YOUR NAME: _____

AT 621
Atmospheric Chemistry

Exam 1

Thursday,
October 23, 2003

Exam is 1 hour
THREE PROBLEMS
** Note point weighting assigned to each problem **

CLOSED BOOK

CLOSED NOTES

1. *[20 points]*

(a) Discuss briefly the most important sources (in the troposphere) for the following three species:

$OH\cdot$
O_3
NO_x

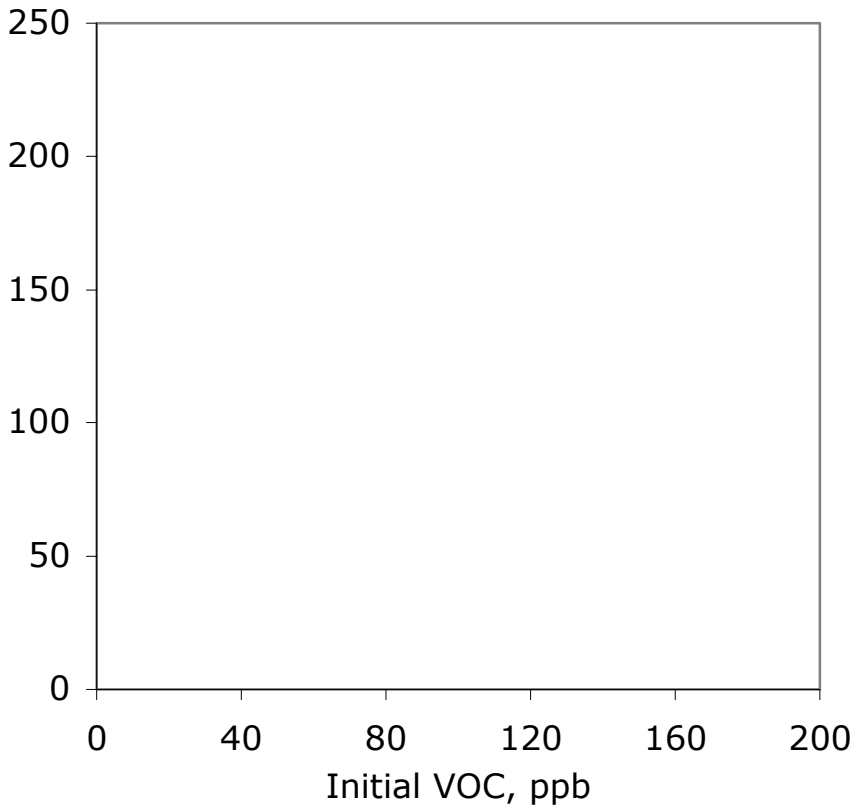
(b) List **3** important NO_x removal mechanisms and indicate whether they are important predominantly in clean or polluted regions.

2. *[40 points]*

This problem concerns production of ozone in urban and suburban regions.

(a) What is the pseudo-stationary-state relation (PSSR – NOT PSSA!)? What reactions are included to derive this relation? Why is it important?

(b) Sketch ozone "isopleths" on the plot below. You do not have to indicate actual ozone concentrations, but you do have to indicate in which direction(s) ozone is increasing. Include a discussion of why the isopleths are shaped as you drew them, and what kinds of reactions are important in the regions labeled A and B.



(Problem 2, continued)

3. *[40 points]*

At a remote site, the diurnally-averaged formation rate of OH is approximately 2×10^5 molecules cm^{-3} s^{-1}. The OH concentration is 8×10^5 molecules cm^{-3}. The OH reacts primarily with CO. The lifetime of CO with respect to reaction with OH is 2 months. The concentration of CO is 50 ppbv, which is approximately equal to 1×10^{12} molecules cm^{-3}.

(a) Is the concentration of OH at this site in steady-state?

(b) If the dry deposition velocity of OH is taken as 0.5 cm s^{-1} (a typical value for gases), does removal by this process in the boundary layer (depth ~ 1 km) play an important role in determining [OH]?