November 4, 2010: CH301 Random Musings—Every Problem for the Rest of the Course

1.Exam 2 results—still waiting on a final decision for exam 2 make-up. Sadly, with Travis on another continent, possibly never to return again, we are in a waiting mode before I make final decisions on the make-up exam. I do know that the regular exam had an average of 83 after killing one question for which the correct answer was not correctly programmed. As for the make-up, it currently sits at a 60, which is unfortunate. I need to find out whether this is a statistically valid result. I do know that at least two questions will be killed because they have ambiguous (multiple) correct answers. So please be patient, I apologize for the delay.

2. **Southpark does thermodynamics.** You don't produce two college age males without watching a lot of Southpark. So you can imagine my dismay, when about eight years ago, mid-November, 2002, while watching epidsode 612, The Death Camp of Tolerance, I was deeply saddened to hear the following, utterly shocking statement from Mr. Garrison:

[South Park Elementary, day, Garrison's class. Mr. Garrison enters, having previously set up a chemistry experiment on the teacher's desk.]

Mr. Garrison: Okay, children, let's take our seats. Uh, apparently, none of you tried to get me fired yesterday, so I guess we're just gonna have to go on and learn more today. [*sits on a corner of the desk*] Now who can tells me what happens to water when we heat it up in the Bunsen burner?

Butters: It evaporates.

Mr. Garrison: Good, Butters. Now if we take the glass tube of the Bunsen burner, we can also see how other things react. [*takes the tube in hand and walks over to Mr. Slave*] Evaporation is an exothermic reaction, so let's look at an endothermic one…..

NOOOOOOOOOOOO!!!!!!!!

You see, the problem is Mr. Garrison wasn't "being the system". If you will "be the system" you realize that water evaporating is an endothermic process, because you are adding heat to the system (ΔH is positive.) He should have said Evaporation is an endothermic physical process

Anyway, you know it is hard enough trying to get students to "be the system" without having it contradicted by cable television. So very, very sad.

3. Signing up for my class—yesterday and today you were added to my course, by hand, if you indicated you wanted into the course on a form you turned in to me. Now be aware that when you are dealing with 100s of pieces of paper, mistakes happen. So don't get upset, just e-mail and let me know if you weren't added. By the way, the reason might be that you signed up for another 302 course, that you signed up for a course in my time slot, or that you signed up for more than the maximum hours. Those issues are not my problem. Fix them, and I will be able to add you.

Be aware that for whatever reasons a lot of people would like to take my class, and that I have a massive wait list to add. If you don't want to stay but then later ask to get back in, or get dropped because your parents don't pay your fee bill, or don't pass the course, then chances of being added back in are small. So be respectful of the narrow window of opportunity for getting in. I can't add folks passed the capacity of the room.

4. Schedule for the rest of the course. Is the semester really almost over?

20	H	11/4	Quantitative Thermodynamics	
21	T	11/9	Statistical Thermodynamics	
22	H	11/11	Internal Energy	Quiz 5
23	T	11/16	Internal Energy and Entropy	
24	H	11/18	Entropy	
24	T	11/23	Entropy and pie and ice cream and Periodic Table-off	Quiz 6
25	T	12/1	Free Energy and the big final musings	
W		12/2		Exam 3 Lectures 18-25

5. Quiz 5 is next Thursday with the question types presented below:

- Bomb calorimeter calculation
- Hess' Law and calculating enthalpy changes
- Bond energy calculation
- Work calculation
- Sign convention
- Predicting entropy change
- Temperature dependence of reaction spontaneity
- Theory (laws, state functions, etc.)

6. Worksheets 11 and 12 were posted Monday to help you prepare for the quiz. A practice quiz 5 will be posted this weekend in the Portal on Friday and a TA practice quiz will be posted on Sunday or so.

7. Question Types. What better way to spend the Thanksgiving holidays than studying, and what better way to study than to sink those question types for the class into your brain before you begin to study. So here you go, Quiz 6, Exam 3 and Final Exam question types for the rest of the semester, reproduced at the bottom of the musings.

