CHMY 421.00: Advanced Instrument Analysis

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Chemistry 421
Advanced Instrumental Analysis
Spring Semester 2014

Instructor: Prof. Mike DeGrandpre, Chemistry Bldg 318, phone: 243-4118, email: michael.degrandpre@umontana.edu, also http://www.cas.umt.edu/chemistry/facultyDetails.cfm?id=528 for additional information. Office hours are during lab hours, 9:10-12:00 Mon.-Thurs. or by appointment. Please go through my lab, Room 317, to get to my office (not through 318).

TA: Virginia Porden

Lab: Room 119. Student access code is 136831.

Texts: Required: Principles of Instrumental Analysis, 6th ed (2007) Skoog, Holler, and Crouch. Helpful tutorials can be found at www.thomsonedu.com/chemistry/skoog under “Instructor Companion Site”. Also, Quantitative Chemical Analysis by Harris, or any other Quantitative Analysis textbook, is an additional helpful resource.

Prerequisites: It is assumed that you have taken CHMY 311 or its equivalent as a prerequisite. If you have not taken this course, please talk to me. I assume you have good wet chemistry skills, i.e. ability to use volumetric glassware/pipettes, analytical balances, perform dilution calculations, 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 comprehensive knowledge of 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 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 lab hours scheduled for each section and to team up with a classmate(s). All students must work in groups of two1. The lab will be open from 8 am - 5 pm Mon-Fri. With this open schedule, you must 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. **However, if you are uncertain about a procedure please ask – personal injury or equipment damage may result if proper procedures are not followed.**

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1 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.
Lab notebooks and reports: A bound lab notebook with numbered pages is required. Your lab notebook must be present and open in lab for recording procedures, data, and observations. The notebook and lab report formats are given later in this lab manual. 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 are not allowed. Working in the lab outside of designated lab hours is not allowed. Not following safe lab practices will result in up to a 5% grade reduction. 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.

Other Stuff: You will need some sort of data storage device (e.g. USB flash drive) for saving programs and spreadsheet files. Do not rely on the lab computers for storage. Files may be inadvertently deleted. Lastly, I 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%
<table>
<thead>
<tr>
<th><strong>General topics</strong></th>
<th><strong>Dates</strong></th>
<th><strong>Specific labs</strong></th>
<th><strong>Reading (focus on chapters related to your current lab)</strong></th>
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<tbody>
<tr>
<td><strong>Check-in</strong></td>
<td>1 week Jan 26 – Jan 30</td>
<td>Course intro; lab check in</td>
<td>Chapters: 1, 2A1-3, 2B, 3A, 3B, 3C-1, 4, 5, 22A-C, 23A-D, 23G-H</td>
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<tr>
<td><strong>Topic 1: General lab instrumentation; potentiometry (pH)</strong></td>
<td>2 weeks Feb 2 – Feb 13</td>
<td>Electronics and LabView programming; Computer interfacing and pH measurements</td>
<td>same as above</td>
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<tr>
<td><strong>Topic 2: Spectrochemical methods</strong></td>
<td>5 weeks** Feb 17 - Mar 20</td>
<td>UV/VIS, fluorescence and atomic absorption spectrophotometry</td>
<td>Ch. 6, 7A-H, 8, 9A-D, 10A(1,3)C(1), 13, 14A-D-2, 15</td>
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<tr>
<td><strong>Topic 3: Chemical separations and mass spectrometry</strong></td>
<td>3 weeks ** Mar 23 - Apr 17</td>
<td>GC-MS and liquid chromatography</td>
<td>Ch. 20A-B-1, 26,27,28</td>
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<tr>
<td><strong>Topic 4: Independent project</strong></td>
<td>3 weeks Apr 20 - May 8</td>
<td>N/A</td>
<td>above chapters</td>
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<tr>
<td><strong>Finals Week</strong></td>
<td>3:20-5:20 Tue May 12</td>
<td>N/A</td>
<td>all course material</td>
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**Holidays Feb 16 (President’s Day), March 30-April 3 (Spring Break)**