Chem 106 Hour Exam 3 (Final) Study Guide (Computers, UV-Vis, XRF-Putirka, XRF-Zellmer, Electrochem)
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100 points (Exam sums to 152, scored on 137)

Directions: Answer all questions in the spaces provided. Most questions require a diagram and/or a brief explanation. I will grade all questions for partial credit. Note that points can be missed. The maximum score on this exam will be 100 points.

OK, here's your study guide. The exam is 8 pages long, about the same as previous hour exams. As you can see from the exam header above, it covers the lectures on computers and computer interfacing, the molecular absorption (UV-Vis) lectures I gave, Dr. Putirka's lectures on XRF, and my follow-up lecture on XRF on Mars. The exam concludes with questions on Electrochemistry, with emphasis on Voltammetry.

Under computers, I will first ask you to identify and describe all the computerish components there were on the instruments we all used this semester. Review all the computer interface components I described, and know what the inner parts of the computers themselves are that make this all happen. Be sure to review any special terms used. In some cases, the instrument used didn't have one of the computer components you will be asked to describe. In that case be prepared to explain how the function was carried out anyway. You all were asked to describe these instruments when you wrote your lab reports. If all you did on your reports was download a generic block diagram from my Modular Zoo and make some general statements, this could come back to haunt you.

Oh, I have a bits and bytes question too.

Under the UV-Visible questions, be familiar with the spectral characteristics of light sources, cells and other optical materials, detectors, etc. Be able to describe all the parts of the monochromators we used, and don't forget about the differences between slit width and bandwidth and how these will affect the appearance of a spectrum. Know how to select a good wavelength region, and what will happen if you don't. Be prepared to describe how to use chemometric methods, and when we may need to use those. Also, why do absorption or emission spectra for molecules have the shapes they do.

You had two lectures on XRF. Dr. Putirka described what makes XRF work, how his wavelength-dispersive instrument works, how his instrument makes X-rays, how the X-rays are separated by wavelength using Bragg's Law, how X-rays are detected, what X-ray spectra look like, and how they are related to atomic number, Z. Finally, what is sample prep like for quantitative work and for qualitative work? What are the pitfalls of poor sample prep? Why is good quantitative analysis so tricky that it requires special calibration and computer software?

I had a small presentation on how a working XRF can be built into a soup can and put on Mars. How does it produce the X-rays or other excitation needed? How does it separate the X-rays by wavelength or by energy? What kinds of X-ray detectors does it use? How does it phone all this information home?

I asked you to read a lot of stuff about electrochemistry, but I tried to limit my questions to those parts I discussed with you in lecture. Make sure you know how a three-electrode potentiostat works, what it controls, and what it measures. Be able to draw diagrams. Then be able to describe all the diffusion-controlled voltammetry stuff, including Fick's Laws. Be able to use diagrams to explain how current varies with time and voltage both in still systems and in stirred or flowing systems. Then be able to apply this to some real-world applications such as those I described (cyclic voltammetry, anodic stripping, voltammetry in stirred or flowing systems). In other words, it's from my lectures!

Good luck! I'll see you Tuesday at 8:45 am. We will have to find out which rooms are open to us; we might end up in lab.