Study Guide for the First Midterm – Friday February 22, 2008

This exam will be taken closed book/closed notes. The only tool you may use during the exam is a pencil and a calculator for simple calculations – no stored equations or variables. All work must be shown explicitly! The examination period is 11:00 - 11:55.

I. The behavior of gases (chapter 12)

a. Measurements, units of pressure
b. Dalton's law of partial pressures
c. Gas Laws, Ideal gas law
d. Stoichiometry and pressures
e. Kinetic Theory, u_{rms}

II. Chemical Kinetics (chapter 16)

a. Definition of reaction rate
   Relating plots of [ ] vs. time to rate. Instantaneous rates of reaction. Initial rates.
b. Linking reaction rate to concentration of reactants - standard rate law
   i. Pairwise comparisons
   ii. Plots of log(rate) vs. log[reactant]
   iii. Difference between first, second and zeroth order behavior.
c. Use of the integrated rate laws, half-life, lifetime
d. Mechanisms and rate law
   i. Elementary reactions and rate laws
   ii. Rate determining steps and predicted rate laws.
   iii. Identification of catalysts, intermediates, reactants and products
   iv. Rapid Equilibrium assumption, solving for intermediate concentration
   v. Steady state assumption
e. Rate and temperature, the Arrhenius equation
f. Catalysis

III. Stratospheric Ozone (E- O3 Textbook; Rowland & Molina, 1974)

a. Structure of the atmosphere: temp & pressure vs. altitude
b. Chapman oxygen-only chemistry
c. Catalytic cycles in stratospheric ozone chemistry
d. CFC's and ozone depletion
e. Heterogenous catalysis of ozone destruction in polar springtime

VI. Experiments #1 and #2 (first week only)

Equations and constants available on the exam (a periodic table will also be provided).

$R = 8.3145\ ^{J}/_{mol\,K} = 0.08206\ ^{Latm}/_{molK}$ $\qquad u_{rms} = \sqrt{\frac{3RT}{M}}$ $\qquad KE = {}^{3}/_{2}RT$

$1\text{ atm} = 1.01325 \times 10^{5}\text{ Pa}$ $\quad 1\text{ Pa} = 1\ ^{kg}/_{ms^2}$ $\qquad 1\text{ J} = 1\ ^{kgm2}/_{s^2}$

$\ln[A]_t = \ln[A]_o - nkt$ $\qquad 1/[A]_t = 1/[A]_o + nkt$ $\qquad \tau = [A]/(\text{rate of removal of A})$

$k = A\exp(-E_a/RT)$ $\qquad \ln\left(\frac{k_1}{k_2}\right) = -\frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$