ATS621, Fall 2025
Atmospheric Chemistry
Tuesday and Thursday: 11 – 11:50, 121 ATSW (Classroom)

Instructor: Prof. Sonia Kreidenweis
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Teaching Assistant: Andrey Marsavin
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Student learning goals: 1) Understand quantitatively how emissions, transport, chemistry and deposition impact atmospheric chemical composition; 2) Explain the chemical and physical mechanisms behind ozone depletion, air pollution and acid rain from the molecular to global scales; 3) Develop skills needed for further specialized study on atmospheric composition.

Sonia's Office Hours: by appointment
Andrey's Office Hours: TBD

Required / Primary Texts:
Introduction to Atmospheric Chemistry, **D.J. Jacob** Princeton University Press, 1999
PDF versions of the chapters can be obtained here: https://acmg.seas.harvard.edu/education/introduction-atmospheric-chemistry
Atmospheric Chemistry and Physics, **Seinfeld and Pandis,** Wiley-Interscience, 2006.
Corresponding readings are listed on the syllabus, and an online version can be obtained through the CSU library: https://lib.colostate.edu/

Course Materials: There is a CSU Canvas site for this class. All course materials will be posted there.

Other Helpful Texts:
1. *Chemistry of the Upper and Lower Atmosphere,* **Finlayson-Pitts and Pitts**, Academic
2. *Physical Chemistry for the Atmospheric Sciences* **P.V. Hobbs** Cambridge University Press

Course Structure and Grading:
Periodic homework is assigned and is due at the start of the class indicated. Late homework assignments are not accepted without prior approval. Incorrect answers on homework assignments can be resubmitted for the opportunity to earn back 50% of the points subtracted during the first grading, but the corrected homework assignments must be returned to the TA by the following class or as arranged. There will be two in-class exams.

Grades are weighted as follows:
Homework: 40% Exam 1: 20% Exam 2: 20% Project: 20%

The project involves independent research on a topic of the student's choice (approved by instructor) and preparation of a two-page summary writeup. Students will present their topics in class as short talks.

Statement on Academic Integrity
This course will adhere to the CSU Academic Integrity Policy as found in the General Catalog (https://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity) and the Student Conduct Code (https://resolutioncenter.colostate.edu/wp-content/uploads/sites/58/2024/10/Student-Conduct-Code.pdf). At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.

Contact Hours: 2 (At least 2 hours of effort are expected to complete homework assignments outside of class for each hour of class time).

CSU Principles of Community: ***Inclusion*:** We create and nurture inclusive environments and welcome, value and affirm all members of our community, including their various identities, skills, ideas, talents and contributions ***Integrity*:** We are accountable for our actions and will act ethically and honestly in all our interactions. ***Respect*:** We honor the inherent dignity of all people within an environment where we are committed to freedom of expression, critical discourse, and the advancement of knowledge. ***Service*:** We are responsible, individually and collectively, to give of our time, talents, and resources to promote the well-being of each other and the development of our local, regional, and global communities. ***Social Justice:*** We have the right to be treated and the responsibility to treat others with fairness and equity, the duty to challenge prejudice, and to uphold the laws, policies and procedures that promote justice in all respects.

