San José State University
/Chemistry Department
Chem 055L, Quantitative Analysis Laboratory, Section 01

Spring 2020

Course and Contact Information

Instructor: Eva Mª CAMPO SAHAGÚN

Office Location: DH413

Telephone: 408-924-4912

Email: eva.camposahagun@sjsu.edu

Office Hours: MW (10:00 – 10:30 am)

Class Days/Time: Monday & Wednesday 10:30 am - 1:20 pm

Classroom: Duncan Hall, room 413

Prerequisites: listed in the SJSU Catalog: CHEM 55L

Course Format

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on Canvas web page at URL: https://sjsu.instructure.com. Username: SJSU 9-digit ID. You are responsible for regularly checking with the messaging system through Canvas to learn any updates.

Internet connectivity or technology requirements: each student should have an access to the computer and fast internet. On-line lab notebook is required. Information about purchasing of the electronic lab notebook will be send at the start of the semester.

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on CANVAS learning management system course website. You are responsible for regularly checking with the messaging system through MySJSU (or other communication system as indicated by the instructor) to learn of any updates.
Course Description

Chem 055L Quantitative Analysis Laboratory
Introduction to theories and techniques of chemical analysis. Lab 6 hours.
4 units

Learning Outcomes and Course Goals

Upon successful completion of this course, students will be able to:

PLO #3 - Demonstrate understanding of core concepts and to effectively solve problems in analytical chemistry.

PLO #6 - Answer questions regarding safe practices in the laboratory and chemical safety.

PLO #7 - Demonstrate safe laboratory skills (including proper handling of materials and chemical waste) for particular laboratory experiments.

Course Learning Outcomes (CLO) Chem 55L

Upon successful completion of this course, students will be able to:

CLO #1   Perform accurate and precise analysis in the field of analytical Chemistry
CLO #2   He or she will be able to keep records of all performed analysis in the manner which is required in modern analytical laboratory.
CLO #3   Student will be able to do statistical analysis and evaluate repetability of obtained results
CLO #4   Perform quantitative and qualitative analysis of known standards as well as unknown samples.
CLO #5   Identify, properly use, and care for equipment and supplies used in analytical laboratory
CLO #6   Identify the requirements for adequate protection of personnel form solvents and materials used in the analysis.

Required Texts/Readings

Textbook
Quantitative Chemical Analysis; D.C. Harris, same edition as Chem 55 lecture

Other Readings


Other equipment / material requirements

Lab Notebook: A laboratory notebook, is required for all students. We will use electronic lab notebook. Notebook pages will be due (by upload to the lab notebook web site) at the conclusion of each day of lab. Each page has to be electronically dated and signed.

Chem 55L, Fall 2019 S01
All primary data must be taken in the notebook and after each experiment summary and resume pages must be prepared in the lab notebook. In many industry or research laboratories, the lab notebook can be used as a legal document, so good notebook habits are essential for success in science! Notebooks can be purchased via link which I will send to all enrolled students.

**Course Requirements and Assignments**

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in University Policy S12-3 at [http://www.sjsu.edu/senate/docs/S12-3.pdf](http://www.sjsu.edu/senate/docs/S12-3.pdf).

**Experiments:** In Chem 55L course we will:

a. Discuss quantitative chemical analysis, statistics and error analysis, chemical equilibria, acid-base and buffer chemistry, basic spectrophotometry, chromatography and electrophoresis.

b. Conduct lab experiments in acid – base and EDTA titrmetry, flame and solution photometry, electrochemistry, high performance liquid chromatography and capillary electrophoresis.

**Final Examination:**

Final Exam:
1. Exam will be conducted on the date set up by SJSU (see Academic Calendar)
2. Final exam will cover the material from all the experiments performed in Chem 55L laboratory, including theory, practical information and calculations for each experiment.

**CHEM 55L – LABORATORY ACTIVITIES (See schedule for the due dates)**

1. Check-in and preliminary operations
   a. Safety orientation and safety quiz, has to be taken on Canvas website before second lab
   b. Review of analytical balance

2. Preparation of standard EDTA solution.

3. EDTA determination of total hardness, calcium, and magnesium in brine sample.

4. Manganese determination by atomic absorption spectroscopy using both calibration curve and standard addition procedures.

