

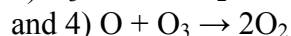
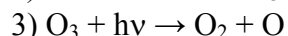
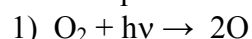
CHEMISTRY 253
Spring, 2015 - Dixon
Group Assignment #2

Group Names _____

Stratospheric Chemistry Problem:

1. By carrying out a number of calculations or thought experiments, we can better understand the Chapman Mechanism chemistry involving ozone production and destruction.

The Chapman mechanism reactions are:



Answer the following specific questions:

1. What does M refer to in step 2)?

2. If the rate constant, k , for reaction 2 is $2 \times 10^{-33} \text{ cm}^6 \text{ molec}^{-2} \text{ s}^{-1}$, calculate the lifetime of O atoms with respect to loss by reaction 2 at 25 km if $P_{\text{air}} = 0.04 \text{ atm}$ and $\%O_2$ by volume = 20%. Assume $T = -40^\circ\text{C}$. $R = 0.0821 \text{ L atm/mol K}$ and $0^\circ\text{C} = 273 \text{ K}$.

Hint: you can use the ideal gas law to get n/V in mol/L and then convert to molec cm^{-3} . The lifetime (in s) can be calculated as the ratio of the concentration (molec cm^{-3}) to the sink ($\text{molec O cm}^{-3} \text{ s}^{-1}$), cancelling out [O] (since it is not given).

$N_{\text{Avagadro}} = 6.02 \times 10^{23} \text{ molecules/mol}$

3. Within the stratosphere, how will the lifetime of O with respect to reaction 2 depend on altitude?

4. At night in the stratosphere, reactions 1 and 3 are stopped. Would you expect the concentration of O_3 to decrease to zero? What about the concentration of O atoms? You can assume that the concentration of O_3 is much higher than O atoms.