**CHEM 105: Chemistry in a Changing Climate**

Spring 2022

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[Course Zoom Link](https://pugetsound-edu.zoom.us/j/9648741789?pwd=Q2tmblU1T1FHbDZ1TGlHV3JVOGJDZz09)

**Course Description**

In this introductory chemistry course, you'll learn and apply fundamental chemical modes of analysis to challenges presented by a changing climate. These modes include acid/base and buffer chemistry, oxidation/reduction reactions and the thermodynamics of combustion, electrochemistry, spectroscopy relevant to the greenhouse effect and photochemistry, and the principle of radiative balance as a way to model Earth's climate.

**Course Textbook**

*Chemistry in Context: Applying Chemistry to Society* (ACS, 9th edition)

**Course objectives**

*Concepts*. After completing this course, students should be able to:

1. Point to patterns in the Periodic Table, including families of elements, that suggest metallic or nonmetallic chemical behavior, and the kinds of compounds that result when they react.
2. Describe the shell and orbital structure of atoms.
3. Describe the temperature structure and chemical composition of Earth's atmosphere.
4. Explain the principles embodied in a balanced chemical equation.
5. Describe the distinctive role each part of the electromagnetic spectrum plays in controlling planetary radiative balance.
6. Explain why some molecules are greenhouse gases, while others are not.
7. Use thermodynamics to compare and contrast compounds as fuels.
8. Use principles of electrochemistry to describe the workings of a photovoltaic cell.
9. Apply concepts of acid-base chemistry to explain the effect of atmospheric carbon dioxide on ocean acidity.

*Skills*. During this course, students will become skilled in:

1. The use of electronic structure software (Spartan) to set up and interpret electronic structure calculations, including photochemical and vibrational properties of key atmospheric molecules.
2. The use of spreadsheets (Google Sheets) to carry out chemistry-related calculations, including conversions between mass and moles of a substance, and rudimentary climate modeling.
3. How to maintain an annotated and descriptive laboratory notebook.

**Labs**

Labs will involve wet chemistry, the use of chemical instrumentation, and computations. Some lab activities will span multiple weeks, in which you will develop technical expertise the first week, and then apply those skills in the subsequent week. **If you receive less than 50% in the laboratory portion of the course or if you miss two or more labs, you will receive a failing grade for the entire course.**

**Weekly schedule**

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| **Week** | **Class** | **Lab** |
| 1 | Shells and the Periodic Table | The stickiness of atoms |
| 2 | Introduction to the Atmosphere | Global distribution of greenhouse gases |
| 3 | Mass and Moles | Techniques for analyzing an unknown gas |
| 4 | Introduction to Orbitals | Analyzing an unknown gas |
| 5 | Interviews | Techniques for analyzing an unknown salt |
| 6 | Electromagnetic Radiation | Analyzing an unknown salt |
| 7 | Infrared Spectroscopy | Infrared spectroscopy |
| 8 | Covalent Bonds | Orders, Strengths, and Lengths of Covalent Bonds |
| 9 | Spring Break |  |
| 10 | Photochemistry | Photochemistry |
| 11 | Modeling the Greenhouse Effect | Albedo and Climate |
| 12 | Interviews | Bomb Calorimetry |
| 13 | Combustion | Electrochemical Cells |
| 14 | Electrochemistry | Structure of a scientific paper |
| 15 | Carbon Sequestration | Ocean pH |
| 16 | Wrap-up and evals |  |