Preview Sheet for Test 1

Chapters 1 and 2 (and a tiny little bit of 21)
Lectures from 9/5 through 10/1; Problem Sets 1 and 2

The test will be on Monday, October 8, in Olin-Rice 100 (our normal classroom), starting at **7:30 a.m.** You will have 2 hours to work on the exam. (You cannot work past 9:30 a.m., out of fairness to those who have 9:40 classes, and to those who got up early enough to start at the specified time!)

Studying Strategies:

- Focus on your lecture notes and homework first, then look at your textbook. (See the course web page for class overheads and homework keys.)
- If a topic was not covered in homework or in lecture, you are not responsible for it!
- In addition, you are not responsible for the application of Kirchhoff's law typified by Atkins and de Paula Exercise 2.26(a). We will spend more time in Chapter 3 on using heat capacity data to calculate how enthalpy and entropy increase with temperature.
- Do extra problems at the ends of the chapters.
- It is important to understand concepts from lecture not covered explicitly in the homework problems. These will typically be covered by short essay questions.

Test Format: 50 points based on calculations, and 50 points based on short essay questions.

Here's a preview of the instructions:

1. Write your name in the space above and on the backs of the other pages.
2. Your exam booklet should have **eight pages** total, with questions on pages 2-6, formulas and constants on p. 7, and a periodic table on p. 8. Check to see you have eight pages now. If you do not, ask for another copy of the exam.
3. You may use programmable calculators, but chemical data should not be stored in them.
4. You should always demonstrate your thought process in writing. You will be awarded credit only for work I can decipher.
5. You have a maximum of **2 hours** to work on this exam.

Also note the formulas and constants you will be given on the exam (on back):

$pV = nRT$ $\quad p = \frac{1}{3}\left(\frac{n}{V}\right)m\langle c^2\rangle$ $\quad \sqrt{\langle c^2\rangle} = c_{\text{rms}} = \sqrt{\frac{3RT}{M}}$ $\quad \bar{c} = \sqrt{\frac{8RT}{\pi M}}$ $\quad E_{\text{K}} = \frac{3}{2}nRT$

$\frac{dV}{V} = \alpha dT$ $\quad \alpha = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_{\text{n,p}}$ $\quad \frac{dV}{V} = -\kappa_{\text{T}} dp$ $\quad \kappa_{\text{T}} = -\frac{1}{V}\left(\frac{\partial V}{\partial p}\right)_{\text{n,T}}$

$p = \rho gh = \frac{F}{A}$ $\quad p = \rho g(H-h)$ $\quad p = p_{\text{o}}\exp(-Mgh/RT)$ $\quad p = \frac{nRT}{V-nb} - a\left(\frac{n}{V}\right)^2$

$$Z = \frac{pV}{nRT} = \frac{pV_{\text{m}}}{RT} = 1 + \frac{B(T)}{V_{\text{m}}} + \frac{C(T)}{V_{\text{m}}^2} + \frac{D(T)}{V_{\text{m}}^3} + \ldots = 1 + B'(T)p + C'(T)p^2 + D'(T)p^3 + \ldots$$

$dU = \left(\frac{\partial U}{\partial V}\right)_{\text{T}} dV + \left(\frac{\partial U}{\partial T}\right)_{\text{V}} dT$ $\quad \left(\frac{\partial U}{\partial V}\right)_{\text{T}} = \pi_{\text{T}}$ $\quad \left(\frac{\partial U}{\partial T}\right)_{\text{V}} = C_{\text{V}} = nC_{\text{v,m}}$

$C_{\text{V}} = \frac{1}{2}nR$ for each continuous way to store energy $\quad dU = nC_{\text{v,m}}dT$

$\frac{N_{\text{f}}}{N_{\text{i}}} = \exp(-\Delta U/kT)$ $\quad \Delta U = q + w$ $\quad dw = -Fdl = -p_{\text{ext}}dV$

$pV^{\gamma} = \text{constant}$ $\quad \gamma = \frac{C_{\text{p,m}}}{C_{\text{V,m}}}$

$H = U + pV$ $\quad dH = \left(\frac{\partial H}{\partial p}\right)_{\text{T}} dp + \left(\frac{\partial H}{\partial T}\right)_{\text{p}} dT$ $\quad \left(\frac{\partial H}{\partial T}\right)_{\text{p}} = C_{\text{p}} = nC_{\text{p,m}}$

$C_{\text{V}} + nR = C_{\text{p}}$ $\quad dH = nC_{\text{p,m}}dT$ $\quad w = -RT\Delta n_{\text{g}}$

1 Pa = 1 kg m^{-1} s^{-2} 1 bar = 10^5 Pa 1 atm = 1.01325 x 10^5 Pa = 760 torr = 760 mm Hg

R = 0.0820574 L atm mol^{-1} K^{-1} = 8.31447 J mol^{-1} K^{-1} $\quad k$ = 1.38065 x 10^{-23} J K^{-1}

1 J = 101.325 L atm 1 J = 1 kg m^2 s^{-2} g = 9.80665 m s^{-2}

N_{A} = 6.02214 x 10^{23} mol^{-1} 1 L = 1 dm^3 = 10^3 mL T (K) = T(°C) +273.15