CHEM 220L – Fundamentals of Analytical Chemistry Lab – Maymester 2016

Meeting Time
MTWRF 12:15 – 6:15 pm, SSMB 323

Instructor Information
May 16 – May 20
Dr. Wendy Cory
coryw@cofc.edu, SSMB 314
843-953-1405

Instructor Information
May 23 – May 27
Dr. Kate Mullaugh
mullaghkm@cofc.edu, SSMB 310
843-953-6587

Description
Analytical Chemistry Lab (also called Quantitative Analysis Lab) is your opportunity to learn and perfect laboratory skills that will serve as the foundation for techniques you will use in upper-level laboratory experiences and laboratory research. This quantitative chemistry lab course complements the CHEM 220 lecture, which is a co-requisite for this course. You cannot drop one course without dropping the other. At every lab meeting, you will need to bring the required materials listed below and arrive safely attired.

Required Materials
1) Safety glasses or goggles
2) Lab coat
3) Nitrile gloves (not latex)
4) Bound composition notebook to serve as a laboratory notebook
5) Ballpoint pen for all lab notebook recording
6) CHEM 220L Quantitative Analysis Laboratory Manual, version 7, 2016 (available in the bookstore)

Safety
Please review the departmental Lab Safety Policy (available in the Lab Manual and on the departmental website). You are responsible for your own safety and the safety of those around you. This responsibility includes reading the procedures before arriving in lab to identify and anticipate safety hazards as well as speaking up if you observe someone doing something unsafe. If you do not wear appropriate safety gear, you will not be allowed to work in the lab. Please note:

1) Safety glasses or goggles are mandatory at all times in the lab,
2) Proper footwear, long pants, long sleeves, and lab coats are required to minimize your skin exposure to chemicals and other hazards, and
3) Nitrile gloves must be worn when handling chemicals.
Student Learning Outcomes
- Perform quantitative analytical methods including titrations, pH measurements, spectrophotometry, and chromatography.
- Demonstrate quantitative laboratory skills capable of obtaining precise and accurate results including:
  - ways to prevent the contamination of reagents, glassware, and instrumentation
  - how and when to dry a solid to constant weight
  - dispensing a known mass of a substance
  - methods of quantitative transfer
  - sample preparation
  - reading analog and digital devices
- Properly communicate results using appropriate calculations, statistical analyses, estimates of precision (significant figures), estimates of accuracy (confidence intervals), and units (percent by mass, molarity, percent by volume, and parts per million).
- Prepare high quality plots using Excel to visualize and analyze data.
- Demonstrate proper use of volumetric glassware, including the buret, pipet, and volumetric flask and when their use is warranted.
- Assess the credibility of data obtained in the laboratory.
- Keep a good laboratory notebook.
- Apply appropriate methods of safely handling chemicals and performing laboratory procedures, analyze health and safety information from safety data sheets (MSDS or SDS) and chemical labels, and identify chemical safety hazards.

Lab Stations and Glassware
Each student will be assigned a laboratory drawer containing glassware and other tools needed to perform the lab exercises. Each student is responsible for the contents of their assigned drawer and for returning all glassware (clean) and tools at the end of each lab period to the appropriate drawer. The assigned work area, the balance areas, and the areas for reagents are to be kept neat and clean. All spills are to be cleaned up immediately.

Laboratory Procedures
The CHEM 220L Fundamentals of Analytical Chemistry Laboratory Manual contains all procedures for this course. It is your responsibility to read each week's procedure and complete all preparations contained in the procedure before arriving in lab. Preparing yourself before class is critical to completing each exercise in a safe and timely manner. Each student is to work independently on the laboratory exercises. Exceptions are some instrumental procedures when group exercises are conducted.

Results Submission
Results sheets (which you can detach from the lab manual) are to be turned in the day the lab is completed or the next day. Your final results should always be clearly labeled on the report sheet in pen with the correct number of significant figures.
Lab Notebook
Your laboratory notebook should provide a full record of what was performed during the experiment. Most importantly, all data must be recorded in your notebook in pen as soon as they are generated. All calculations should be shown in the laboratory notebook such that both you and the instructor may follow your logic and see your complete calculations. You must get in the habit of labeling all measurements with proper units and cancelling those units in calculations. At the end of each experiment, do not leave the lab until your notebook has been checked, initialed, and dated by the instructor. At the end of the semester, your notebook will be a valuable resource to you during the final exam, and it will also be graded, so it is to your benefit to be as complete and organized in your record-keeping as possible.

Grading Policy
In this lab, you are graded on the accuracy of your quantitative results, which is dependent on your laboratory technique and skill. Your experimental results for each unknown will be compared to the expected results, and your grade will be calculated based upon the difference between the two. Regardless of your percent error, if you have completed the laboratory exercise and submitted a complete report, the lowest grade you will receive is 65%. Note that you can receive lower than 65% if you have safety violations, fail to properly clean the lab, or submit an incomplete lab report. Results that are incorrect due to calculation errors may be re-submitted for an improved grade, with a loss of 5 points. Resubmission must occur within one week of receiving your graded report.

