

ATMOSPHERIC CHEMISTRY

CHEM 406 / 606 (cross listed as ATM606) Overview and Schedule ---- Spring 09

Instructor	Dr. William Simpson (NSF 186, IARC 335, 474-7235, ffwrs@uaf.edu)
Office Hours	Tu, Th 11:15A-12:45P and any other time
Lecture	Tu, Th, 9:45A-11:15A, REIC 202
Text:	Introduction to Atmospheric Chemistry, Daniel J. Jacob
Supplements	Chemistry of the upper and lower atmosphere: Theory, experiments, and applications, Barbara J. Finlayson-Pitts and James N. Pitts Handouts in Class Primary literature handed out in class

Course Description (from catalog):

Chemistry of the lower atmosphere (troposphere and stratosphere) including photochemistry, kinetics, thermodynamics, box modeling, biogeochemical cycles and measurement techniques for atmospheric pollutants; study of important impacts to the atmosphere which result from anthropogenic emissions of pollutants, including acid rain, the “greenhouse” effect, urban smog and stratospheric ozone depletion. Special fees apply. Prerequisites/Co-requisite: ATM F601 or permission of instructor. (Cross-listed with ATM F606. Stacked with CHEM F406.) (3+0)

Course objectives / Learning Goals:

By the end of the semester, you will have a basic knowledge of:

- The atmospheric chemical composition
- The transformations of these compounds
- The importance of chemicals in the atmosphere for climate, human health, and ecosystem health
- Air pollution and atmospheric removal of pollutants

You will be able to understand the conversations of atmospheric chemists, seminars on atmospheric chemistry, and discussions with fellow students studying atmospheric chemistry. You will also develop skills in higher-order analysis that will assist both in chemistry pursuits and general studies.

Prerequisites:

Because students may come to this class with a variety of backgrounds, I have made accommodations for students who are either from a pure atmospheric or a pure chemistry background. In either case, I will provide tutorials on the topic that you are missing. A fully prepared student will have the following:

- Interest in understanding the atmosphere’s chemical composition and transformations
- Basic atmospheric structure (Atmospheric layers, vertical profiles of pressure and temperature) (A)
- Basic Chemistry (periodic table, simple compound naming) (B)

If you feel you have a lack in either (A: Atmospheric structure) or (B: Basic chemical principles), you should attend the tutorial sessions. These sessions will be held during the first three weeks of classes at a time that is convenient for interested students. In addition to these basic topics, we will cover the following topics, but some knowledge in this area would be beneficial:

Chemical equilibrium, Chemical kinetics, Oxidation states, Chemical catalysis, Basic photochemistry (light – matter interaction)

Course Structure

Lecture sections, held twice a week, describe theoretical and practical aspects of atmospheric chemistry. Following an introduction period, we will begin discussions on recent key papers from the atmospheric chemistry literature. All students will read the paper(s) before attending the discussion (which will be during the Thursday class). One student will be assigned to be the discussion leader. The leader will scan appropriate figures into a powerpoint presentation and give an overview of the paper to the rest of the class. The overview and subsequent discussion will take approximately 20 minutes. In preparation for your turn leading the discussion, you are required to discuss the paper(s) one-on-one with the professor. This discussion will probably take a half hour to an hour, and you are responsible for making an appointment with the professor. In addition to lectures and in-class literature presentations, you will solve problem sets. Problem sets are assigned every two weeks. The solutions to problem sets are due at the beginning of class on Tuesday. Please begin the problem set early so that you do not have a deadline crunch and are able to ask questions regarding the problems.

Working in groups:

While working on your solutions to problems, you may work in groups. In fact, working in groups usually results in faster and deeper learning. Whether you work in a group or alone, you must **write up your own** solution to the problem. This provision includes computational work; you must write up your own spreadsheet to solve a numerical problem. Copying the solution of another student is not working in a group and will lead to a hole in your understanding that will appear in your exam performance. My advice is to work in groups but don't cheat yourself.

Grading:

This class is a stacked course, meaning that both senior-level undergraduates and graduate students can take the course. Undergraduates taking the course (those taking CHEM406) will be graded by the following scheme:

Midterm exam	20%
Final exam	25%
Problem sets	40%
Oral presentations in class	15%

Students taking CHEM/ATM 606 complete a few extra problems on the problem sets and will write a research “term” paper on a topic of their choice (agreed upon by the professor). This paper will constitute 10% of their grade, with the remaining 90% made up of the scheme listed above.

Students with documented disabilities who may need reasonable academic accommodations should discuss these with the professor during the first two weeks of class. You will need to provide

documentation of your disability to Disability Services in the Center for Health and Counseling, 474-7043, TTY 474-7045

Homework problem sets are due on Tuesdays at the beginning of class. I will give you 5 free late days. You may use these days whenever you want without penalty. If you exhaust these 5 free days, each additional late day is penalized 10% of your grade on that late problem set. If you have to travel for a conference or have another emergency, I will make every reasonable attempt to accommodate these issues as long as you either inform me before a planned absence or immediately after an emergency.

Tentative Grade Scale:

A	90 - 100%
B	80 - 89%
C	70 - 79%
D	60 - 69%

Class web page:

Our webpage is through the UAF Blackboard system, which is accessed at <https://classes.uaf.edu/>

Topical Coverage Schedule:

Week	Topic	Reading
0	Introduction and beginning concepts	1
1	Atmospheric chemical composition	2
2	Simple atmospheric models; lifetimes	3
3	Atmospheric Transport	4.2,4.3
4	Oxidation states of elements and geochemical cycles	6
5	Aerosols	8
6	Equilibrium and kinetics	9.1, 9.2
7	Spring Break – No classes	----
8	Photochemical reactions	9.3, 9.4
9	Stratospheric ozone	10
10	Aqueous / heterogeneous reactions	10
11	Tropospheric oxidation	11
12	Ozone air pollution	12
13	Acid deposition	13
14	Arctic atmospheric chemistry	handouts

Important dates:

30 Jan 09 (Fr) Last day for 100% refund of fees and tuition

6 Feb 09 (Fr) Last day to drop class (without W on transcript), 50% tuition refund

3 Mar 09 (Tu) Midterm exam (in class)

9-13 Mar 09 (Mo – Fr) Spring Break

27 Mar 09 (Fr) Last day to withdraw from class (with W on transcript)

4 May 09 (Mo) End of Instruction (overall UAF)

9 May 09 (Sa) 8:00-10:00 AM Final Exam

Weekly Calendar of Class Events

Week	Sun	Mon	Tues	Wed	Thur	Fri	Sat
0		19 Jan MLK Birthday	20	21	22 First day of Classes	23	24
1	25	26	27	28	29	30 Last day for 100% refund	31
2	01-Feb	2	3	4	5	6 Last day to Drop (no W on transcript) 50% tuition refund	7
3	8	9	10	11	12	13	14
4	15	16	17	18	19	20	21
5	22	23	24	25	26	27	28
6	01-Mar	2	3 Midterm exam (in class)	4	5	6	7
7	8	9 Spring Break	10 -----	11 -----	12 -----	13 End Spring Break	14

8	15	16	17	18	19	20	21
9	22	23	24	25	26	27 Last day to withdraw (W on transcript)	28
10	29	30	31	01-Apr	2	3	4
11	5	6	7	8	9	10	11
12	12	13	14	15	16	17	18
13	19	20	21	22	23	24	25
14	26	27	28	29	30	01-May	2
15	3	4 Last day of Instruction	5	6	7	8	9 Final Exam 8—10 AM