

CH302 Random Musings April 9, 2010—All the Extra Credits

0. Etiquette Corner. It is amazing how as we grow more comfortable in a setting we tend to forget what makes it possible for human beings to exist in each other's company without wanting to tear them apart limb from limb. Yes, etiquette is what keeps us civil and the loss of it makes us, at best, not very nice to each other. I can't control your ability to be civil in the rest of your life, but I can do my best with respect to this course. So a simple reminder that will serve as a guide to perfect classroom behavior, just remember the following and let it guide your actions:

You are not the center of the universe.

If you remember this, then while I am lecturing you will know that if you talk to your friend, hug in the aisles, develop a sudden urge to leave, decide to update your facebook page, or eat a bag of potato chips, you are keeping someone else from learning. And that isn't right.

Thank you.

1. The score for exam 2 was a 78 for the Thursday exam, the highest in the history of the equilibrium exam in this course. The make-up exam score was not so good—actually it was a perfectly bimodal distribution with the half of the students who knew the material earning an average a little over 80 and the half who did not having an average around 50. I still haven't had time to address individual concerns about questions—my time is really stretched right now, but I will get to it soon. Sorry about the delay.

2. This is where I remind you to never give up. Many of you came to see me in preparing for the second exam after struggling on the first—some did much better. Some are still getting used to how to do well on this kind of exam. But you have to keep after it. All it takes is getting everything under control and in your head for just one glorious 3 hour period during the final exam in May, and you can have your A for the course as well. To help you prepare, I provide the question types from the final exam at the bottom of the musings.

3. Some good news--the last third of the semester prepares you for the last exam of the semester, one that typically has the highest averages, often in the mid to high 80s. Why? There is a lot of descriptive chemistry to end the course-- a lot of qualitative material that students tend to manage well. To help you get started studying for exam 3, the question types are found at the bottom of the musings.

4. Of course another reason students did well on the second exam is that the electrochem wasn't included. But it is material to be found on the third exam and makes up the entire fifth quiz which is one week from today. It concerns me that office hour attendance has been very poor this week as folks decompress from the second exam and work in other courses. But this coming week will really need some hard work on the electrochemistry material.

5. The 8 electrochemistry question types are listed below. As always I will provide an electrochemistry practice quiz this weekend and the TAs will provide another Sunday or Monday.

- Identifying oxidation and reduction in a chemical reaction
- Balancing a chemical reaction in acid or base
- Assigning cell convention in an electrochemical cell
- Understanding the table of standard half cell reduction potentials
- Calculating a standard cell potential
- Nernst equation calculation
- Ranking oxidizing and reducing agents
- Stoichiometry calculation using the Faraday

6. We are on to kinetics so as we start, here is an example of kinetics from my own life involving kinetics:

Dave figures out how to save hundreds of dollars on potatoes over his lifetime using kinetics concepts

Often I shop at WalMart for groceries because they are so darn cheap. Consequently I end up being able to buy a 10 pound bag of potatoes for the cost of a 5 pound bag elsewhere. The problem is that I don't like making mashed potatoes every night of the week, so the potatoes end up sitting around. Before I know it, they have grown those nasty tentacles, which are so disgusting I end up throwing the potatoes away. Like clockwork, every second week, boom, five pounds of tentacled left-over potatoes tossed—I might as well be shopping at Randall's. Then one day I remembered my kinetics and how maybe all that stuff about rates of reactions of chemicals applied to potatoes as well. I stuck a bag of potatoes in the refrigerator in the garage, and have kept it there for 3 months— no tentacles at all. The only problem is that they are in the garage so I forget I have them and the rate of eating mashed potatoes has gone way down as storage time has soared.



2 months in a refrigerator --yummy mashed potatoes



2 months in the pantry--too gross for words

What is particularly enlightening here is that the data that I collected for this kinetics experiments--

concentration versus time data at two different temperatures

The data:

Day	tentacle length (78°F)	tentacle length (35°F)
1	0	0
2	0	0
3	0	0
4	0	0
5	2	0
6	3	0
7	5	0
8	7	0

Rate of tentacle growth between days 7 and 8:

$$\begin{array}{l} (35^\circ\text{F}) \quad 0 \text{ mm per day} = (0-0)/(8-7) \\ (78^\circ\text{F}) \quad 2 \text{ mm per day} = (7-5)/(8-7) \end{array}$$

is exactly the kind of kinetics data that you collect for any kind of kinetics experiment--see worksheet 12 from 2008 which is a really good worksheet to do:

<http://laude.cm.utexas.edu/courses/ch302/ws12s08.pdf>

and the source material for next Tuesday's lecture. Note that the data sets are just like the potato data:

concentration versus time data at two different temperatures

The data:

Seconds	300K	310K
0	Unknown starting [C]	Unknown starting [C]
1	.12 M	.074 M
2	.074 M	.027 M
3	.044 M	.009 M
4	.027 M	.0036 M
5	.016 M	.0013 M
6	.009 M	.0005 M
8	.0036 M	.000067 M
10	.0013 M	.0000091 M

