ATMO 469A/569A CHEE 569A
Section 001 Fall Semester 2021

Syllabus

ATMO 469A/569A CHEE 569A: Air Pollution I: Gases

Class Hours
10:00 am – 10:50 am Monday, Wednesday, Friday

Class Location
In-Person, Harshbarger Bldg., Rm 206

Instructor
Dr. Avelino F. Arellano, Jr. (Ave)
afarellano@email.arizona.edu
Harshbarger 314C, 520-626-3015
Zoom Personal Meeting ID: 889 197 9205
Office Hours, Mon/Wed 11:00-12:30pm or by appointment

Course Description
This is the 1st course of a two-semester series introducing atmospheric chemistry and physics. For this particular course, we will cover topics related to natural biogeochemical cycles, atmospheric photochemistry, stratospheric ozone, urban ozone and particulate matter, atmospheric visibility, acid deposition, air pollution meteorology, chemical transport modeling, and air quality. The course is designed to provide a foundation in atmospheric chemistry suitable for advanced study in atmospheric sciences and professional employment.

Goals & Expectations
My intent as an instructor is to convey fundamental concepts of atmospheric chemistry such that students will:

a) gain an understanding of basic principles of atmospheric chemistry and composition;
b) prepare students for more advanced fields in atmospheric chemistry and help you in your own research;
c) grasp the role of atmospheric composition (pollutants, trace gases) in our changing environment.

Textbook
We will use the book by Seinfeld and Pandis (2006/16) as our main textbook. This will be supplemented, most especially in my lectures, by Jacob (1999) and Jacobson (2012). See also the reference section of this syllabus for a list of other useful references. Additional materials (e.g. articles, websites) will be distributed in class during the course of the semester. Lecture notes and other materials will be posted in our D2L site.

Learning Outcomes
By the end of this course, students will be able to:

a) derive and solve formulations related to: chemical mechanisms of stratospheric and tropospheric ozone, plume dispersion and transport, mass balance, and lifetime;
b) identify sources and sinks of key pollutants and trace gases;
c) describe dynamical, physical, chemical, and optical properties of trace gases;
d) explain some techniques on how air quality (AQ) is monitored and how trace gases are measured;
e) explain the impact of ozone to public health, regional haze, and climate.

Meeting Times
This class will be taught as In-Person in Harshbarger 206, MWF 10-1050am. However, lectures will be recorded to provide opportunity for asynchronous learning of the course materials.

Dates and Deadlines

Last Day of Dropping:
Sep 05, 2021 (469A)
Sep 19, 2021 (569A)

Mid-Term Exams:
Sep 29, 2021
Nov 3, 2021

Final Exam:
Dec 10, 2021 (10:30am-12:30pm)

Holidays/No Classes:
Sep 06, 2021 (Labor Day)
Sep 15, 2021 (No Class)

Thanksgiving Recess:
Nov 25-28, 2021

Last Day of Classes:
Dec 8, 2021

Useful Websites
registrar.arizona.edu
deanofstudents.arizona.edu
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On top of the outcomes listed previously, 569A students will also be able to:

a) apply these concepts to existing AQ science problem (or to their own research)

b) present related application in a clear, understandable, and efficient manner.

This class is scheduled to be taught in the in-person course modality. The course is designed as an introduction to atmospheric chemistry under a hands-on learning environment. Students are encouraged to be engaged (before, during and after lectures).

A prerequisite for this class is sufficient math background to know how to handle a first order linear ODE.

Course Assessment

Students will be assessed on how they are able to grasp the key concepts, mainly through assignments, group exercises, and exams. The percentage distribution of your grade will be as follows:

Assignments : 40% (U), 30% (G)
Midterm Exam : 2 x15% (U & G)
Final Exam : 15% (U & G)
Class Exercises: 15% (U & G)
Project : 15% Optional* (U), 10% (G)
* to replace lowest exam score

Letter grades are determined using the following scale:

A : ≥ 90.0 %
B : 80 to 89.9 %
C : 65.0 to 79.9 %
D : 55.0 to 64.9 %
E : below 55.0 %

A large part of your grade will be through ~6 assignments + 3 class exercises, 2 midterm exams and 1 final exam. Assignments can be in the form of derivation, computer exercises, problem solving or science article review/discussion. Assignments are typically given after a major section has been discussed (i.e., ~weekly). See Course Outline section for details.