Using Excel for spreadsheets and graphing will be necessary throughout this course. It is your responsibility to make your own graphs and sharing graphs (even if you collected data with a partner) is considered academic dishonesty.

Lab Cleanliness
Keeping the lab clean is essential for a safe and productive working environment. You are responsible for keeping your own station and glassware clean. Additionally, everyone in the lab is responsible for ensuring shared areas are not left messy at the end of the lab period. Your instructor will occasionally ask you to clean shared areas around the balances and in the fume hoods before leaving lab.

Grading Scheme and Scale:

<table>
<thead>
<tr>
<th>Letter</th>
<th>%</th>
<th>GP</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>93-100</td>
<td>4.0</td>
</tr>
<tr>
<td>A-</td>
<td>90-92</td>
<td>3.7</td>
</tr>
<tr>
<td>B+</td>
<td>87-89</td>
<td>3.3</td>
</tr>
<tr>
<td>B</td>
<td>83-86</td>
<td>3.0</td>
</tr>
<tr>
<td>B-</td>
<td>80-82</td>
<td>2.7</td>
</tr>
<tr>
<td>C+</td>
<td>77-79</td>
<td>2.3</td>
</tr>
<tr>
<td>C</td>
<td>73-76</td>
<td>2.0</td>
</tr>
<tr>
<td>C-</td>
<td>70-72</td>
<td>1.7</td>
</tr>
<tr>
<td>D+</td>
<td>67-69</td>
<td>1.3</td>
</tr>
<tr>
<td>D</td>
<td>63-66</td>
<td>1.0</td>
</tr>
<tr>
<td>D-</td>
<td>61-62</td>
<td>0.7</td>
</tr>
<tr>
<td>F</td>
<td>Below 60</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Final Exam
The final exam is a lab practical exam, which will test your ability to perform and apply the skills you will develop in lab this semester. Your success on the practical exam will be aided by keeping a good lab notebook and by making sure you understand the procedures and calculations used throughout the term.

Attendance Policy
Labs are experiential learning courses that emphasize the scientific method and data interpretation and they provide training in essential technical skills for chemists and other scientists. It is not possible to master these essential technical skills without attending the labs. Furthermore, the technical lab skills presented in one course are assumed to be mastered in subsequent chemistry courses. Thus, attendance in all lab periods is crucial. If you foresee that you will miss lab, talk to your instructor ASAP to arrange to join the other lab section to complete the lab that week. Note that lab sections are only on Monday and Tuesday each week so it is not always possible to make up work in another section. Unplanned absences, even when accompanied by an absence memo, will not be accommodated. Experiments that are not completed will result in a zero for that lab report. In all cases, if a student misses 3 lab periods without making up the lab in another section, whether these absences are excused or unexcused, that student will receive a WA for a final grade. A WA grade is equivalent numerically to an F. If you are ejected from lab for a safety violation you will get a zero for the experiment, and it counts as an unexcused absence.

Scientific Integrity
Each student is expected to observe the College of Charleston Policy on Scientific Integrity (available in the Lab Manual and on the departmental website). For this course, please be cognizant of how honesty and scientific integrity apply to the specific actions of working individually to perform the experimental procedure and calculations, accurately recording data in your lab notebook as the primary record, and completing your results sheets.

Department Facebook Page
Follow the "Chem and Biochem at the College of Charleston" Facebook page to see announcements of opportunities for chemistry and biochemistry students.
Lab Schedule
During Maymester CHEM 220L is a self-paced lab meaning you may work ahead to complete the experiments. However, it is your responsibility to make sure you stay on track to ensure you can complete all experiments in the time allowed (see table below). If time allows, you may redo one experiment to obtain a better result and resubmit these results for grading.

<table>
<thead>
<tr>
<th>Day</th>
<th>Lab which you should at least be starting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday May 16</td>
<td>Lab Safety and Introductory Exercises (First two experiments)</td>
</tr>
<tr>
<td>Tuesday May 17</td>
<td>Titrimetric Determination of Soda Ash</td>
</tr>
<tr>
<td>Wednesday May 18</td>
<td>Iodometric Determination of Copper</td>
</tr>
<tr>
<td>Thursday May 19</td>
<td>Determination of Ascorbic Acid in Vitamin C Tablets</td>
</tr>
<tr>
<td>Friday May 20</td>
<td>Determination of the Formula Weight and Ionization Constant of an Organic Acid</td>
</tr>
<tr>
<td>Monday May 23</td>
<td>Hydronium and Chloride Ion Selective Electrodes (two experiments)</td>
</tr>
<tr>
<td>Tuesday May 24</td>
<td>Spectrophotometric Determination of Iron</td>
</tr>
<tr>
<td>Wednesday May 25</td>
<td>Atomic Emission of Li Atomic Absorption of Sr</td>
</tr>
<tr>
<td>Thursday May 26</td>
<td>HPLC Determination of Aspirin</td>
</tr>
<tr>
<td>Friday May 27</td>
<td>Determination of the Equivalent Weight of a Salt by Ion Exchange Chromatography</td>
</tr>
</tbody>
</table>
| Monday May 30| MEMORIAL DAY
              | No lab                                                                     |
| Tuesday May 31| Lab Practical                                                              |