

AOSC 433/633 & CHEM 433/633 Atmospheric Chemistry and Climate

Admission Ticket, Lecture 15

Due: Thursday, 28 March 2013 (at start of class)

15 points

Your name: \_\_\_\_\_

A. Write the two chemical reactions involving NO and NO<sub>2</sub> that, when they occur in sequence, are equivalent to the reaction  $O + O_3 \rightarrow 2 O_2$ :

B. What is the mathematical expression for loss of odd oxygen due to this reaction sequence?

C. The description of the cycling of NO and NO<sub>2</sub> suggests an expansion of the definition of odd oxygen. How is this definition expanded?

D. The reaction sequence that causes loss of odd oxygen by chlorine radicals in the mid-latitude, middle to upper stratosphere, is:



Which step is the rate limiting process for removal of odd oxygen by chlorine radicals (i.e., which reaction provides an excellent approximation of the rate for the chlorine-catalyzed path for the reaction of O with O<sub>3</sub>)?

E. What is the thermodynamic reason why stratospheric bromine is more reactive than stratospheric chlorine?