While assignments are best done individually, you can certainly discuss (and to an extent I do encourage you to discuss) your methods and the results with other students in the class. Students can sometimes learn more by discussing the ideas and methods with others than they can on their own. Given that you have different backgrounds/perspectives, the views of others can often be beneficial to a larger group. However, do NOT copy your solutions from anyone else (for programs, each student should write his/her own code) or from any other source such as solution manuals that often have typographical errors. Please cite/acknowledge appropriately if your ideas/methods are not your own.

Homework is due at the beginning of class on the scheduled due date (see D2L). Submit either as hardcopy or through D2L. I will accept late assignments with full credit as long as the solutions have not been distributed in class. However, any assignments received after the solutions are distributed will not be accepted for credit. Note: A one letter grade drop will be applied for the first violation of the Code of Academic Integrity (including using a solution manual or other service to assist you with homework) in addition to receiving a zero for that assignment.

Assignments can be in the form of either of the following: a) numerical chemistry modeling exercises, b) chemical data analysis, or c) critical review of a research article related to air pollution, or term paper of a particle topic – e.g., wildland fires, alternative energy, urbanization

Exams will be all take-home exams, open books/notes, but no internet access except D2L access. See tentative our sched.
Attendance
The UA’s policy concerning Class Attendance, Participation, and Administrative Drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable https://policy.arizona.edu/human-resources/religious-accommodation-policy

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/absences

- If you feel sick or may have been in contact with someone who is infectious, stay home. Except for seeking medical care, avoid contact with others and do not travel.
- Notify me if you will be missing a course meeting or an assignment deadline.
- Non-attendance for any reason does not guarantee an automatic extension of due date or rescheduling of examinations/assessments.
- Please communicate and coordinate any request directly with me.
- If you must miss the equivalent of more than one week of class, you should contact the Dean of Students Office DOS-deanofstudents@email.arizona.edu to share documentation about the challenges you are facing.
- Voluntary, free, and convenient COVID-19 testing is available for students on Main Campus.
- If you test positive for COVID-19 and you are participating in on-campus activities, you must report your results to Campus Health. To learn more about the process for reporting a positive test, visit the Case Notification Protocol.
- COVID-19 vaccine is available for all students at Campus Health.
- Visit the UA's COVID-19 page for regular updates.

Life, Physical, & Mental-health Challenges
If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office can be reached at (520) 621-2057 or DOS-deanofstudents@email.arizona.edu.

If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520) 621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.

If you determine that disability-related accommodations are necessary, please register with Disability Resources (621-3268; drc.arizona.edu) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations.

Academic Integrity
Note that associated with your learning experience are sets of ‘rules’ to diligently follow. From the University perspective, you are expected to adhere to the University’s “Code of Academic Integrity” and “Student Code of Conduct”. You are responsible for knowing these codes (and revisions).

Academic Advising
If you have questions about your academic progress this semester, please reach out to your academic advisor (https://advising.arizona.edu/advisors/major) Contact the Advising Resource Center (https://advising.arizona.edu/) for all general advising questions and referral assistance. Call 520-626-8667 or email to advising@email.arizona.edu.
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Nondiscrimination & Anti-Harassment
The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

Student Responsibilities
To learn this course, you are expected to be involved all throughout. As a student, you are responsible in a) actively asking and answering questions during class, b) doing your assignments (including reading materials) after class, and c) responding to d2l class announcements/surveys. Doing so will greatly enhance your learning experience. As your instructor, I invite you to make use of our office hours if you have some pressing questions. From the University perspective, you are expected to devote a minimum of two (2) hours outside class (for study, reading, homework) for every contact hour (or 50 minutes) in classroom.

