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Course Objectives:
• to develop the tools necessary to think about atmospheric chemistry  
• to learn the atmospheric chemistry behind well-known phenomena such as smog, acid rain, and stratospheric ozone depletion

Credits: 3

Grading: problem sets (25%), mid-term exam (20%), final exam (30%), and case studies (25%)

Meeting time: Two 1.5-hour meeting each week. Meeting day/time to be arranged based on students’ schedules/availability.

Course Outline:
1. Introduction  
   1.1. A timeline of atmospheric chemistry  
   1.2. Lifecycles of atmospheric constituents  
   1.3. Units and Conversions
2. The troposphere  
   2.1. General Composition  
   2.2. Important meteorological concepts  
   2.3. Trace chemicals
3. Tropospheric photochemistry  
   3.1. Actinic flux  
   3.2. Simplified spectroscopy  
   3.3. Absorption  
   3.4. Chemical kinetics
4. Tropospheric gas-phase chemistry  
   4.1. NOx photochemistry  
   4.2. Chemistry of the clean troposphere  
   4.3. Atmospheric organic chemistry  
   4.4. VOCs and NOx in ozone formation  
   4.5. Regulatory strategies  
   4.6. Halogen chemistry
5. Aqueous phase chemistry  
   5.1. Atmospheric liquid water  
   5.2. Chemical equilibria and Henry’s Law  
   5.3. Sulfur chemistry and acid rain  
   5.4. Nitrogen chemistry  
   5.5. Organic acids  
   5.6. Ecological and structural damage
5.7. Successes and failures

6. Stratospheric chemistry
   6.1. Dynamics revisited in a little more detail
   6.2. Sources of stratospheric constituents
   6.3. Sources, reservoir and reactive species
   6.4. Ozone-destroying catalytic cycles
   6.5. The ozone hole
   6.6. The Montreal Protocol

7. Atmospheric chemistry and climate
   7.1. Atmospheric constituents that link chemistry and climate
   7.2. Radiative forcing

Textbooks and References:
- Chemistry of the Upper and Lower Atmosphere, Barbara Finlayson-Pitts, James Pitts, 2000 (Recommended text)
- Atmospheric Chemistry and Physics: From Air Pollution to Climate Change, John Seinfeld and Spiros Pandis, 2nd Ed., 2007 (Recommended text)
- Introduction to Atmospheric Chemistry, Daniel Jacob, 1999.
- Aeronomy of the Middle Atmosphere, Brassuer and Solomon, 1986.