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### CHMY 421.00: Advanced Instrumental Analysis

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## Chemistry 421 Advanced Instrumental Analysis Spring Semester 2020

**Professor:** Mike DeGrandpre, Chemistry Bldg 318, phone: 243-4118, email: [michael.degrandpre@umontana.edu](mailto:michael.degrandpre@umontana.edu), also <http://hs.umn.edu/chemistry/people/default.php?s=DeGrandpre> for additional information. Office hours are during lab hours, 9:10-12:00 Mon.-Thurs. or by appointment. **Please go through my lab door, Room 317, to get to my office (not through 318).**

**TA:** Beth Shetler

**Lab:** Room 004. Open 8 a.m. to 5 p.m. Mon. – Fri.

**Texts:** Required: *Principles of Instrumental Analysis*, 6th ed (2007) Skoog, Holler, and Crouch. Also, *Quantitative Chemical Analysis* by Harris, or any other Quantitative Analysis textbook, is a helpful resource.

**Prerequisites:** CHMY 311 or its equivalent is a prerequisite. Please talk to me if you have not taken this course. I assume you have good wet chemistry skills, e.g. ability to use volumetric glassware/pipettes, analytical balances, perform dilution calculations, make up calibration standards, etc. Familiarity with Excel and basic data analysis, e.g. simple statistics, linear regressions, etc. is essential.

**Course objectives:** In this course you will **1)** obtain a solid foundation on the theory and practice of instrumental methods used in modern chemical laboratories and **2)** improve your laboratory, data interpretation and technical writing skills. The goal of this course is to develop your lab and instrument (and problem solving!) skills to a point where you can work with confidence in a modern chemical laboratory. To achieve this goal, you will work more independently than you have in previous lab courses. Most experiments are structured to first illustrate the basic operating principles of each instrument followed by analysis of an unknown sample. You will complete the semester with a forensic analysis project where you must identify and quantify an unknown contaminant.

**Course logistics:** To allow individual access to instruments, it is necessary to run the lab outside of the 6 lab hours scheduled for each section and to team up with a classmate. All students must work in groups of two<sup>1</sup>. The lab will be open from **8 am - 5 pm Mon-Fri**. This open schedule requires that you be self-disciplined and well-organized (**and safe, see Lab Safety below**). During each lab introduction, it is critical that you take detailed notes when I explain how to operate an instrument so that you can perform the experiments later without repeating explanations or making mistakes. **If you are uncertain about a procedure please ask – personal injury or equipment damage may result if proper procedures are not followed.**

**Lab notebooks and reports:** A bound lab notebook with numbered pages is required. Your lab

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<sup>1</sup> However each person must analyze their own unknown. Lab group multi-tasking, e.g. one person preparing standards while another does the analyses is not allowed. All lab mates must participate in every aspect of the lab.

notebook must be present and open in lab for recording procedures, data, and observations. The notebook and lab report formats are described below. A laboratory report will be turned in for each lab. **All laboratory reports are due in my mailbox at 5 pm on the Tuesday of the week following completion of each lab.** Late reports lose 10% each day thereafter.

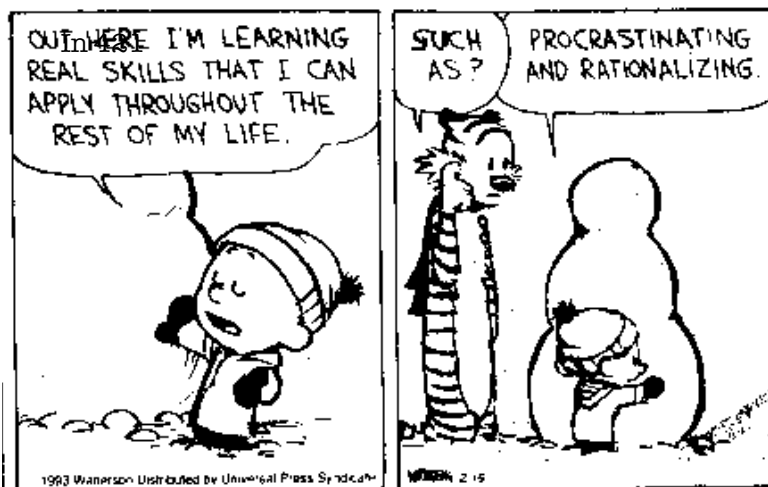
**Lab Safety:** Safety goggles or safety glasses are required. Open toed shoes, food and beverages are not allowed. Working in the lab outside of designated lab hours is not allowed. Corrosive, toxic, and flammable chemicals are used in this class. You must use good judgment when handling all chemicals, e.g. use the hoods when working with volatile substances or gloves when using toxic chemicals. Specific hazards regarding the chemical instrumentation are presented in each lab handout. Please note locations of the eyewash and shower stations. Cleanliness is also an important aspect of a safe laboratory. Please keep the lab clean. **Not following safe lab practices will result in up to a 5% grade reduction.**

**Other Stuff:** You will need some sort of data storage device (e.g. USB flash drive) for saving data files. Do not rely on the lab computers for storage. Files may be inadvertently deleted. Lastly, we appreciate your help maintaining the lab. Please keep the printers loaded with paper, throw away (or recycle) used paper, fill distilled water (DW) bottles, etc.

**Grading:** Grades will be on the +/- scale (A, A-, B+, etc) with the following breakdown:

- Homework assignments 5%
- Lab safety 5%
- Labs (7) 45%
- Semester exams (2) 20%
- Independent project 10%
- Final Exam 15%

**Graduate increment:** An additional problem will be included for graduate students on each exam



<b>Chemistry 421– Advanced Instrumental Analysis Schedule</b>			
<b>General topics</b>	<b>Dates</b>	<b>Specific labs</b>	<b>Reading (focus on chapters related to your current lab)</b>
<b>Check-in</b>	1 week Jan 13 – Jan 17	Course intro; lab check in	Chapters: 1, 2A1-3, 2B, 3A, 3B, 3C-1, 4, 5, 22A-C, 23A-D, 23G-H
<b>Topic 1: General lab instrumentation; potentiometry (pH)</b>	2 weeks** Jan 20 – Jan 31	Electronics and LabView programming; Computer interfacing and pH measurements	same as above
<b>Topic 2: Spectrochemical methods</b>	5 weeks** Feb 3 - Mar 6	UV/VIS, fluorescence and atomic absorption spectrophotometry	Ch. 6, 7A-H, 8, 9A-D, 10A(1,3)C(1), 13, 14A-D-2, 15
<b>Topic 3: Chemical separations and mass spectrometry</b>	3 weeks** Mar 9 – Apr 3	GC-MS and liquid chromatography	Ch. 20A-B-1, 26,27,28
<b>Topic 4: Independent project</b>	4 weeks Apr 6 – May 1	N/A	above chapters
<b>Finals Week</b>	3:20-5:20 Thurs May 7	N/A	all course material

\*\*Holidays Jan 20 (MLK day), Feb 17 (President's Day), March 16-20 (Spring Break)