

Environmental Chemistry Exam 1

HANDOUT

Constants:

$$R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1} = 0.08206 \text{ L atm mol}^{-1} \text{ K}^{-1}$$

$$k = R/N_A = 1.38066 \times 10^{-23} \text{ JK}^{-1}$$

$$h = 6.626 \times 10^{-34} \text{ Js}$$

$$c = 2.998 \times 10^8 \text{ ms}^{-1}$$

$$m_p = 1.67265 \times 10^{-27} \text{ kg}$$

$$e = 1.602 \times 10^{-19} \text{ C}$$

$$M_a = 0.0290 \text{ kg mol}^{-1}$$

$$g = 9.81 \text{ m s}^{-2}$$

Formulas you might want:

$$k(T) = A \exp(-E_a / RT)$$

$$v_{rms} = \sqrt{\frac{3kT}{m}}$$

$$\frac{I}{I_0} = \exp(-tm)$$

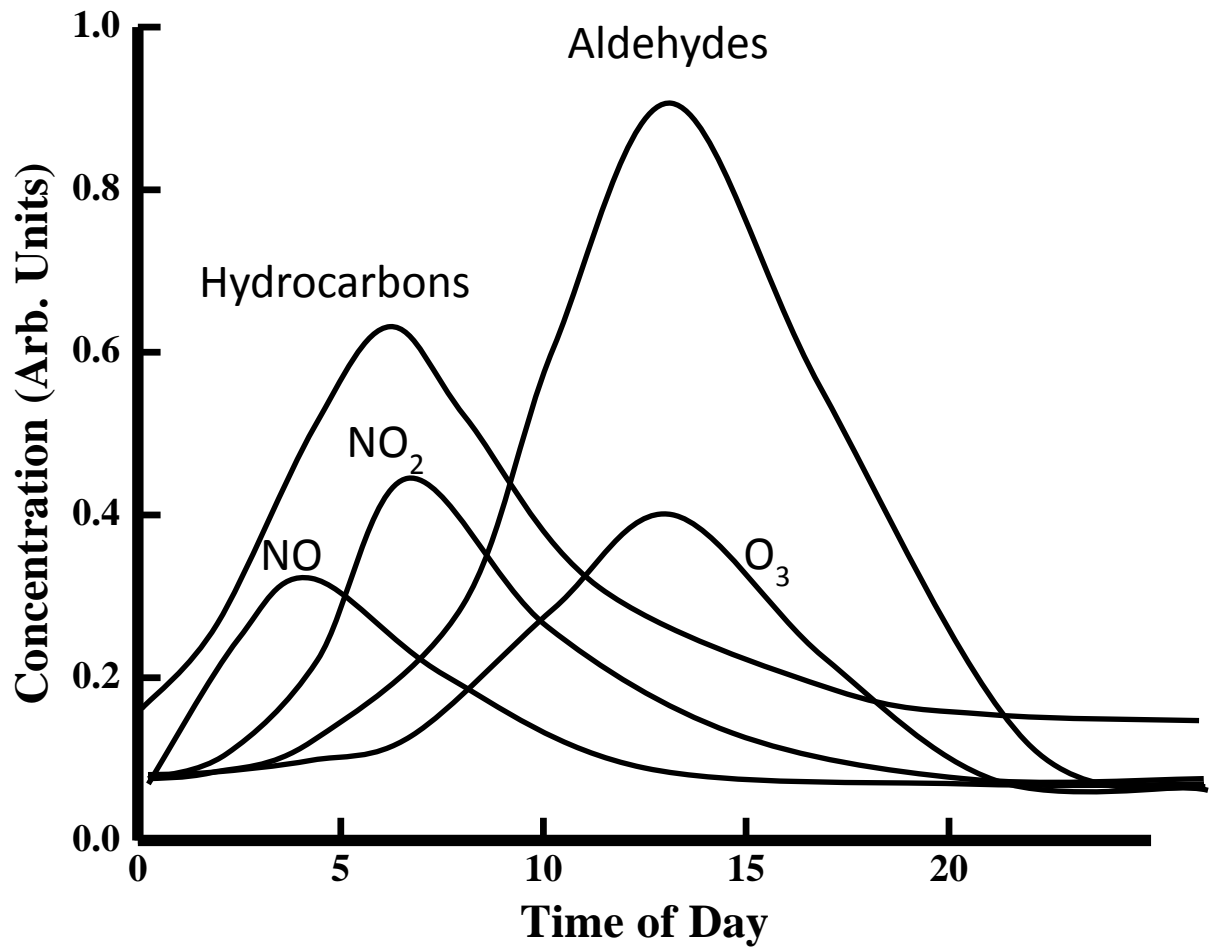
$$t = t_{sg} + t_{ag} + t_{sp} + t_{ap}$$

$$t_{sg} = \frac{1.044 \times 10^5 (n_{0\lambda} - 1)^2}{\lambda^4}$$

$$J(\lambda) = \frac{2\pi hc^2}{\lambda^5} \frac{1}{\exp(hc / kT\lambda) - 1}$$

$$\lambda_{max} = \frac{2.88 \times 10^{-3}}{T}$$

$$P_h = P^o e^{-M_a g h / RT}$$



3. The chart shown above shows the concentrations of several troposphericly relevant species as a function of time of day (hours from midnight). Explain the appearance and disappearance of each species. Why do we see these species peak when they do? (15 Points)

4. Although CFC use has been done away with, we still have an ozone hole. Why do we still see that, and will it ever heal? Include in your answer information about how CFC's get to the stratosphere, what happens to them there, and how they get removed from the stratosphere. You should use "20 years" and "lifetime" somewhere in the explanation. (15 Points)

5. What is the Global Warming Potential of a greenhouse gas? (5 Points)

b. The GWP of CFC-11 is 3400. What does this tell you about CFC-111 in terms of its effect on the climate? (5 Points)

c. What does this tell you about CFC-11 and how it interacts with light? (5 points)

6. Write the reactions in the Chapman Mechanism (ozone). (10 Points)

b. Use the Chapman Mechanism that you wrote above to explain why there is an 'ozone layer' in the stratosphere. (Think about pressure and solar light at that particular level.) (10 points)

7. List the steps of the $\cdot\text{OH}$ initiated oxidation of ethane up to the point of the formation of acetaldehyde. (10 points)

8. On the following graphs sketch, as accurately as possible, the curves expected given the dependence of temperature on altitude.

a. In addition to the temperature vs. altitude curve indicate the relevant regions of the atmosphere and the wavelengths of light that reach each layer. (15 points)

