



**UNIVERSITY OF CALGARY  
FACULTY OF SCIENCE  
DEPARTMENT OF CHEMISTRY  
COURSE SYLLABUS  
WINTER 2021**

**1. COURSE: CHEMISTRY 521 – Introduction to Atmospheric Chemistry**

LEC	DAYS	TIME	ROOM	PROFESSOR	OFFICE	PHONE	EMAIL	OFFICE HOUR
L01	TuTh	11:00-12:15	n/a	Dr. Hans Osthoff	SB 205	403-220-8689	<a href="mailto:hothoff@ucalgary.ca">hothoff@ucalgary.ca</a>	by appointment

Desire2Learn (D2L): CHEM 521 L01 - (Winter 2021) - Introduction to Atmospheric Chemistry, <https://d2l.ucalgary.ca/d2l/home/362551>

Departmental Office SA 229, (403) 220-5341, e-mail: [uginfo@chem.ucalgary.ca](mailto:uginfo@chem.ucalgary.ca)

To avoid IT problems, it is recommended that the students use their U of Calgary account for all course correspondence. Please include 'CHEM 521' in the subject line of your email.

**2. Course Description:** An introduction to tropospheric and stratospheric chemistry. The detailed chemistry of the stratosphere and troposphere; gas-phase chemical kinetics; photochemistry and atmospheric radiation; aerosols; anthropogenic pollution and air quality; climate forcing; introduction to modelling and atmospheric transport

**3. TEXTBOOKS:**

**Required:**

*"Introduction to Atmospheric Chemistry"*, Daniel J. Jacob, Princeton University Press (1999) available for download at <http://acmg.seas.harvard.edu/people/faculty/djj/book/index.html>

**Recommended:**

*"Chemistry of the Upper and Lower Atmosphere"*, Barbara Finlayson-Pitts, James Pitts, Academic Press (2000), ISBN 978-0122570605. This book is available via the University of Calgary library web site.

*"Atmospheric Chemistry and Physics: From Air Pollution to Climate Change"*, 2<sup>nd</sup> ed., John H. Seinfeld and Spyros H. Pandis, Wiley (2006), ISBN 9780471720188. This book is available via the University of Calgary library web site.

**4. TOPICS COVERED AND SUGGESTED READING:**

Topic	DJ	BFP	JS/SP
Measures of atmospheric composition: Mixing ratio, number density and partial pressure	Ch. 1	Ch.1 and 2D	Ch. 1.6
Atmospheric pressure, structure, and transport; sea-breeze and Hadley circulation	Ch. 2 and 4	Ch. 2B	Ch.1.3-1.5, 21.1-21.3; 16.1-16.2
Gas-phase kinetics: Bimolecular reactions, 3-body reactions, chemical equilibria	Ch. 9	Ch. 5	Ch. 2.1 and 3
Atmospheric photochemistry: Actinic Flux, calculation of photolysis rate constants	Ch. 9.3	Ch. 3-4	Ch. 4
Simple models: Box and puff models	Ch. 3		Ch. 25
Stratospheric ozone: Chapman mechanism, catalytic loss cycles, polar ozone loss, aerosols	Ch. 10	Ch. 12	Ch. 5
Oxidizing power of the troposphere: OH and HO <sub>x</sub> , global CO, CH <sub>4</sub> , NO <sub>x</sub> , and O <sub>3</sub> budgets	Ch. 11	Ch 6-7	Ch. 6
Ozone production efficiency and control strategies	Ch. 12	Ch. 16	Ch. 6
Acid rain	Ch. 13	Ch. 8	Ch. 7
Aerosols	Ch. 8	Ch. 9	Ch. 8-15
Greenhouse effect and global climate	Ch. 7	Ch. 14	Ch. 23-24

This course does **not** have a laboratory component.

