DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Departments of Physics and Atmospheric Science, Chemistry, and Oceanography
PHYC 4595, 5595; CHEM 4595; OCEA 4595, 5595
Atmospheric Chemistry
Fall 2018

Instructor: Prof. Randall Martin randall.martin@dal.ca Dunn 224

Lectures: MWF, 12:30 – 1:30, Chem 540

Teaching Assistants: Paul Bissonnette paul.bissonnette@dal.ca, Deanna Kerry Deanna.Kerry@dal.ca, Jun Meng jun.meng@dal.ca

Office hours: Instructor MF 1:30-2:30; Teaching Assistants TBD

Optional Tutorial: TBD

Course Description
A fundamental introduction to the physical and chemical processes determining the composition of the atmosphere and its implications for climate, ecosystems, and human welfare. Origin of the atmosphere. Nitrogen, oxygen, carbon, sulfur cycles. Climate and the greenhouse effect. Atmospheric transport and turbulence. Stratospheric ozone. Oxidizing power of the atmosphere. Regional air pollution: aerosols, smog, acid rain.

Course Prerequisites
MATH 1000, PHYC 1190.03/1290.03 or PHYC 1300, and CHEM 1011/1012

Course Objectives/Learning Outcomes
Develop critical-thinking skills
Identify dominant processes affecting atmospheric composition
Integrate knowledge of atmospheric chemistry to formulate simple models
For 5595, apply knowledge of atmospheric chemistry to scientific writing and public speaking

Course Materials
Introduction to Atmospheric Chemistry, by D.J. Jacob, 1999
Errata: http://acmg.seas.harvard.edu/people/faculty/djj/book/errata.print.html
Supplemental Problems:
http://acmg.seas.harvard.edu/education/eps133/Jacob_atmchem_problems_aug_2014.pdf
Other useful texts:

- Modeling of Atmospheric Chemistry, by G.P. Brasseur and D.J. Jacob, 2017
- Atmospheric Chemistry and Physics, by J.H. Seinfeld and S.N. Pandis, 2016
- Introduction to Atmospheric Chemistry, by Peter Hobbs, 2006
- Chemistry of the Upper and Lower Atmosphere, by B.J. Finlayson-Pitts & J.N. Pitts, 2000
- Chemistry of Atmospheres, by R.P. Wayne, 2000
- Chemistry of the Natural Atmosphere, by P. Warneck, 2000

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Course Assessment

Component	Weight (% of final grade)	Date
Quizzes	4595 (35%); 5595 (30%)	Oct 12, Nov 2
Final exam	4595 (35%); 5595 (30%)	Scheduled by Registrar
Assignments	4595 (25%), 5595 (20%)	Various
Participation	5%	
Graduate Project	5595 (15%)	Nov 28

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (<50)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies

- Assignments will be due in class. Late assignments will not be accepted. The assignment with the lowest grade will be discarded when computing the average grade.
- Assignments are intended to be individual efforts. You can discuss the problem with fellow students, but collaboration between students in the writing of solutions is not allowed. You must write the solutions alone.
- Missed quizzes will be dropped. The quiz grade will be determined from the remaining one. At least one quiz is required to pass the course.
- A missed final exam will be made up.
- The Dalhousie regulation of self-declaration of absence is welcome in lieu of sick notes.
- Graduate students will be expected to answer extra problems on assignments, quizzes, and exams. Graduate number to letter conversion: A+(90-100), A(85-89), A-(80-84), B+(77-79), B(73-76), B-(70-72), F(below 70)
- To comply with Department of Chemistry policy, a minimum average of 50% on the quizzes and final exam component is required to pass the course.

University Policies and Statements are posted on the course website

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Tentative Schedule of Lectures

5 Sep	Course Organization / Introduction
7 Sep	Ch. 1: Measures of atmospheric composition
10 Sep	Ch. 2: Structure of atmosphere
12 Sep	Ch. 3: Atmospheric lifetimes
14 Sep	Ch. 3: Simple models
17 Sep	Ch. 3: Examples of simple models
19 Sep	Ch. 4: Horizontal Atmospheric Transport
21 Sep	Ch. 4: Vertical Atmospheric Transport
24 Sep	Ch. 6: Principles of geochemical cycling
26 Sep	Ch. 6: Nitrogen Cycle
28 Sep	Ch. 6: Oxygen cycle
1 Oct	Ch. 6: Carbon chemistry in ocean
3 Oct	Ch. 6: Carbon and sulfur cycles
5 Oct	Ch. 7: Greenhouse effect
8 Oct	Thanksgiving
10 Oct	Ch. 7: Chemical forcing of climate
12 Oct	Quiz
15 Oct	Ch. 9: Chemical kinetics
17 Oct	Ch. 10: Chapman cycle
19 Oct	Ch. 10: Chemical families
22 Oct	Ch. 10: Catalytic cycles for stratospheric ozone loss
24 Oct	Ch. 10: Stratospheric dynamics and trends
26 Oct	Ch. 10: Polar ozone chemistry
29 Oct	Ch. 11: Oxidizing power of atmosphere
31 Oct	Ch. 11: Global budgets of CO and methane
2 Nov	Quiz
5 Nov	Ch. 11: Tropospheric ozone
7 Nov	Ch. 11: Tropospheric nitrogen oxides
9 Nov	Ch. 12: Ozone smog
12-16 Nov	Study Break
19 Nov	Ch. 12: Ozone-NO_x-VOC sensitivity
21 Nov	Ch. 12: Ozone production efficiency
23 Nov	Ch 13: Aerosol formation
26 Nov	Ch 13: Acid rain
28 Nov	Graduate presentations
30 Nov	Current topics in atmospheric chemistry
3 Dec	Graduate presentations