ATS 621 Fall 2025 Schedule

				Content / Modules	*Pre-Class Assignment(s)*	*Readings*	*Assignment Due Dates*
1	August	26	T	Introduction to semester Basic chemistry refresher and units	Review Welcome to ATS 621 on Canvas. Also, Students, TA and instructor each make a 1-slide intro with 5 photos and 8 nouns to describe themselves and add to a google slide deck. Whiteboard Video: Units	Welcome to ATS 621 (on Canvas): find course information and other readings on CSU policies Jacob Chapter 1	
		28	Th	Units and Kinetics	Whiteboard Video: Bimolecular and 3-body Reactions	Jacob Chapter 9 Review refresher on solving ODEs	
2	September	2	T	Biogeochemical Cycles / Sources and Sinks	Whiteboard Video: Dry Deposition Basics	S&P: Chapter 2 for cycles; S&P Chapters 19 & 20 for deposition; and/or Jacob Notes Posted in Reading & Resources	
		4	Th	Biogeochemical Cycles		same as above	HW 1
3		9	T	Lifetime & Box Models	Whiteboard Video: Lifetime and Mass Balance Equation	Jacob Chapter 2; ECG Brief: Atmospheric Lifetimes of Trace Gases	
		11	Th	Lifetime & Box Models		same as above	Start thinking about project topics & lit survey
4		16	T	Photochemistry	Photolysis reading https://www.acom.ucar.edu/Models/TUV/Interactive_TUV/	ECG Brief: Calculating photolysis rates and estimating photolysis lifetimes	
		18	Th	Photochemistry		same as above	HW 2
5		23	T	Stratospheric Chemistry	Whiteboard Video on Chapman Cycle NASA Ozone Watch: https://ozonewatch.gsfc.nasa.gov	Jacob Chapter 10	
		25	Th	Stratospheric Chemistry	Whiteboard Video: HOx and NOx cycles	Jacob Chapter 10	Propose topic (title) with 3 recent references (after 2010)
6		30	T	Stratospheric Chemistry	Whiteboard Video: Chlorine Radical Cycles	Jacob Chapter 10	
	October	2	Th	Stratospheric Chemistry	Watch after class: NASA Videos ongoing research and proof of recovery: https://www.youtube.com/watch?v=_Aw8c-0CBZQ; https://youtu.be/uVeTJSlbGm8	20 Q & A About the Ozone Layer	HW 3
7		7	T	Chemistry of the Background Troposphere	Whiteboard Video: OH production	Jacob Chapter 11	
		9	Th	Chemistry of the Background Troposphere	Whiteboard Video: Methane Oxidation	Jacob Chapter 11	Abstract outline due
8		14	T	*Review session (Andrey)*			
		16	Th	EXAM 1	*Biogeochemical cycles, box models, sources / sinks, photochemistry, stratospheric chemistry*		
9		21	T	Chemistry of the Background Troposphere	Whiteboard Video: Global NOx Budget and Cycling	Jacob Chapter 11	
		23	Th	Urban ozone	Whiteboard Video: Ozone Production (Precursors and Chain of Reactions)	Jacob Chapter 12	Abstract draft due (for feedback - optional)
10		28	T	Urban ozone	Whiteboard Video: Ozone Production Efficiency (OPE)	Jacob Chapter 12	
		30	Th	Urban ozone	ECG Topic Brief: Atmospheric Chemistry at Night	ECG Topic Brief: Atmospheric Chemistry at Night	HW 4
11	November	4	T	Aerosols	Please see the reading. These sections are quite dense!	S&P Sections 2.7, 8.3, 8.4	
		6	Th	Aerosols	Please see the reading. These sections are quite dense!	S&P Sections 8.1 and 8.2	HW 5
12		11	T	Aerosols		S&P Sections 8.1 and 8.2	
		13	Th	Aqueous Chemistry	Whiteboard Video: Henry's Law	S&P Section 7.1 and 7.2	Lightning talk instructions; Final Abstracts due
13		18	T	Aqueous Chemistry	Whiteboard Video: SO2 - Water Equilibrium	S&P Section 7.3 and 7.4	
		20	Th	Aqueous Chemistry		S&P Section 7.5 and 7.6	HW 6
		25	T	*Thanksgiving break - no class or office hours*			
		27	Th	*Thanksgiving break - no class or office hours*			
14	December	2	T	guest lecture (to be confirmed)			
		4	Th	Presentations			last HW due
15		9	T	Presentations			
		11	Th	*Review session*			*Course survey open*
FINAL EXAM WEEK		18	Th	EXAM 2, 6:20-8:20 PM	*Background + urban chemistry, aerosols, aqueous chemistry*		