Lecture Synopsis

R.P. Wayne — *Atmospheric Chemistry*
(6 lectures)

1. Introduction to atmospheric chemistry

   The variety of atmospheres in the solar system
   Chemistry, photochemistry and cyclic processes in atmospheres;
   Origins of the atmospheres in the Solar system
   Composition of Earth's atmosphere and comparison with Venus and Mars
   Pressures and temperatures in the Earth's atmosphere; "greenhouse" heating

2. The stratosphere

   The ozone layer and its significance
   Oxygen-only chemistry
   Evolution of the atmosphere and life
   Importance of minor constituents in atmospheric chemistry
   Catalytic cycles for ozone destruction, reservoirs, *etc.*
   Sources and sinks of minor species
   Dynamics, motions and chemical processes
   Modelling atmospheric chemistry
   Atmospheric measurements of minor species, atoms and radicals

3. Perturbations to stratospheric ozone

   Man's contribution to catalytic species
   Stratospheric aircraft; fertilizers and agriculture
   The CFC problem; halons - bromine chemistry; CFC alternatives
   Polar ozone chemistry - the Antarctic "hole" and Arctic perturbations
   Trends in ozone concentrations - their detection and their consequences

4. The troposphere

   Sources and sinks of tropospheric gases; biological sources
   Oxidation in the troposphere: initiation, oxidation, ozone production
   The importance of the oxides of nitrogen; PAN; the nitrate (NO_3) radical
   The importance of the hydroxyl radical
   Feedbacks in atmospheric chemistry; "Gaia"

continued overleaf

5. Heterogeneous chemistry, air pollution and related topics

Aerosols and droplets, and chemistry occurring on and in them
Homogeneous and heterogeneous oxidation of sulphur compounds
London smog and acid rain
Photochemical air pollution and Los Angeles smog

6. Airglow; the mesosphere

Optical emission from atmospheres and information that it yields
Excitation mechanisms
Hydroxyl emission - the Meinel bands
The emissions from atomic and molecular oxygen
Atomic sodium emission

Reading Material

Some sources are:

R.P. Wayne, *Chemistry of Atmospheres*, 3rd edition, OUP, 2000.
Hobbs, P.V., *Introduction to Atmospheric Chemistry*, CUP, 1999.
Seinfeld, J.H. and Pandis, S.N. *Atmospheric Chemistry and Physics*, Wiley, 1998.
B.J. Finlayson-Pitts and J.N. Pitts, Jr., *Chemistry of the upper and lower atmosphere*, Academic Press, 2000
T.E. Graedel and P.J. Crutzen, *Atmospheric Change*, Freeman, 1993.
T.E. Graedel and P.J. Crutzen, *Atmosphere, Climate and Change*, Scientific American Library, 1997.
P. Brimblecombe, *Air: Composition and Chemistry*,2nd edn., CUP, 1996
J.L. Seinfeld, *Atmospheric Chemistry and the Physics of Air Pollution*, Wiley, 1986
G. Brasseur and S. Solomon, *Aeronomy of the Middle Atmosphere: Chemistry and Physics in the Stratosphere and Mesosphere (second edition)*, D. Reidel, 1986.
P. Warneck, *Chemistry of the Natural Atmosphere*, Academic Press, 1988
J.S. Levine, ed., *The Photochemistry of Atmospheres*, Academic Press, 1984
J. Gribbin, *The Hole in the Sky*, Corgi Books, 1988
C.C. Park, *Acid rain*, Methuen, 1987

The first of these books was written specifically with the needs of chemistry undergraduates in mind, and a (biassed) opinion suggests that it is still probably the most accessible up-to-date account available. A much condensed version of some of the material is to be found in an article available in most college libraries

R.P. Wayne, *Atmospheric Chemistry*, Science Progress, **74**, 379 (1990)

The books by Graedel and Crutzen and by Brimblecombe are interesting, easy to read, and cover additional material. That by Finlayson-Pitts and Pitts deals with the chemical aspects in detail, while those by Brasseur and Solomon and by Seinfeld lean more towards physics and atmospheric dynamics, transport and motions. Warneck is particularly strong on heterogeneous reactions. The last two books are popular accounts of two important topics, perhaps becoming a little dated now.

WEB SITE FOR NOTES: http://physchem.ox.ac.uk/~wayne/atmos.html