

R5-Related Issues, Responses to Index Cards

Recitation Format

Surprisingly to me, a lot of people liked today's lecture-heavy format, primarily people in R1. However, almost as many people (of the people who mentioned it at all) wanted to go back to a more problem-solving oriented recitation. I may try the suggestion of lecturing *over* problems that I do on the board, if I can find suitable problems to cover everything in a short time-frame, but basically it will go back to a 50-50 split or so. I have also taken note of the desire for more emphasis on concepts instead of equations.

PS4 – general

Sorry for going over part of the problem set when you didn't have it in front of you. When I am planning my recitations – which I typically do *not* save for the last minute, ahem – I have to make an educated guess about whether you will have them or not. Hopefully if you took good notes they will make sense to you once you see the problems again. Also, some of the general concepts related to the problems didn't necessarily require the problems themselves, which I thought were better emphasized now than later.

PS4 – problem 3

I think I explained this well by R2, but for those of you in R1 let me explain my choice of taking off points if you started from the mixing equation, which we did not derive in class but which is available in the book. In the problem you were told to prove something, and the picture itself and the material we've covered (chemical potentials) was suggestive of how you might go about doing that. So if you only prove it by beginning with the mixing equation and making the mathematical argument ($x < 1$ so $\ln(x) < 0$), versus making the thermodynamic conceptual argument that gets you *to* that equation, then I don't think you've done what you could reasonably have inferred you should do. This is simply my subjective judgment. If your final grade is on the line, feel free to bring it up then.

PS4 - problem 5

I am not sure which part was confusing to who asked about it, so please be specific on your index cards. Let me reiterate that $\Delta G = \Delta H - T\Delta S$. If one of these state functions gets a superscript naught, so do they all. So although $\Delta G = 0$ at equilibrium, $\Delta G^\circ = -RT \ln K_p$, and ΔS° should be solved for accordingly. See me in OH or over email if you still have questions; you may also find lecture 12 useful – there you will see that ΔG° is just a reference state free energy change. In the future, we will try to inform you in a timely fashion if an answer in the book is wrong. Of course, feel free to ask me about it if you believe you have found an error.

Miscellaneous Questions

Confusion over sub- and superscripts for chemical potential. Subscripts refer to which component (e.g., “Zn” or “A”) is being described. Superscripts (e.g., “g” or “s”) refer to the phase. Some superscripts include a naught (e.g., “o, g”), which means that the component in that phase is at a specific reference state (typically $P = 1$ atm, and the temperature of interest) as opposed to at any given pressure. You don’t need to know the book’s notation, but if you want to, and if recitation didn’t clear it up, then please see me.

Had trouble understanding the Gibbs energies that are unique for each state. Okay, I think this was referring to the initial state and final state in the mixing problem. I compared this process to subtracting product and reactant formation free energies in a chemical reaction process. Since molar Gibbs energy is the same as chemical potential, the Gibbs energy of the two states is the sum of μ_A in the solution and μ_B in the solution (final state), versus μ_A in its pure state and μ_B in its pure state (initial, separated state). As you saw in problem 2, chemical potential of the *same* component in its pure state versus in a solution are *not* equal. Hope that helps.

How do we know what expressions like $(dF/dT)_V = -S$ are? For first derivatives, it comes right from your state function expressions. On the one hand, $dF = -SdT - PdV$. On the other hand, $dF(T, V) = (\delta F/\delta T)_V dT + (\delta F/\delta V)_T dV$ (I’m using deltas instead of dels so I don’t have to go into equation editor; yes, sometimes I’m lazy). You just compare those two expressions, so make sure you have them in your notes for an exam. For the second derivatives, you have to do a little more work, but basically they will come out to either an expression using heat capacity or one using compressibility, and you can learn and note down those two patterns. As always, I’m available in OH and over email.

lecture vote: 6 clear, 3 suggestive (mostly R1)
problems vote: 4 clear, 2 suggestive (mostly R2)
mixed vote: 5
not mentioned: 9