8. My discussion sessions next week will be in my office on Monday and Tuesday, and in the classroom on Wednesday and Thursday. I need to have a TA sub for me on Monday.

9. Extra Credit Opportunities. As promised, here is an opportunity to add 1% to your total course grade.

Extra Credit 1. The Instructions.

- I want you to teach a science-hater something interesting about chemistry that you have learned in this class. The person you teach has to say to you, "gee, I had no idea chemistry was that interesting" when you have finished (you can make them say it even if they don't mean it.). You can choose what you teach but I would recommend that it be something of interest and utility, like the complications of cooking at high altitude if you happen to be skiing at Thanksgiving, or why South Park was wrong about evaporation or why Jesus would have a harder time walking on liquid nitrogen than water or how ozone is polar even though it has no electronegativity difference between the O atoms. Choose anything from the course and have a fine conversation.

- Submit the assignment as simple text in an e-mail (no attachments)

- Use the specific text written below as the subject heading of the e-mail:
  EC1f10—your uteid
  and send it to dalaude@mail.utexas.edu.

- If you do not provide the correct subject heading and your UTEID, you will not receive credit.

- Due Date: December 3 at 5 p.m.

10. Poetry corner. Okay, I know I am supposed to do happy poetry only for the rest of the semester, but I can't, completely, so what about subbing some deeply personal, really good, very, very sad poetry. Here are poems from two of the very greats, Keats, who died tragically of tuberculosis at age 25, three years after writing "when I have fears that I may cease to be", and Yeats, who lived a zillion years but spent his entire life chasing Maud Gonne, a glimmering red-head who spent much of her life leading him on, evidently to fuel him with enough angst to write about a hundred poems about how sad he was he could never have her.

When I have fears that I may cease to be
Before my pen has glean'd my teeming brain,
Before high-piled books, in charactery,
Hold like rich garners the full ripen'd grain;
When I behold, upon the night's starr'd face,
Huge cloudy symbols of a high romance,
And think that I may never live to trace
Their shadows, with the magic hand of chance;
And when I feel, fair creature of an hour,
That I shall never look upon thee more,
Never have relish in the faery power
Of unreflecting love;--then on the shore
Of the wide world I stand alone, and think
Till love and fame to nothingness do sink.
- John Keats

Song of the Wandering Aengus

I went out to the hazel wood,
Because a fire was in my head,
And cut and peeled a hazel wand,
And hooked a berry to a thread;
And when white moths were on the wing,
And moth-like stars were flickering out,
I dropped the berry in a stream
And caught a little silver trout.
When I had laid it on the floor
I went to blow the fire aflame,
But something rustled on the floor,
And some one called me by my name:
It had become a glimmering girl
With apple blossom in her hair
Who called me by my name and ran
And faded through the brightening air.
Though I am old with wandering
Through hollow lands and hilly lands,
I will find out where she has gone,
And kiss her lips and take her hands;
And walk among long dappled grass,
And pluck till time and times are done
The silver apples of the moon,
The golden apples of the sun.
-- William Butler Yeats

Question Types for the Rest of the Course
Quiz 6 question types.

- Statistical thermodynamics theory
- Statistical thermodynamics internal energy calculation ($E = 0.5kT$)
- Statistical thermodynamics positional entropy calculation ($S = k \ln W$)
- Internal Energy theory
- Internal energy calculation ($\Delta U = q + w$)
- Ranking system entropies
- Calculation of ΔS from heat transfer ($\Delta S = q/T$)
- Calculation involving the second law equation ($\Delta S_{univ} = \Delta S_{sys} + \Delta S_{surr} > 0$)

Exam 3 Question Types
Chapter 6
1. Theory: First Law of Thermodynamic
2. Definition: Enthalpy
3. Signs for thermodynamic quantities
4. Definition: state functions
5. Definition: Heats of formation
6. Definition: Heat capacity
7. Calculation: Bomb calorimeter
8. Calculation: Hess' Law and heats of formation
9. Calculation: Hess's Law and combined reaction enthalpies
10. Calculation: Statistical mechanics determination of internal energy
11. Calculation: Bond energies
12. Calculation: Work calculation
13. Definition: Internal Energy
14. Theory: Calorimetry
15. Calculation: Internal Energy calculation (q and w)

