“Education in and about chemistry is critical in addressing challenges such as global climate change, in providing sustainable sources of clean water, food and energy and in maintaining a wholesome environment for the well being of all people…” –UN International Year of Chemistry resolution

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Pre-requisites: CHEM 220 and 220L

Required Materials: Scientific calculator with logarithmic and exponential functions

Recommended Materials: A general chemistry textbook for reviewing basic chemical concepts

Student Learning Outcomes:
- To deepen understanding of the chemical processes that influence the environment (air, water, soil and climate).
- To apply fundamental chemical principles (specifically acid-base chemistry, thermodynamics, kinetics, redox reactions and light-matter interactions) to understand the sources, transport, transformation and ultimate fate of various chemical species in the environment.
- This course will be divided into three main units that reflect the most pressing issues in modern environmental chemistry. We will cover:
  - Atmospheric Chemistry and Air Pollution
  - Climate Change and Energy
  - Water Chemistry, Pollution and Treatment

Attendance/Participation: You are expected to attend all classes. If you must miss a class due to an illness or school sanctioned event, it is your responsibility to get the material you missed from another student. Regular participation by all students in this class is expected.

Homework: Homework assignments will be in the form of problem sets that will be assigned regularly and posted on OAKS. Assignments are due at the start of class on their due date. Late homework will not be accepted.

Quizzes: Quizzes will be administered online using OAKS. Material covered by quizzes and due times will be announced in class.

Tests: There will be four in-class tests, approximately every three weeks (tentative dates: Feb. 3, Feb. 24, March 24 and April 21). If you know in advance you will miss a test due to a religious observance or school sanctioned event, it is your responsibility to let me know immediately so arrangements can be made. If you miss a test unexpectedly, you must provide documentation in the form of an absence memo if you expect to make it up.

Final Exam: The final exam is cumulative and will cover lecture material from the entire semester. The final exam will be Friday, April 28, 8:00 am – 11:00 am.
**Grading:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Four in-class tests</td>
<td>60%</td>
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<tr>
<td>Homework</td>
<td>10%</td>
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<tr>
<td>OAKS quizzes</td>
<td>5%</td>
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<tr>
<td>Attendance/Participation</td>
<td>5%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
<th>What each grade means</th>
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<tbody>
<tr>
<td>A</td>
<td>93.0 - 100</td>
<td>The student has achieved mastery of the material. Not only does the student demonstrate understanding of all aspects of the material to significant depth, but can reliably apply that understanding toward solving problems, both familiar and unfamiliar. What sets this student apart from others is the ability to solve problems that require synthesis of various ideas.</td>
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<tr>
<td>A-</td>
<td>90.0 – 92.9</td>
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<tr>
<td>B+</td>
<td>87.0 – 89.9</td>
<td>The student is very competent with the material. The student demonstrates understanding of most aspects of the material, but some gaps exist. He or she can routinely apply that understanding toward solving familiar problems, but will struggle slightly when solving unfamiliar problems. The student especially struggles to solve problems that require synthesis of various ideas.</td>
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<tr>
<td>B</td>
<td>83.0 – 86.9</td>
<td></td>
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<tr>
<td>B-</td>
<td>80.0 – 82.9</td>
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<tr>
<td>C+</td>
<td>77.0 – 79.9</td>
<td>The student is moderately competent with the majority of the material, but does not understand it to great depth. Thus, the student can solve routine problems that he or she has seen before, but definitely struggles to solve unfamiliar problems, especially ones that require synthesis of various ideas.</td>
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<tr>
<td>C</td>
<td>73.0 – 76.9</td>
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<tr>
<td>C-</td>
<td>70.0 – 72.9</td>
<td></td>
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<tr>
<td>D+</td>
<td>67.0 – 69.9</td>
<td>The student does not demonstrate significant command of the material, essentially because he or she does not understand it. He or she struggles to solve most problems, even familiar ones. Such a student relies primarily on rote memorization, and therefore is not able to solve problems that require synthesis of ideas.</td>
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<tr>
<td>D</td>
<td>63.0 – 66.9</td>
<td></td>
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<tr>
<td>D-</td>
<td>60.0 – 62.9</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>&lt; 59.9</td>
<td>The student shows essentially no command of the material and is unable to solve problems that are deemed straightforward. Such students rely essentially entirely on rote memorization, and therefore are not able to solve problems that require synthesis of ideas.</td>
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OAKS: OAKS will be used for announcements, quizzes, homework assignments, supplementary materials and handouts used in class. You are responsible for printing all necessary materials yourself if you would like a hard copy.

Office hours: My regularly scheduled office hours will be immediately after class each day. If you would like to meet with me and are unavailable at that time, please suggest some different times that work for you and we will be able to schedule a time that works for both of us.

Disability Services: If you are a student with a documented disability who will require accommodations in this course, please provide the proper documentation in the form of a Professor Notification Letter (PNL). Please come to speak with me during office hours about how I may best accommodate you in this course.

Academic Dishonesty: Lying, cheating, attempted cheating, and plagiarism are violations of the Honor Code of the College of Charleston (http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php). As it pertains to this course, examples of academic dishonesty would include copying another student’s work during an exam or collaborating with another student on online quizzes. Working together on homework is not considered academic dishonesty in this course, but students should use their best judgment to ensure collaborations are mutual so both/all students benefit from homework as a learning tool.

Classroom Conduct: It is expected you will behave as professional adults in this class. Please do not be disruptive by talking while the professor is lecturing or another student is speaking. Do not be late for class. Do not get up to take breaks – only leave during class when absolutely necessary.

Electronic Device Policy: Using electronic devices for activities not related to class (e.g., texting) during lecture is rude to your instructor and a distraction to your classmates. If you choose to use a laptop or tablet device during class, you should refrain from any social networking, games, etc. that are distracting to others. If your device becomes a distraction, you may be asked to put it away or move to the back of the classroom.

Important Dates

- Monday, January 16 – MLK Day – no class
- Wednesday, January 18 – Last day to drop/add
- Friday, February 3 – Test 1 (tentative)
- Friday, February 24 – Test 2 (tentative)
- Monday, March 6 – Friday, March 10 – Spring Break – no class
- Thursday, March 23 – Last day to withdrawal with a grade of “W”
- Friday, March 24 – Test 3 (tentative)
- Friday, April 21 – Test 4 (tentative)
- Friday, April 28 – Final Exam (8:00 – 11:00 am)
**Lecture Schedule**
Class time will be largely devoted to lectures on new material, discussions on assigned reading from the literature and doing group work. Students are encouraged to ask questions throughout the class period. If significant review of material from general chemistry is needed, students will be encouraged to review this material outside of class.

**Lecture Outline**
- Chemistry of the Stratosphere
  - Layers of the atmosphere
  - Ozone layer
  - The ozone holes
- Chemistry of the Troposphere
  - Gas concentration units
  - Chemical fate of trace gases
  - Hydroxyl radical reactions
  - Photochemical smog
  - VOC’s, NO\textsubscript{x} and ground level ozone
  - Aerosols
  - Sulfur dioxide emissions
  - Sources and effects of acid rain
- Chemistry of Climate
  - Mechanism of the greenhouse effect
  - Sources and effects of major greenhouse gases and aerosols
- Energy Use
  - Fossil fuels
  - Biofuels
  - Renewable energy
  - Nuclear energy
- Chemistry of Natural Waters
  - Dissolved oxygen
  - Oxidation of organic material
  - pE/pH diagrams
  - Carbonate System
- Pollution and Purification of Water
  - Drinking water purification
  - Waste water treatment
  - Toxic heavy metals
  - Organic pollutants