Preview Sheet for Test 3
Thursday, November 6, starting at 8:00 a.m., OR 350

Atkins/Jones: Chapter 3 (pp. 106-115—but focus on class notes)
Hanson/Green: Chapter 2 (pp. 31-36), Chapter 3 (pp. 45-61)
Chapter 4 (pp. 80-82), Chapter 5 (pp. 95-102)
Lectures from 10/6 to 10/30; Problem Sets 7, 8, and 9

Studying strategies:

- Focus on your lecture notes and homework first, then look at the textbooks. Anticipate some conceptual questions not based on the homework. Also understand the "big ideas" from the Molecular Vibrations lab and the theory section in the instructions to the Calorimetry lab.
- If a topic was not covered in homework, lecture, or lab, you are not responsible for it! Please ask me if you are unsure about whether a particular topic is "fair game" for the exam.
- You will not be tested on constructing energy level population diagrams (as in Hanson and Green Problems 2.2 and 2.4 from Problem Set 7). As we saw in class on October 31, these diagrams come up again when we talk about entropy. You should know how to construct these diagrams for the final.
- You are responsible for the other major topic of Chapter 2, the Boltzmann distribution law.
- Expect a mixture of mathematical and short explanation questions. You should be able to use equations not only to calculate numbers, but also to make qualitative arguments.

Instructions before starting the test:

1. Write your name in the space above and on the backs of the other pages.
2. This exam is closed-everything.
3. Your exam booklet should have **eight** pages total, with questions on pp. 2-6, equations and constants on p. 7, and a periodic table and a table of bond dissociation energies on p. 8. Check to see you have eight pages now. If you do not, ask for another copy of the exam.
4. You may use programmable calculators, but chemical data should not be stored in them.
5. To receive full credit for a mathematical problem, you must show the method by which you obtained the final answer, including dimensional analysis. However, you do not need to justify how you calculated molar masses.
6. Assume that the mass of an isotope (in amu) is given by its mass number to one decimal place. So, for example, assume ^{11}B weighs 11.0 amu.
7. A final numerical answer must contain the correct units and number of significant figures to receive full credit.
8. You have **100 minutes** to work on this exam. Do not start until you are instructed to.

What not to memorize (they will be provided in the test booklet):

(1) The periodic table
(2) A table of bond dissociation energies
(3) The information on the back side of the page:

$$c = \lambda \upsilon \qquad \frac{1}{\lambda} \equiv \tilde{\nu} \qquad \upsilon = c\tilde{\nu} \qquad E = h\upsilon$$

$$\frac{N_{\mathrm{j}}}{N_{\mathrm{i}}} = \exp\left(-(E_{\mathrm{j}} - E_{\mathrm{i}})/kT\right) \qquad \Delta E = -\Re Z^2\left(\frac{1}{n_{\mathrm{f}}^2} - \frac{1}{n_{\mathrm{i}}^2}\right) \qquad \mu = \frac{m_1 m_2}{m_1 + m_2}$$

$$E_{\mathrm{vib}} = \left(i + \frac{1}{2}\right)h\nu \quad \text{where} \quad \nu = \frac{1}{2\pi}\sqrt{\frac{k_f}{\mu}} \text{ and } i = 0,1,2,...$$

$$E_{\mathrm{rot}} = i(i+1)\frac{h^2}{8\pi^2}\left(\frac{1}{\mu R^2}\right) \quad \text{where} \quad i = 0,1,2,...$$

$$E_{\mathrm{trans}} = \left(n_x^2 + n_y^2 + n_z^2\right)\frac{h^2}{8}\left(\frac{1}{mV^{2/3}}\right) \quad \text{where} \quad n = 1,2,3...$$

$$\Delta U = \Delta U_{\mathrm{C}} + \Delta U_{\mathrm{T}} = q + w \qquad \Delta U_{\mathrm{T}} = C\Delta T = m\hat{C}\Delta T = n\tilde{C}\Delta T$$

$$w = -p_{\mathrm{surr}}\Delta V \qquad pV = nRT \qquad T\,(\mathrm{K}) = T\,(^\circ\mathrm{C}) + 273.15\ \mathrm{K}$$

N_A = 6.022 x 10^{23} particle mol^{-1} c = 2.998 x 10^8 m s^{-1} = 2.998 x 10^{10} cm s^{-1}

h = 6.626 x 10^{-34} J s $\mathrm{particle}^{-1}$ $\Re$ = 2.179 x 10^{-18} J $\mathrm{particle}^{-1}$

k = 1.381 × 10^{-23} J K^{-1} $\mathrm{particle}^{-1}$ 1 amu = 1.661 × 10^{-27} kg $\mathrm{particle}^{-1}$

1 m = 10^9 nm = 10^{10} Å 1 mL = 10^{-3} L 1 J = 1 kg m^2 s^{-2} 1 kJ = 10^3 J

R = 0.08315 L bar mol^{-1} K^{-1} = 8.315 J mol^{-1} K^{-1} 1 L bar = 100 J

Important Alterations to the Course

I will be missing at least a week of class later this month to help take care of my new baby. Prof. Varberg will be filling in for me as much as possible, but there will be still be some unavoidable disruptions and loss of class time. To account for this, I am making the following changes:

- Test 4 (scheduled for November 26) will be canceled.
- The final exam will be comprised of a regular set of questions (i.e. short essays and calculations) on material covered since Test 3, and a set of multiple-choice questions covering material on the first three tests.
- Each of the three unit exams will now count 15% towards your final grade, and the final exam will now count 25% towards your final grade.