the assigned exercises.
- reflective statements: Will be collected once every two weeks; will be graded based on completion of the assignment.

\*Note: Missed assignments cannot be made up. However, you will get to drop your lowest grade at the end of the semester.

### Sustainability Blog Posting:

Blog postings will be graded based on the evaluation of a short written article. Students will work in small groups in the process of completing a short article that will be posted on the CHEM 100Z blog. These articles will address a variety of issues related to environmental sustainability. Detailed instructions for this assignment will be given in a separate document.

### Laboratories

Laboratory activities will be graded based on the evaluation of written reports. Generally, this will be done in the form of a report sheet or a formal written summary. Descriptions for the lab report sheets and formal summaries will be provided in separate documents.

\*Note: Missed labs cannot be made up.

### **Ground-level Ozone Project - TPSL**

Each student will complete a ground level ozone detection study by working in a collaborative group with two other students. The initial problem will be given to you in the form of a case study. Once the major learning goals have been identified in the case study, each group will research the necessary background information required to address the major learning objectives. Included in this will be why ground-level ozone in Newton County needs to be measured and how one could actually go about measuring it. This information will be presented to students at Cousins Middle School (Talk 1). Each group will then construct ground-level ozone detectors and design an experimental protocol for collecting ozone concentration data. The experimental work will be done in collaboration with the middle school students from Cousins. Subsequently, each group will write a report that summarizes all of the pertinent background information, as well as the ozone concentration data and analysis. This report will be given to the local environmental agency Keep Covington/Newton Beautiful. The ground-level ozone project will be graded based on the evaluation of the oral presentation, the written report, and student self-evaluations.

Final letter grades will be assigned as shown below:

A	(93-100%)
A-	(90-92%)
B+	(87-89%)
B	(83-86%)
B-	(80-82%)
C+	(77-79%)
C	(73-76%)
C-	(70-72%)
D+	(67-69%)
D	(60-66%)

## Honor Code

It is assumed that all Oxford College students will adhere to the highest standards of academic honesty and will uphold the Oxford College Honor Code.

Specific things to keep in mind for CHEM 100Z:

- you are expected to do your own work when taking an exam
- only a non-programmable calculator, pencil, and other pre-approved documents are permitted in the exam
- no cell phones are allowed in class during an exam period
- all work handed in for lab must be done as an individual unless otherwise stated by the lab instructor
- any idea or thought used in a laboratory assignment must be properly referenced
- even though you may collect data in groups, you are not to collaborate with other students when completing lab report sheets/formal summaries

It is my duty, according to the Honor Code, to report any incidences of misconduct to the Honor Council. Anyone who is found guilty of violating the Honor Code may receive a grade of F for the course. It is strongly recommended that each student carefully read through the Oxford College Student Honor Code.

## Tentative Schedule

Week 1: Course introduction / Read ozone case study

Week 2: Unit 1 (Experimental Design and Measurement – Ch1 Bettelheim)

Week 3: Unit 2 (Atomic Structure – Ch2 Bettelheim)

Week 4: Unit 2

### Exam I

Week 5: Unit 3 (Chemical Bonding – Ch4 Bettelheim)

Week 6: Unit 3

Week 7: Unit 4 (States of Matter and Gas Laws – Ch 6 Bettelheim)

Week 8: Unit 4

### Exam II

Week 9: Unit 5 (Chemical Reactions and Energy of Reactions – Ch 5 Bettelheim)

Week 10: Unit 5

Week 11: Unit 6 (Aqueous Solutions and Aqueous Reactions – Ch 5 & 7 Bettelheim)

### Exam III

Week 12: Ground Level Ozone Detection Study

Week 13: Ground Level Ozone Detection Study

Week 14: Ground Level Ozone Detection Study

Week 15: Ground Level Ozone Detection Study

**Final Written Report for Ground Level Ozone Detection Study due Dec. 12**