1. Look up the rate constants for the OH + NO three-body association reaction and using these data estimate the steady state HONO concentration under the following conditions: T=300 K; J_{HONO} = 0.001 s^{-1}; cloudy sky; wind speed = 3.2 knots (northeast); barometer reading 680 mm Hg; humidity = 80 %; LA local time = 12.33 pm; [OH] = 5 \times 10^6 \#/cm^3; serious traffic jam in the area of I-405 and I-5 intersection; [NO] = 1 ppb; [NO_2] = 30 ppb; perfect visibility. Assume that the primary source of HONO is the OH+NO reaction, and the primary sink is photolysis.

2. Using the rate constants for OH + NO_2 reaction given in the most current NASA kinetics database (or lecture notes) to calculate the relative yield of HOONO vs. HNO_3 at a). 300 K @ 760 Torr and b). 220 K @ 100 Torr. Note that you will have to use Troe formalism for both reactions.

3. Estimate the lifetime of N_2O_5 with respect to heterogeneous hydrolysis on the surfaces of aerosols at T=290 K. Assume the N_2O_5 uptake coefficient (look up its definition in the textbook) of gamma = 0.001. Assume that the aerosols are characterized by the active surface of concentration of 10^{-5} cm^2 of surface area per cm^3 of air.

4. You add 100 ppb of NO_2 in a chamber filled with air at room temperature and atmospheric pressure, and turn on the UV lights. The NO_2 photolysis rate for your chamber has been measured previously: J(NO_2)=10^{-3} s^{-1}. An ozone monitor attached to the chamber 10 reports that the chamber contains 40 ppb of ozone after some time of photolysis. Assuming that there is a photo stationary equilibrium in your chamber, estimate the concentrations of [O], [NO], and [NO_2]. Assume that only the following reactions are taking place:

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   \begin{align*}
   \text{NO}_2 + \text{hv} & \rightarrow \text{NO} + \text{O} \\
   \text{O} + \text{O}_2 + \text{M} & \rightarrow \text{O}_3 + \text{M} \\
   \text{NO} + \text{O}_3 & \rightarrow \text{NO}_2 + \text{O}_2
   \end{align*}
   \]

   \textit{Hint:} use the mass balance equation for nitrogen species.