## Tentative schedule for Winter 2021

#	Day	Date	Video lecture topics (length in MM:SS)	Suggested readings ( <i>Ch. in italics beyond the scope of Chem 521</i> )	In-class activity	Assign out	Assign due
1	T	Jan 12	-	<b>BFP</b> Ch. 1	Intro class		
2	R	Jan 14	Atmospheric composition (21:44)	<b>DJ</b> Ch. 1; <b>BFP</b> Ch. 2D; <b>JS</b> Ch. 1.6	Activity 1	1	
3	T	Jan 19	Atmospheric pressure, temperature and structure, sea breeze, Hadley cells (36:04)	<b>DJ</b> Ch. 2; <b>BFP</b> Ch. 2B; <b>JS</b> Ch. 1.3-1.5, 21.1	-		
4	R	Jan 21	Atmospheric transport (60:47)	<b>DJ</b> Ch. 4; <b>BFP</b> Ch. 2B; <b>JS</b> Ch. 16.1, 16.2, 21.1 - 21.3	Activity 2	2	1
5	T	Jan 26	Gas-phase kinetics: Bimolecular and 3-body reactions, equilibria I (44:58)	<b>DJ</b> Ch. 9; <b>BFP</b> Ch. 5A; <b>JS</b> Ch. 2.1 and 3	-		
6	R	Jan 28	Bimolecular and 3-body reactions, equilibria II (46:39)	<b>DJ</b> Ch. 9; <b>BFP</b> Ch. 5A; <b>JS</b> Ch. 2.1 and 3	Activity 3	3	2
7	T	Feb 2	Atmospheric photochemistry I (63:38)	<b>DJ</b> Ch. 9.3; <b>BFP</b> Ch. 3-4; <b>JS</b> Ch. 4	-		
8	R	Feb 4	Atmospheric photochemistry II (10:31)	<b>DJ</b> Ch. 3; <b>JS</b> Ch. 25	Activity 4		3
9	T	Feb 9	Stratospheric chemistry (48:36)	<b>DJ</b> Ch. 10; <b>BFP</b> Ch. 12-13; <b>JS</b> Ch. 5	-		
	R	Feb 11	-	(Lectures 1-6)	<b>Quiz 1</b>		
	T	Feb 16	<i>Reading week - no lecture</i>	-	-		
	R	Feb 18	<i>Reading week - no lecture</i>	-	-		
10	T	Feb 23	Modeling (22:03)	<b>DJ</b> Ch. 3; <b>JS</b> Ch. 25	Activity 5	4	
11	R	Feb 25	-	<a href="http://www.wavemetrics.com/products/igorpro/videotutorials">www.wavemetrics.com/products/igorpro/videotutorials</a>	Activity 6		
	T	Mar 2	-	(Lectures 7-11)	<b>Quiz 2</b>		
12	R	Mar 4	Tropospheric Chemistry I (49:49)	<b>DJ</b> Ch. 11-12; <b>BFP</b> Ch. 6-7; <b>JS</b> Ch. 6			
13	T	Mar 9	Tropospheric Chemistry II (68:56)	<b>DJ</b> Ch. 11-12; <b>BFP</b> Ch. 6-7; <b>JS</b> Ch. 6	Activity 7	5	4
14	R	Mar 11	Tropospheric Chemistry III (37:55)	<b>DJ</b> Ch. 11-12; <b>BFP</b> Ch. 6-7; <b>JS</b> Ch. 6			
15	T	Mar 16	Tropospheric Chemistry IV (60:38)	<b>DJ</b> Ch. 11-12; <b>BFP</b> Ch. 6-7; <b>JS</b> Ch. 6	Activity 8	6	5
16	R	Mar 18	Tropospheric Chemistry V (67:13)	<b>DJ</b> Ch. 11-12; <b>BFP</b> Ch. 6-7; <b>JS</b> Ch. 6			
17	T	Mar 23	Tropospheric Chemistry VI (60:12)	<b>DJ</b> Ch. 13; <b>BFP</b> Ch. 8 ( <i>JS</i> Ch. 7)	Activity 9	7	6
18	R	Mar 25	Aerosols I+II (71:35)	<b>DJ</b> Ch. 8; <b>BFP</b> Ch. 9; ( <i>JS</i> Ch. 8-15)	-		
19	T	Mar 30	-	(Lectures 12-16)	<b>Quiz 3</b>	8	7
20	R	Apr 1	Aerosols III (44:38)	<b>DJ</b> Ch. 8; <b>BFP</b> Ch. 9; ( <i>JS</i> Ch. 8-15)	Activity 10		
21	T	Apr 6	Climate (62:42)	<b>DJ</b> Ch. 7; <b>BFP</b> Ch. 14; <b>JS</b> Ch. 23-24	-		8
22	R	Apr 8	-	Student handouts	Student presentations		
23	T	Apr 13	-	Student handouts	Student presentations		
24	R	Apr 15	-	(Lectures 17-21)	<b>Quiz 4</b> (+ Presentations)		