Equipment and Software
For this class you will need access to the following hardware: [laptop or web-enabled device; regular access to reliable internet signal; ability to download and run the following software: [Matlab/R/Python, spreadsheet, e.g., MS Excel, web browser to access D2L, PDF reader, text editor -e.g., Microsoft Word, slide presentation -e.g., Powerpoint].

For lecture recordings, which are used at the discretion of the instructor, students must access content in D2L only. Students may not modify content or re-use content for any purpose other than personal educational reasons. All recordings are subject to government and university regulations. Therefore, students accessing unauthorized recordings or using them in a manner inconsistent with UArizona values and educational policies (Code of Academic Integrity and the Student Code of Conduct) are also subject to civil action.

Main Reference Materials

Jacob, D.J. (1999), Introduction to Atmospheric Chemistry, New Jersey, Princeton University Press.


Useful Reference Materials


Final Note
Some information in this syllabus may be subject to change with advance notice as deemed appropriate by the instructor. Your comments are welcome and appreciated.
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## Air Pollution I: Gases

### Course Outline

Below is our tentative schedule. We may extend/shorten the lecture/discussion of some sections (e.g. special topics) depending on the average progress of the class. Exam dates, on the other hand, are fixed.

**Course Syllabus/Introduction**  
Aug 23

**Basic Concepts**  
The Atmosphere and Its Composition  
Aug 25-30 (Ch 1-2 S&P; Ch 1-3.6 DJ; Ch 2-3 MJ)

Atmospheric Circulation and Meteorology  
Sep 1-8 (Ch 16, 21 S&P; Ch 4-5 DJ; Ch 6 MJ)  
HW 1 Assigned

Chemical Kinetics and Lifetime  
Sep 10-17 (Ch 3 S&P; Ch 9 DJ; Ch 1 MJ)

Atmospheric Photochemistry  
Sep 20-24 (Ch 4 S&P; Ch 7,9 DJ; Ch 2 MJ)  
HW 2 Assigned

Review/Guest Lecture  
Sep 27

**Mid-Term Exam 1**  
Sep 29 (due Oct 1)  
Class Exercise 1 due

Chemistry of the Atmosphere  
Chemistry of the Stratosphere  
Oct 1-Oct 15 (Ch 5 S&P; Ch 10 DJ; Ch 11 MJ)  
HW 3 Assigned

Chemistry of the Troposphere  
Oct 18-29 (Ch 6 S&P; Ch 11 DJ; Ch 4 MJ)  
HW 4 Assigned

Review/Guest Lecture  
Nov 1

**Mid-Term Exam 2**  
Nov 3 (due Nov 5)  
Class Exercises 2&3 due

### Ozone and Aerosol Air Pollution

Nov 5-10 (Ch 6 S&P; Ch 12 DJ; Ch 8 MJ)

Properties and Dynamics of Aerosols  
Nov 12-17 (Ch 8-9 S&P; Ch 8 DJ; Ch 5 MJ)

HW 5 Assigned

**Atmospheric Diffusion and Transport**  
Nov 19-29 (Ch 18 S&P; Ch 3-5 DJ)  
HW 6 Assigned

### Possible Field Trips to PDEQ AQ Site and to a Cement Plant

We plan to have a visit to Children’s Park Tucson some time in November for you to be familiarized with how PDEQ monitor air quality. We also plan to visit an industry in the area for you to learn activities and technologies currently implemented for air pollution and environmental quality discussed in class.

Schedule to be arranged.

### Air Pollution and Our Environment

Local to Global AQ Models and Observations  
Dec 1-3 (Ch 18, 25-26 S&P; Ch 3-5 DJ)

### Final Notes

Dec 6

**Review**  
Dec 8

**Final Exam**  
Dec 10 1030-1230pm  
Project (G) due Dec 10 5pm