Preview Sheet for Final Exam
Monday, December 8, 10:15 a.m. – 12:45 p.m., in Olin-Rice 101

Part 1: 100 points based on calculations and short essay questions

- Coverage: Entropy, enthalpy, Gibbs energy, chemical equilibrium, and acid-base chemistry
- Hanson and Green Chapters 2 (in particular calculation of W), 7, 8, 9, and 10
- Atkins and Jones Chapters 9 and 10
- Lectures from 10/31 through 12/5
- Problem Set 10, 11, and 12
- As always, in your studying, focus on your lecture notes and homework first, then look at the textbook. (See the course web page for class overheads and homework keys.)
- As always, if something in the textbook was not covered in lecture or on the homework, you are not responsible for it!

Part 2: 40 points based on multiple-choice questions

- Coverage: Same as in Part 1, plus other major topics from Hanson and Green
- Not covered: Material on first two unit tests, hybridization
- 10 multiple-choice questions from American Chemical Society standardized tests (mostly).

Overall Comments

- You will have 2 hours and 30 minutes to work on the final. You are free to divide your time between Parts 1 and 2 (and go back and forth between the two parts) as you see fit.
- You are allowed to fill both sides of an 8.5" x 11" piece of paper with whatever information you want, and use it during the exam. In addition, I will provide all of the equations and constants given on the third unit test, a periodic table, and the following information:

$$\Delta S_{\text{sys}} + \Delta S_{\text{surr}} = \Delta S_{\text{univ}} \geq 0 \qquad S = k \ln W \qquad \Delta S_{\text{surr}} = \frac{q_{\text{surr}}}{T} = -\frac{\Delta H}{T}$$

$$\Delta S = nR \ln \frac{V_2}{V_1} \qquad \Delta S = -nR \ln \frac{p_2}{p_1} \qquad \Delta S = -nR \ln \frac{[\text{X}]_2}{[\text{X}]_1}$$

$$S_x = S_x^o - R \ln P_x / \text{bar} \qquad S_x = S_x^o - R \ln [\text{X}]/\text{M} \qquad \Delta_r S = \Delta_r S^o - R \ln Q$$

For the reaction $\text{a A}(g) + \text{b B}(g) \rightarrow \text{d D}(g)$, $Q = \dfrac{p_{\text{D}}^{\text{d}}}{p_{\text{A}}^{\text{a}} p_{\text{B}}^{\text{b}}}$

$$H = U + pV \qquad \Delta H = \Delta U + p\Delta V \qquad p\Delta V = RT\Delta n_{\text{gas}}$$

$$G = H - TS \qquad \Delta G = \Delta H - T\Delta S \leq 0$$

$$\Delta G = \Delta G^o + RT \ln Q \qquad \Delta G^o = -RT \ln K \qquad \Delta G^o = \Delta H^o - T\Delta S^o$$

$$pX = -\log[X]$$

$K_aK_b = [H_3O^+]\,[OH^-] = 1.0 \times 10^{-14}$ (at 25°C) $\qquad pK_a + pK_b =$ pH + pOH = 14.00 (at 25°C)

Instructions before starting the test:

1. Write your name in the space above and on the backs of Pages 2-9.
2. Your exam booklet should have **eleven** pages total, with questions on Pages 2-9, and a periodic table and other reference data on Pages 10-11. Check to see you have eleven pages now. If you do not, ask for another copy of the exam.
3. You may tear off Pages 10-11 if you wish, but be careful not to remove the staple.
4. Part I of this test (on pp. 2-6) contains questions on entropy, enthalpy, Gibbs energy, chemical equilibrium and acid-base chemistry. Justify all of your answers in Part I. Partial credit will be awarded for work in Part I.
5. Part II of this test (on pp. 7-9) contains **10** multiple-choice questions, each worth 4 points, covering most of the major topics of the semester after the second unit test. Circle the correct answer to each of the questions in the exam booklet. There is no penalty for incorrect answers. Feel free to use blank spaces in this exam booklet for scratch work. However, realize that you will receive no partial credit for this work.
6. You may use as a reference a single sheet of 8.5"x 11" paper that you have filled (front and back) with information.
7. You have **2 hours and 30 minutes** to work on this exam. Do not start until you are instructed to.