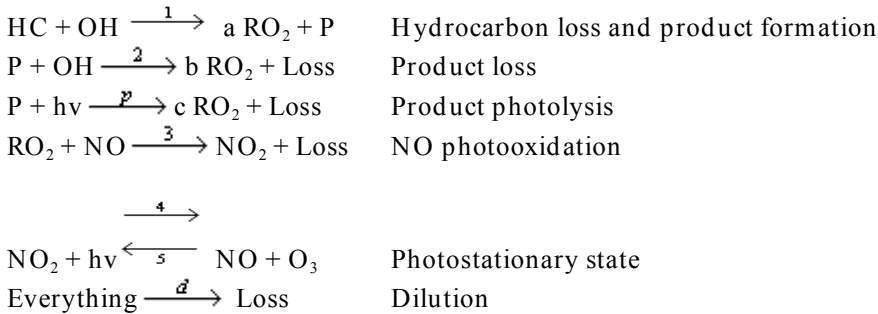


AT 621 F 12
Homework #5
 Due Wednesday, 24 October

Problem 1.

Moshiri and O'Brien (1984) have proposed the following simplified mechanism for predicting O₃ formation in photochemical smog systems. In this mechanism, HO₂ radicals are lumped with RO₂, and, to a first approximation, all RO₂ are assumed to react with NO. This mechanism does not predict the OH concentration, taking instead the quantity $k_1[\text{OH}] = m$ as an input "hydrocarbon reactivity parameter".



Show that the mechanism can be used to predict the number of net NO photooxidations produced per hydrocarbon consumed, as follows. Use of the quantity $[\text{NO}] - [\text{O}_3]$ as net NO oxidized effectively cancels out the photostationary state; thus ozone is simply "negative nitric oxide" (explain why this is so).

$$\frac{d([\text{NO}] - [\text{O}_3])}{d[\text{HC}]} = \frac{m(a[\text{HC}] + b(k_2/k_1)[\text{P}] + ck_p[\text{P}] + k_d([\text{NO}] - [\text{O}_3]))}{(m + k_d)[\text{HC}]}$$

Problem 2.

Problem 6.9 from Seinfeld and Pandis (Role of NO_x in tropospheric ozone production).

Problem 3.

The sketch below shows an urban region, with forested areas in the region. There are large emissions of NO_x and hydrocarbons from automobiles in the urban region. Assume that typical concentrations in the urban area are $\text{NO}_x = 0.2 \text{ ppm}$ and $[\text{VOC}] = 0.4 \text{ ppm}$. Use the “ozone isopleth diagram” to examine the following.

- What concentrations of ozone do you expect in the urban region?
- If the city decides to control NO_x emissions to produce a 25% reduction in ambient concentrations, what impact on ozone levels do you predict?
- If the city decides to control VOC emissions to produce a 25% reduction in ambient concentrations, what impact on ozone levels do you predict?

