Syllabus for EPS200 – Atmospheric Chemistry and Physics - Fall 2023

Instructor: Daniel Jacob <djacob@fas.harvard.edu>
Teaching Fellow: Sarah Hancock <sarahhancock@g.harvard.edu>

Lectures: WF 10:30-11:45am
Location: Geological Museum 375

This course is intended to be an introduction to atmospheric chemistry to serve first-year Ph.D. students in the atmospheric sciences as well as students specializing in other areas of Earth & Planetary Sciences or Environmental Science & Engineering. Undergraduate students may take EPS200 with permission of the instructor.

Recommended Preparation: college mathematics up to multivariable calculus, matrix algebra, some college physics and chemistry.

Lecture schedule
(this is intended to show the flow of the course. Several lectures will need to be rescheduled because of DJJ travel, so dates will change)

W	Sep	06	Introduction: atmospheric composition and structure (Sarah Hancock)
F	Sep	08	Introduction: atmospheric circulation and radiation (Sarah Hancock)
W	Sep	13	Introduction: chemical kinetics
F	Sep	15	Stratospheric chemistry: Chapman mechanism
W	Sep	20	Stratospheric chemistry: catalytic cycles
F	Sep	22	Stratospheric chemistry: polar ozone depletion
W	Sep	27	Tropospheric oxidants: OH radicals (to be rescheduled)
F	Sep	29	Tropospheric oxidants: nitrogen oxides
W	Oct	04	Tropospheric oxidants: ozone production
F	Oct	06	Tropospheric oxidants: hydrocarbon oxidation mechanisms
W	Oct	11	Aerosol chemistry: general processes
F	Oct	13	Aerosol chemistry: sulfate formation
W	Oct	18	Aerosol chemistry: sulfate-nitrate-ammonium thermodynamics
F	Oct	20	Aerosol chemistry: organic aerosol formation
W	Oct	25	Geochemical cycles: nitrogen
F	Oct	27	Geochemical cycles: oxygen
W	Nov	01	Geochemical cycles: carbon chemistry in the ocean
F	Nov	03	Geochemical cycles: carbon
W	Nov	08	Geochemical cycles: mercury (to be rescheduled)
F	Nov	10	Atmospheric chemistry modeling: continuity equation
W	Nov	15	Atmospheric chemistry modeling: transport and chemistry operators
F	Nov	17	Atmospheric chemistry modeling: inverse methods
W	Nov	22	Thanksgiving break
F	Nov	24	Thanksgiving Break
W	Nov	29	Special topics: methane
F	Dec	01	Special topics: something else if we have time (likely not)

Class requirements

1. Weekly homeworks, 50%
2. Mid-semester presentation, 15%. A critical review of the literature on a relevant topic of your choice. 10-minute oral presentation to the class + 5 minutes for questions.
3. Presentation at end of semester, 20%. A critical review of the literature on a relevant topic of your choice. 10-minute oral presentation to the class + 5 minutes for questions.
4. Answers to pre-lecture questions, 10%. You won't be graded on whether you're right or wrong but on having thought through the questions individually or as a group.
5. Participation in lectures and sections, 5%. You are expected to be an active participant in lecture and in section. Bar is low, but if you are absent or totally silent that's a problem. (graded 0 or 5)

Homework policy

- Weekly homeworks will be assigned on Wednesday, due the following Wednesday, and returned on Friday. Late homeworks will not be accepted, but your lowest grade of the semester will be dropped when computing the grade average.
- You are encouraged to work in small groups of two to four, and this will be arranged at the beginning of the semester. You must write the solutions alone, without access to others' solutions.
- Access to homeworks or solution sets from previous years is strictly forbidden.
- Use of AI tools is strictly forbidden for homeworks (searching the web for information is OK). If you are stuck, see TF or Prof.

Presentations policy

- Any web or AI tools are allowed for researching the topic
- Presentations must be original powerpoints and delivered orally without notes

Office hours

- Jacob: before class or by appointment (use email to make appointment)
- Hancock: to be determined

Texts

There is no required text. *Introduction to Atmospheric Chemistry* by D.J. Jacob is a useful primer. Some readings from *Modeling of Atmospheric Chemistry* by G.P. Brasseur and D.J. Jacob will be suggested. These texts can be accessed from Jacob's educational website. Other readings may be suggested in class.