7. A bit of advice on what makes kinetics so challenging. In a word: vocabulary. Unlike acid base equilibrium where I spent 2 months teaching you how to reduce the problems to simple common forms like A^- or BH^+ , the material in kinetics is very broadly and quickly covered and involves concepts that will be unfamiliar even to people who had a lot of chemistry in high school. And to top it off, look at why it all seems like such a blur as you consider trying to distinguish the following phrases from one another:

- Rate
- Rate expression
- Rate constant
- Differential rate law
- Integrated rate law
- Method of initial rate
- Rate determining step

Very simply, if you can't explain EXACTLY how each of these is defined, you can't solve kinetics problems.

8. Oh, and here are the question types for quiz 6 which is coming up in a few weeks

- assigning rate expressions
- method of initial rates
- identifying order of reaction from rate constant
- Arrhenius calculation
- integrated rate law calculation
- half life calculation
- kinetic theory--collision and transition state concepts
- reaction mechanism

9. Extra Credit assignments and your course grade. No, I don't curve. But as mentioned, I will be offering three extra credit opportunities in this class, each worth 1% of your grade. This is what I do rather than "curving" because I am sure that no one in here wants to get a grade they haven't earned.

So here are the details on earning your 3 extra credit. Procedures for turning in extra credits all follow the extra credit process used for Extra Credit 1--you must follow these in order to get the points--please don't make my life difficult by not doing what you are told.

Procedure:

- Complete the extra credit task below.
- Write it up (probably 100 words or so, but write as much as you want to tell the story.)
- Submit it as plain text in the body of the e-mail (no attachments!!)
- Include your uteid when you identify yourself in the e-mail.
- Send it to dalaude@mail.utexas.edu by the deadline
- Jump for joy at having earned 1% of your course grade

Extra Credit Assignment 1:

- Title: **EC1s10 Spring Break** (If you do not use this subject you will not be filtered into the file from which I assign extra credit.)
- Due Date: I have set this twice and about 97% of you have gotten it in. The rest should do so as well, ASAP.

Instructions. During spring break I want you to teach a science-hater something interesting about chemistry that you have learned in this class. To get the points, 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 spring break or why fish explode if you happen to be at the beach, or why South Park was wrong or the value of adding salt to water to boil your pasta or why you shouldn’t add pure antifreeze to your car or why water balls up on windshields or how neutral water isn’t always pH 7 and on and on. It is your choice.

Extra Credit Assignment 2:

- Title: **EC2s10 Research** (If you do not use this subject you will not be filtered into the file from which I assign extra credit.)
- Due Date: Saturday May 8 at 3 am

Instructions. Go to the undergraduate poster session on Friday, April 16th, sometime between 11 am and 3 pm in the Welch Foyer (right outside this classroom.)

For details, see: <http://cns.utexas.edu/research/undergraduate-opportunities/undergraduate-research-forum>

Find a poster you like, talk to the person standing in front of it for 5 minutes, and then going home and email me about your experience. Spend a few sentences telling me who did the poster, why you liked the poster and how neat it is to see that students your own age are doing world class research that you could also be doing with a little initiative.

For those of you who can’t go to the poster session, an alternative bonus opportunity is to walk through a science building on campus on the upper floors, staring at the walls. You will see scads of research posters that are up for your perusal. Just take a look at one of those and email me with the same instructions as above except include the name of the first author on the poster.

Extra Credit Assignment 3:

- Title: **EC3s10 Lecture** (If you do not use this subject you will not be filtered into the file from which I assign extra credit.)
- Due Date: Saturday May 8 at 3 am

Instructions. This campus is littered with seminars of a scholarly nature that occur in addition to the normal course lectures that are given. Every department will hold literally hundreds of these a year. You will see signs for these posted everywhere. For example, while walking to a help session last week in Geological Sciences, the first four doors I passed, had descriptions of four entirely separate events that were holding multiple scholarly lectures. Typically these talks are about 50 minutes in length with a question answer period and occur in the late afternoon. They occur non-stop, year round, and should become part of your academic experience as you evolve into an intellectual force on campus. Some of you questioned might ask whether concerts or plays might be considered, or whether the presentation has to be about science. My response is that you must establish a relevance to your academic interests. So if you are a pre-med history major I can see going to a talk about breast cancer cures or why Rome fell, but I am not sure you can justify the ballet. But really, I leave it to you to make the justification as part of your explanation of the experience.

10. There is no way in the world that we will collect all 1500 extra credits without something getting messed up. PLEASE PLEASE PLEASE do not treat this as life and death. I guarantee that we will provide a mechanism for you to check whether you received credit and to rectify any errors before grades are assigned. But sending me panicked e-mails asking if you got credit is not the way to do it.

