Key and guide to exam #1

Chemistry 341, (01:160:341), Fall 2014
Physical Chemistry of Biochemical Systems

Use the hints below to get you started on problems you had trouble with on the first exam. You should arrange to meet with me if you still don't understand how to do the problems.

Problem 1 See Eqs. 3.56 and 3.59; for part (d), see the discussion after Eq. 3.35, or re-read the footnote on p. 90.

Problem 2 There are lots of equations that involve H and T, but the one that determines how how the reaction enthalpy depends upon temperature is that $\Delta_r C_p = (d\Delta_r H/dT)_p$.

Problem 3 Start with $pV = nRT$ or $V = nRT/p$, and differentiate.

Problem 5 At the boiling point, $\Delta_{vap}G = \Delta_{vap}H - T_{vap}\Delta_{vap}S = 0$. Solve for T_{vap}.

Problem 6 (a) At 273 K, $\Delta_{fus}S = \Delta_{fus}H/T_{fus}$; (b) I intended to ask for the heat capacity *of fusion*; since the question was ambiguous, I gave everyone full credit for this part of the question. Since $\Delta_{fus}H$ was assumed to be independent of temperature, this implies that the heat capacity of fusion is zero; and hence that the entropy of fusion is also independent of temperature; (c) $\Delta_{fus}G(253K) = \Delta_{fus}H - (253)\Delta_{fus}S$; (d) determine the volume change upon freezing from the difference in densities: 90 cm^3; (e) since $dG = -SdT + pdV = pdV$ (if T is constant at -253K); (see the discussion immediately following Eq. 3.35 in the text.) Therefore $\Delta_{fus}G(253,p) = \Delta_{fus}G(253,1\,bar) + (p-1)\Delta_{fus}V$; set $\Delta_{fus}G(253,p)$ to zero at equilibrium, and solve for p.