1.085/12.336/1.855: Air Pollution and Atmospheric Chemistry

Fall 2022

MW 9:30-11:00am, 48-308

Instructor: Colette L. Heald (heald@mit.edu)
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Website: https://canvas.mit.edu/courses/15432

OBJECTIVE: Provide a working knowledge of basic air quality issues, with emphasis on a multidisciplinary approach to investigating the sources, transformations and effects of pollution.

PRE-REQUISITE: 18.03 or equivalent

PRIMARY TEXT:
Daniel J. Jacob, Introduction to Atmospheric Chemistry, Princeton University Press, 1999.
(Available online: https://acmg.seas.harvard.edu/education/introduction-atmospheric-chemistry)

BACKGROUND TEXTS:
John H. Seinfeld and Spyros N. Pandis, *Atmospheric Chemistry and Physics: from Air Pollution to Climate Change*, 2nd Ed. John Wiley and Sons, 2006. (Available as ebook through MIT Libraries: http://library.mit.edu/item/001383726)

COURSE STRUCTURE & GRADING CRITERIA:
Periodic problem sets are assigned and are due by 5pm (eastern) on the date indicated on the assignment (planned dates indicated on syllabus and on canvas). Assignments will be published on canvas at least one week before due date. Please submit your problem sets online through canvas or drop off in box outside Colette's office (48-335). Late assignments will be docked 25% each day and will not be accepted after 3 late days. Exceptions will be made for medical or family emergencies, and will require documentation (e.g. doctor's note, communication from S^3) for instructor approval. Homework will be graded and I will provide feedback. Homework assignments can be discussed in groups, but MUST be written up independently. Evidence of copying will result in a zero grade for the assignment.

There will be two in-class quizzes. Quizzes are designed to test understanding of basic concepts and are closed book and closed notes. There is no final exam.

There are 3 projects associated with the class: an analysis of field measurements, an air quality measurement lab, and a final presentation. Further guidelines and grading criteria will be distributed during the course. Note that for the final presentation topic proposals are due in October and will be reviewed to ensure project criteria are met.

Final grades will be allocated as follows:
Problem Sets: 40% Projects: 40% Quizzes: 20%

1.855: Graduate students will be required to complete one extra assignment for the class (will constitute part of the Projects grade percentage). Students will select one of the seven FACSS seminars presented this Fall semester (https://facss.mit.edu/). Students will watch the seminar and are recommended to read the accompanying paper. Students must submit a 1 page summary of the seminar, describing the motivation for the work, the methods, the key results, and how the seminar connects to topics discussed in class. Sign up to the FACSS email list (see website) to receive webinar registration links, or contact Colette to obtain a link for the seminar that you are interested in watching if you cannot attend live (note that links are only available for one week following the seminar, so please plan ahead). This assignment can be submitted at any time during the semester, but must be received by December 5, 2022.

Student Support Services
If you are dealing with a personal or medical issue that is impacting your ability to attend class or complete work, please discuss this with Student Support Services (S^3). The deans in S^3 will verify your situation, and then discuss with you how

to address the missed work. Students will not be excused from coursework without verification from Student Support Services. You may consult with Student Support Services in 5-104 or at 617-253-4861 or via s3-support@mit.edu.

COVID-RELATED:
In anticipation of students being ill this semester lectures will be recorded (slides only with voice-over, no video of classroom). If you have tested positive for Covid-19 and must isolate, please contact Prof. Heald so we can make sure you have access to course materials and discuss extensions for assignments, as needed. You can always contact Student Support Services or GradSupport for additional assistance. If Prof. Heald becomes ill and needs to isolate, some lectures may be delivered online and/or changes may be made to the lecture schedule. Any changes will be communicated via canvas and email.

Ventilation and filtering are highly effective at mitigating the spread of Covid-19. HEPA filters will be running in the classroom at all times to improve air filtration. Prof. Heald will be wearing at KN95 mask at all times while teaching; she requests that you consider also wearing a mask to protect yourself and your classmates. However, masking is optional at MIT and will not be enforced unless campus policies change.

PRELIMINARY CLASS SCHEDULE:

Date			TOPIC	Reading (Ch=Jacob; pp=Seinfeld&Pandis)	PS and Project Due Dates
September	7	We	Intro/Atmospheric Composition	Ch. 1 pp. 75-93	
	12	Mo	Air Quality Regulations & Health		
	14	We	Chemistry Concepts & Atmospheric Pressure	Ch. 9 Ch. 2	
	19	Mo	Models	Ch. 3	
	21	We	Atmospheric Meteorology & Transport	Ch. 4	
	26	Mo	Biogeochemical Cycles	Ch.6	**PS 1** (*basic concepts / atmospheric pressure / box models*)
	28	We	Radiation & the Greenhouse Effect	Ch. 7	
October	3	Mo	Stratospheric Chemistry (distribute Project #2 guidelines)	Ch.10	**PS 2** (transport, *biogeochemical cycles, radiation*)
	5	We	Stratospheric Chemistry	Ch.10	
	10	Mo	MIT Holiday		
	12	We	**IN CLASS QUIZ #1**		
	17	Mo	Tropospheric Chemistry (distribute Project #1 guidelines)	Ch. 11	**PS 3** (*stratospheric chemistry*)
	19	We	Tropospheric Chemistry	Ch. 11	
	24	Mo	Ozone Smog & Urban Air Quality	Ch. 12	**Project #3 Proposal due**
	26	We	No class		**Project #1 due**
	31	Mo	Ozone Smog & Urban Air Quality	Ch. 12	
November	2	We	Introduction to Aerosols	Ch. 8 55-63, 368-389	
	7	Mo	Introduction to Aerosols	Ch. 8 55-63, 368-389	**PS 4** (*tropospheric chemistry and smog chemistry*)
	9	We	Aqueous phase chemistry	284-324	
	14	Mo	Acid Rain	Ch. 13 954-971	**Project #2 due**

	16	We	Air Pollution Control & Energy, Emissions & Air Quality		
	21	Mo	Thanksgiving week - no class		**PS 5** (aerosols, *aqueous chemistry / acid rain*)
	23	We	Thanksgiving Holiday		
	28	Mo	Indoor Air Pollution		
November	30	We	**IN CLASS QUIZ #2**		
December	5	Mo	In-Class Presentations **Project #3**		**1.855** FACSS assignment due
	7	We	In-Class Presentations **Project #3**		