11. Poetry Corner. Student Poetry makes a difference. Most of the student poetry I receive has little impact on the world, even when it gets published in my random musings. One exception is the following poem that was written last year and is the reason I didn't put electrochemistry on the second exam. I guess someone could write a poem that would convince me not to put it on the third exam either..... but it would have to be a heck of a good poem.

The Night Before

With lines upon lines upon two supersized screens
Creates splitting headaches that forces me to scream,
“Why, Dr. Laude, why? Why are you so mean?”

Within barely four classes of electrochemistry,
 (And after seven nights where I lost the ability to see)
You inform me of a test, how can this be!?!?

No, seriously, is this a joke?
A shenanigan meant to make me choke
 On my Spring Break lies, when I told the old parental folks

Which I'll happily quote, as, “Yes daddy-o, I did try my first drink and boy it was sweet!”
Then I passed out on my toilet with not another peep
But now sir, I will admit: I drank myself into a hole; it was very, very deep.

So for the last time, I beg on one knee,
That I'll promise to learn: electrochemistry.
But you must first postpone this test, please, PLEASE, **PLEASE!**

No?!? Why, Dr. Laude, why? Why are you so mean?
You've created splitting headaches that forces me to scream
“I hate all these lines upon lines upon two supersized screens!!!!!”

Question types for Exam 3 are found below:

Question Types for Electrochemistry

1. balancing a chemical reaction in acid or base
2. assigning cell convention in an electrochemical cell
3. understanding the table of standard half cell reduction potentials
4. Nernst equation calculation
5. ranking oxidizing and reducing agents
6. stoichiometry calculation using the Faraday
7. current calculation
8. calculation involving relationship between E, K and ΔG
9. famous battery

Question Types for Kinetics

10. calculating reaction rates
11. method of initial rates
12. integrated rate law calculation
13. integrated rate law calculation (half life)
14. extracting information from straight line plots
15. kinetic theory—collision
16. kinetic theory—transition state
17. combined Arrhenius calculation
18. reaction mechanisms
19. E_a and energy profiles
20. famous catalysts

Descriptive Chemistry

21. properties and reactivity of alkali metals
22. properties and reactivity of alkali earths
23. properties and reactivity of the B family
24. properties and reactivity of the N family
25. properties and reactivity of the C family
26. properties and reactivity of the O family
27. properties and reactivity of the halogen family
28. famous names chemical manufacturing processes
29. identifying famous gemstones

Organic Molecules

30. hydrocarbon isomers
31. naming organic molecules
32. naming organic molecules
33. organic polymer chemistry
34. biomolecule structure
35. biomolecule structure

The 60 questions on the final exam

Chapter 8

1. Theory: temperature and physical equilibria
2. Theory: dissolving gases, liquids, solids
3. Theory: dissolving gases, liquids, solids
4. Ranking: miscibility of liquids
5. Problem: phase diagram navigation
6. Calculation: ΔH for heating across phases
7. Calculation: vapor pressure in binary system
8. Calculation: Clausius Clapeyron
9. Ranking: Van't Hoff and solution conc.
10. Calculation: colligative property

Chapter 9

11. Setting up K from equilibrium expression
12. Calculation: equilibrium concentrations from K
13. Problem: Reaction direction from Q and K
14. Problem: LeChatelier and reaction direction

Chapter 10,11

15. Temperature dependence of K_w
16. Ranking A/B strength from K values
17. Approximations of A/B equations
18. Simple A/B calculation (strong, weak, buffer)
19. Simple A/B calculation (strong, weak, buffer)
20. Identifying buffers (after neutralization)

21. Buffer neutralization calculation
22. Identifying features of a titration curve
23. Titration strong A/B with strong A/B
24. Titration weak A/B with strong A/B
26. Estimating solubility from K_{sp} values
27. Calculating molar solubility from K_{sp}
28. Common ion calculation, K_{sp}
29. Equilibrium expressions for a polyprotic acid
30. Amphoteric polyprotic acid calculations
31. Mass and charge balance
32. Equilibria Calculations: dilute solutions

Chapter 12

33. relating E, ΔG and K
34. balancing redox equations
35. ranking oxidizing and reducing agents
36. stoichiometry calculation from current
37. interpreting electrochemical cell diagrams
38. cell convention: electrolysis versus voltaic
39. understanding standard reduction potentials
40. calculating cell potentials (not Nerst)
41. calculating cell potentials (Nernst)

Chapter 13

Question Types for Kinetics

42. assigning rate expressions
43. calculating reaction rates
44. units of rate constants
45. method of initial rates
46. integrated rate law calculation
47. extracting information from straight line plots
48. kinetic theory
49. Arrhenius equation theory
50. combined Arrhenius calculation
51. reaction mechanisms
52. E_a and energy profiles
53. Famous catalysts

Descriptive Chemistry

54. properties and reactivity of main group elements
55. properties and reactivity of main group elements
56. properties and reactivity of main group elements
57. Famous names chemical manufacturing processes
58. naming organic molecules
59. organic polymer chemistry
60. biomolecule structure