

CHEM 6550
Atmospheric Chemistry
Autumn 2021
MP 1005 (partially Online)
Tuesdays and Thursdays 12:45 to 2:05 PM

Lecturer: Prof Heather C Allen

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Office: 3105 Newman and Wolfrom Lab, 100 W 18th Ave.

Office hours: After class and by appointment

Objective: Chemistry, composition, and reaction kinetics relating to the Earth's atmosphere with focus on tropospheric and stratospheric chemistry with regional and global comparisons is presented. Gas and aerosol phase chemistry will be discussed as well as the interactions of atmospheric constituents with the biosphere, past and present. Perspectives on air pollution, stratospheric ozone depletion, climate change, and anthropogenic influences will be discussed.

Text: *Atmospheric Chemistry: From the Surface to the Stratosphere*, Grant Ritchie, World Scientific 2016, available as Kindle book and softback (from \$28 to ~\$40 on Amazon; <\$13 ebook rental on google play)

Additional reading that you may find helpful:

- Atmospheric Chemistry, Ann M Holloway & Richard P Wayne ISBN 978-1-84755-807-7 Available from Amazon.com new/used books and as an eTextbook ; RSC Publishing, 2010
- Chemistry of the Upper and Lower Atmosphere, B. J. Finlayson-Pitts, J. N. Pitts, Jr., Academic Press, 2001 (& the older version from 1986, "Atmospheric Chemistry", same authors)

Week	Topics
1	Atmospheric Chemistry Overview – History, physical properties and structure of the troposphere and the stratosphere, temperature profile, major components, pressures. Timeline and Historical Context.
2,3	Kinetics review Atmospheric Chemistry of the Stratosphere – stratospheric ozone cycle, depletion, NO _x , Chapman cycle, halogens and NO _x , polar stratospheric cloud chemistry and heterogeneous chemistry, the “smoking gun” correlation, polar stratospheric clouds,
4	Emissions, sources and sinks, tropospheric chemical cycles, hydrocarbons in the troposphere, mixing ratios and units.
5	Atmospheric Oxidants, Photochemistry, and Kinetics – hydroxyl radical, halogen radicals, ozone, and nitrate radical
6,7	Tropospheric chemistry, history, VOCs, Oxidants, Urban Smog - VOC/NO _x – Air pollution reactions, progress and problems in experiments and modeling, assessing human impact on the atmosphere; acid rain
8	Aerosols, Instrumentation, and Historical context of particulate matter (PM), Covid-19 transmission
9	Chemistry of Global Climate Change – Historical account of greenhouse gas and aerosol concentrations, carbon dioxide, ozone and altitude, aerosol uncertainties, sulfur cycle; ice core measurements, past and present; climate models
10	Atmospheric chemistry and Human Health; Indoor Air Pollution

11	Frontier Areas in Atmospheric Chemistry
12	Frontiers in Atmospheric Chemistry and Student Presentations
13	Student Presentations
14	Student Presentations
15	Final EXAM

*There will be several invited speakers during the semester for selected topics.

*There will be some dates that I am out of town for conferences and lectures; therefore, make up lectures may occur on some weekend dates/times and/or evenings according to student's schedules.

*Sequential occurrence of topics may vary depending on course restructuring.

Grading

Homework & Quizzes	15%
Midterm I, and Midterm II	15%, 15%
Student presentation	25%
Presentation moderating	5%
Final exam	20%
Attendance/Participation	5%

Attendance – students are expected to attend all lectures and participate in discussions.

Presentations: Each student will give a presentation based on an approved set of journal articles.

Academic Misconduct

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>.

Students with Disabilities

“Students with disabilities (including mental health, chronic or temporary medical conditions) that have been certified by the Office of Student Life Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office of Student Life Disability Services is located in 098 Baker Hall, 113 W. 12th Avenue; telephone 614- 292-3307, slds@osu.edu; slds.osu.edu.”

Learning outcomes

To understand the composition of the Earth's atmosphere.

To understand regional and global chemistry, and atmospheric cycling.

To understand sources and sinks of atmospheric components.

To understand the chemistry of atmospheric oxidants, trace species, and kinetics.

To understand the role of pollutants (including airborne viruses) and global transport.

To understand the connections between air pollution, stratospheric ozone depletion, marine chemistry, and global warming.