Ozone Chemistry

Topics covered

- Review: Sun light and filtering effects
- Ozone formation and destruction in stratosphere
- Chapman theory for steady state concentration of O and O₃
- Destruction of Ozone by CFCs

Note: The class website is http://www.nd.edu/~pkamat/chem20204.html
- In this lecture we will cover steady state analysis of ozone in the stratosphere. We will devote next class to ozone hole formation.
- **Extra Credit**: Up to 15 points A 10-15 min presentation in class or a written report on an environmental topic is strongly encouraged.
  (One person: Presentation or Report; Team of two: Presentation+Report)
- **Deadline for submission of the outline is January 25**
  (Half page print out with Name, Title and a brief abstract to indicate topics covered. Indicate your preference –Presentation or Report)
- Please browse NASA’s Ozone site: http://ozonewatch.gsfc.nasa.gov
- **Keypoints to remember:**

\[ E = \frac{hc}{\lambda} = \frac{119627}{\lambda} \text{ (kJ/mole)} \]

**Steady State Analysis for Ozone in the Atmosphere:**

Chapman Mechanism

\[
\begin{align*}
\text{O} &\rightarrow 2\text{O} \\
\text{O} + \text{O}_2 + \text{M} &\rightarrow \text{O}_3 + \text{M} \\
\text{O}_3 &\rightarrow \text{O}_2 + \text{O} \\
\text{O}_3 + \text{O} &\rightarrow 2\text{O}_2
\end{align*}
\]

\[
\frac{[\text{O}_3]_{ss}}{[\text{O}_2]_{ss}} = [\text{M}]^{0.5}(k_1k_2/k_3k_4)^{0.5} \quad [\text{O}]_{ss} = (k_1k_3/k_2k_4)^{0.5} / [\text{M}]^{0.5}
\]

Dependence of steady state concentration of O₃ and O on air density (M) and various rate constant

The actual destruction of ozone is more than the prediction. Why?

**Ans. Ozone-depleting substances** (CFCs, HCFCs, HBFCs, and halons) See a cartoon story on EPA site http://www.epa.gov/ozone/science/missoz/missspan.html