CHEM173 Review Notes for Midterm 1

Spring 2006

Note that the questions on the midterm are unlikely to be identical to any of the questions that I have given as homework. The idea is instead that the concepts they review will be useful for the exam.

The best way to study for the midterm is to review your notes from lecture, section, and the text. Here is the summary from lecture:

Review for Midterm 1

Greenhouse Gases (Ch.4)	H_2O, CO_2, N_2O, some CFCs, CH_4	Warms the Earth (~255→286K) by absorbing IR
Chapman Cycle (Ch. 10)	O_2, O_3, $O(^1D)$, $O(^3P)$	Forms O_3 layer that absorbs UV
Stratospheric Ozone Hole (Ch. 10)	CFCs, NO_x, Cl, ClO, $ClONO_2$, O_3, O_2, HNO_3, PSCs	Destroys O_3 layer by CFC photolysis >25km
Atmospheric Composition (Ch. 2, 3, 5.1)	78% N_2, 21% O_2 <1% Ar and CO_2 0-4% H_2O	Five major components of the homosphere

The following problems in Hobbs are particularly helpful: Appendix 1 problems 1g, 1h, 1j, 1m, 1n, 1x, 1dd, 1ee, 1ff, 1gg, 1hh, 1ii, 1jj, 1kk, 1mm, 8,9, 10, 11, 47, 48, 49, 50, 51, 52, 53, 54.

In addition, here are a few questions from old midterms for this course, which are (at least partially) relevant to Midterm 1, that I have selected if you would like additional review problems:

6. (6 pts.) What are the major formation routes for ozone in the troposphere and stratosphere, respectively?

7. (6 pts.) List the key oxygen-containing species that are responsible for absorbing <u>short</u> solar radiation wavelengths in each of the following regions of the atmosphere: thermosphere, mesosphere, and stratosphere. (hint: they block these wavelengths from passing into the troposphere)

8. (4 pts.) Explain the concepts of "good ozone" versus "bad ozone".

9. (4 pts.) Write out the two principal chemical processes than can happen to $O(^1D)$ once it is formed in the troposphere?

12. (5 pts.) Which reaction process is responsible for the temperature inversion observed in the stratosphere?

13. (5 pts.) What is the primary source of NO in the <u>stratosphere</u>?

14. (6 pts.) List three key factors that determine the relative lifetime of a molecule emitted into the atmosphere.

15. (8 pts.) Draw the Lewis dot structures for O_3 and NO. Include resonance structures where appropriate. Which (if any) of these species are considered free radicals?

16. (6 pts.) Draw a plot showing temperature versus altitude (label axes), showing an inversion layer in the troposphere. What is the term used to describe the change in temperature as a function of altitude?

1a (8 points). Describe the processes that lead to the sky being blue. Be specific as to the type of processes (and the species) involved.

1b (8 points). Explain why sunsets are orange and red.

17. Provide the definitions of half life and lifetime for a chemical species in the atmosphere.

18. Which of the following two reaction processes requires a shorter wavelength photon and why?

$O_3 + h\nu \rightarrow O_2 + O(^1D)$ – because it's more excited state

$O_3 + h\nu \rightarrow O_2 + O(^3P)$

19. Provide 2 examples of long lived species in the troposphere that one would expect to have lifetimes long enough for interhemispheric mixing. CFC's and Cl_2, N_2, N_2O

II-1 Mention **five** biological and **two** geochemical sources of gases in the troposphere and provide examples of the main gases released from those sources.

5) Knowing that the final concentration of a chemical involved in a first-order reaction (with a lifetime of 2 min) was $5*10^{10}$ molecules/ cm^3 and that the reaction took place for 10 minutes, it is possible to calculate that the original concentration of the chemical compound was ___________. (p= 1 atm. T=25°C)

(a) 276 ppbv (b) 301 ppbv (c)15 pptv (d)13 pptv