Study Guide for the Second Exam – 3/28/08

This exam will be taken closed book/closed notes. The only tools you may use during the exam are a pencil and a calculator (no problem solving functions!). **All work must be shown explicitly.** The examination period is 11:00 - 11:55.

I. Energy and Enthalpy
   a. Energy and enthalpy
   b. Work, heat and heat capacity
   c. Calorimetry and determining heats of reaction (see exp. #3)
   d. Enthalpic favorability/unfavorability

II. Entropy and Free Energy
   a. Definition of entropy, predicting sign on ΔS for a reaction
   b. Entropic favorability/unfavorability
   c. Standard molar entropies in calculations
   d. Definition of free energy. Predicting spontaneity from ΔG
   e. Calculating $\Delta G°$ from data tables
   f. Gibbs free energy equation: $\Delta G = \Delta H - T\Delta S$
   g. Predicting temperature ranges of spontaneity

III. Equilibrium behavior
   a. Definition of equilibrium, relation to product/reactant concentrations/pressures
   b. The reaction quotient - predicting the progress of the reaction
   d. Solving equilibrium problems by using "ICE boxes"
   c. Le Chatelier's principle – predicting the effect of disturbances upon the system
   e. Equilibrium and temperature – the van't Hoff equation
   f. Equilibrium and free energy
   g. The reaction quotient and free energy

IV. Solution Chemistry
   a. Basic nomenclature of inorganic compounds
   b. Solubility, enthalpy and entropy of solution
   c. Solubility, based on equilibrium (from K_{sp}, ICE boxes as above)
   d. Structure of soils
   e. Intro to acid/base chemistry

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

$R = 8.3145\ {}^{J}/_{mol\ K} = 0.08206\ {}^{Latm}/_{molK}$ $\qquad \Delta G^{\circ} = -RT\ln K$

$1\ atm = 1.01325 \times 10^{5}\ Pa \qquad 1\ J = 1\ {}^{kgm2}/_{s^2}$ $\qquad \Delta G = \Delta G° + RT\ln Q$

$$\ln\left(\frac{K_1}{K_2}\right) = -\frac{\Delta H^{o}}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$