November 11, 2008: CH301 Random Musings—Every Problem for the Rest of the Course

0. Exam 1 results. As mentioned last week, the results for the second exam were very good with an average of about 75. Not questions were tossed. The make-up exam was a different story. Several questions were tossed because of bad programming including two with multiple correct answers and two where the ranking was backward (though most understood the issue.) The average for the make-up exam was about a 64 after the corrections—not great, but acceptable.

1. **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 six 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. Fixing the schedule. If you will recall from the beginning of the semester, I got the week for Thanksgiving wrong and that messed up the schedule

20	H	11/6	Qualitative Thermodynamics	Worksheet 11
21	T	11/11	Quantitative Thermodynamics	
22	H	11/13	Statistical Thermodynamics	Worksheet 12
23	T	11/18	Internal Energy	Quiz 5
24	H	11/20	Entropy	Worksheet 13
24	T	11/25	Entropy and pie and ice cream	Quiz 6
25	T	12/2	Free Energy	
W		12/3	Exam 3	Lectures 19-25

4. Most importantly I have delayed the fifth quiz till next week. My whole schedule was thrown off by having exam 2 take place later in the schedule than usual and it really hasn't allowed time for students to gear up for thermo. So Quiz 5 is now on Tuesday the 18th.

5. Quiz 5 is next Tuesday 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.)

Worksheet 11 will help you prepare for questions 2 through 7 and worksheet 12, which will be posted later in the week, will round out your preparation. A practice quiz 5 will be posted this weekend.

6. 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.

7. My discussion sessions this week will be in my office. Next week they will be in the classrooms Monday and Tuesday.

8. Extra Credit Opportunities. About 45 of you crowded into my office last Tuesday, evidently to inspire me to provide extra credit opportunities. So here is one that will be worth 1% of your course grade.

Extra Credit 1.

• 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:
thanksgiving extra credit—your uteid
and send it to dalaude@mail.utexas.edu

• If you do not provide your UTEID you will not receive credit.

• Due Date: December 5 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

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.

Quiz 6 question types.

- Statistical thermodynamics theory
- Statistical thermodynamics calculation
- predicting compound stability from ΔG_r°
- Calculation of ΔS from heat transfer
- Calculation of phase transition temperature
- The temperature dependence of ΔG_r°
- Calculating ΔG_r° from table values of ΔH_f° and S_f°
- Calculation involving the second law equation

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 and Third Laws of Thermodynamic
4. Theory: Statistical thermodynamics and entropy
5. Calculation: 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 2008 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: assigning 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: Covalent Lewis structures
16. Problem: Covalent Lewis structures
17. Problem: formal charge assignment
18. Problem: formal charge and correct structures
19. Ranking: trends in EN, bond energy and length
20. Calculation: EN difference

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: number of 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: 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: systems, state functions and laws
42. Theory: sign convention
43. Problem: assigning signs to state functions
44. Theory: Energy and Statistical Thermodynamics
45. Calculation: bomb calorimeter
46. Calculation: Hess' law and heats of formation
47. Calculation: Combined reaction enthalpies
48. Calculation: bond energies
49. Calculation: work calculation
50. Theory: internal energy
51. Calculation: Internal Energy

Chapter 7

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