Chapter 7
1. Ranking: Predicting entropy change in a chemical reaction
2. Calculation: Entropy change at a phase transition
3. Theory: Second Law of Thermodynamic
4. Theory: Third Law of Thermodynamic
5. Theory: Statistical thermodynamics and entropy
6. Ranking: Statistical thermodynamics, ranking molar entropy in a compound
7. Calculation: Statistical thermodynamics, Boltzmann formula calculation
8. Problem: Predicting compound stability from ΔG_r°
9. Calculation of ΔS from heat transfer
10. Calculation of phase transition temperature using the Gibbs equation at equilibrium
11. Calculation involving the second law equation
12. Theory: The temperature dependence of ΔG_r°
13. Problem: temperature dependence of reaction spontaneity for a chemical reaction
14. Problem: predicting compound stability from ΔG_r°
15. Calculation: ΔG_r° from table values of ΔH_f° and S_f°

CH301 Fall 2010 Final Exam Question Types

Chapter 1
1. Calculation: electromagnetic radiation spectrum
2. Theory: Balmer, Rydberg and atomic spectra
3. Theory: particle in a box
4. Calculation: uncertainty principle
5. Calculation: deBroglie equation
6. Theory: Schrodinger and wave equations
7. Problem: applying quantum number rules
8. Theory: Aufbau, Pauli and Hund
9. Problem: electronic configurations
10. Definition: periodic table nomenclature
11. Theory: periodic trends: IE, EA, AR, IR
12. Ranking: periodic trends: IE, EA, AR, IR

Chapter 2
13. Ranking: crystal lattice energy
14. Problem: Lewis structures of ionic compounds
15. Problem: Lewis structures of covalent compounds
16. Problem: Lewis structures of covalent compounds
17. Problem: Lewis structures of covalent compounds
18. Problem: formal charge
19. Problem: formal charge and correct Lewis structures
20. Ranking: EN, bond energy, bond length

Chapter 3
21. Ranking: dipole moments and bond polarity
22. Problem: molecule polarity from VSEPR
23. Problem: VB theory of hybrid orbits
24. Problem: electronic and molecular geometry
25. Problem: σ and π bonds in molecule
26. Problem: AOs that comprise MOs in a bond
27. Problem: filling MOs of diatomic molecules
28. Calculation: bond order from MO
29. Problem: paramagnetism from MO
30. Ranking: bond length from bond order

Chapter 4
31. Calculation: ideal gas law
32. Calculation:reaction stoichiometry and PV=nRT
33. Calculation: relative ratio of gas speeds
34. Theory: gas non-ideality

Chapter 5
35. Theory: intermolecular forces
36. Definition: physical properties of solutions
37. Problem: assigning IMF to molecules
38. Ranking: physical properties by IMF
39. Ranking: physical properties by IMF
40. Identifying types of solids

Chapter 6
41. Theory: thermodynamic laws
42. Theory: systems, surroundings and signs
43. Problem: Signs for systems and surroundings
44. Definition: state functions
45. Definition: heats of formation
46. Calculation: bomb calorimeter
47. Calculation: Hess' law and heats of formation
48. Calculation: Combined reaction enthalpies
49. Calculation: bond energies
50. Calculation: work calculation
51. Theory: internal Energy

Chapter 7
52. Problem: predicting entropy change
53. Calculation: entropy change at a phase transition
54. Theory: statistical thermodynamics
55. Calculation: statistical thermodynamics
56. Calculation of phase transition temperature
57. Calculation involving the second law equation
58. Problem: Predicting compound stability
59. Calculation: ΔG_r^o from values of ΔH_f^o and S_f^o
60. Problem: T dependence of reaction spontaneity