5. Complexing titrations, HPLC - Quiz

6. Gravimetric determination of calcium in a solid sample.

7. Gravimetric Analysis - Quiz

8. Preparation and standardization of 0.1 M NaOH.

10. Titration of a mixture of phosphoric acid and sodium dihydrogen phosphate.

11. Submit explicit directions for the preparation of 500 mL of 0.050 M pH 7.0 phosphate buffer solution. Use activity coefficients.

12. Phosphates, HPCE - Quiz

13. HPLC (Determination of components of a mixture of polycyclic aromatic hydrocarbons by high performance liquid chromatography.)

14. HPCE (Capillary Electrophoresis determination of Analgesics) experiments are done in groups of 4 students (due to instrumentation restrictions). Note for experiment 14 and 15 above: There will be a sign up sheet for both experiments (14 and 15). The report for each experiment will be due after next lab period. For example if you perform experiment on Tuesday November 3rd, the report will be due in the end of the lab on Thursday November 5th, 2015, etc. Grades for the HPLC, HPCE experiments will depend on each individual student (sample preparation-HPLC, report- HPCE).

15. Determination of Ascorbic Acid in a mixture by Analytical Voltametry.


Check out of locker on or before last day of laboratory. Students failing to check out officially will be charged a fee for the Service Center to check out the locker.

NOTE that University policy F69-24 at http://www.sjsu.edu/senate/docs/F69-24.pdf states that “Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se will not be used as a criterion for grading.”

Safe and Respectful Community

We hope that the classroom and laboratory will serve as an environment that will promote learning and the development of new ideas, as well as be a safe and respectful community. Behavior that interferes with the normal academic function in a classroom or lab is unacceptable. Students exhibiting this behavior will be asked to leave the class. Examples of such behavior include

a) Persistent interruptions or using disrespectful adjectives in response to the comments of others.

b) The use of obscene or profane language.

c) Yelling at classmates and/or faculty.

d) Persistent and disruptive late arrival to or early departure from class without permission.

e) Physical threats, harassing/bullying behavior, or personal insults (even when stated in a joking manner).

f) Use of personal electronic devices such as pagers, cell phones, PDAs in class, unless it is part of the instructional activity.

Chem 55L Grading Information

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practices. Other course structures will have equivalent workload expectations as described in the syllabus.”
• **2 POINTS PENALTY** will be assigned for leaving the laboratory after 1.20 pm.
• **10 POINTS PENALTY** will be assigned for turning late reports (after the due date).
• **10 POINTS PENALTY** will be assigned if the calculations are wrong and/or report is not in correct format.
• It is possible to repeat the failed experiment, however new sample for the experiment has to be obtained from the instructor. **10 POINTS PENALTY WILL BE ASSIGNED IF THE EXPERIMENT HAS TO BE REPEATED.**
• Each experiment will be graded for accuracy (difference between value provided by Certified Laboratory for the unknown sample and value determined by the student) and precision (determined by standard deviation of the results – spread of the values). **REPORT WILL NOT BE GRADED IF IT IS NOT PREPARED IN THE LAB NOTEBOOK AND REPORT PAGE POSTED ON CANVAS.** There will be 10 points penalty for not uploading report on Canvas.
• Lab notebook will be graded as follows: a: based on the report after each lab 60 points total. Daily reports dated and signed are due before midnight on the day of the lab. Daily reports will be checked 3 random times for each student, each time is worth 20 points. For each lab notebook check (worth 20 points out of total 60) points will be deducted for missing lab reports (-10 points) or lab reports turned in after midnight on the lab day (-5points). If the pages are not signed 5 points will be deducted.
• **NO EXTRA points are available in this class.**

**Example of the grading scale for Hardness experiment:**

<table>
<thead>
<tr>
<th>key for hardness</th>
<th>key for Ca only</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>points</strong></td>
<td><strong>points</strong></td>
</tr>
<tr>
<td>difference ppm</td>
<td>difference %w/v</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10 ppm</th>
<th>0.001</th>
<th>99</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 ppm</td>
<td>0.002</td>
<td>97</td>
</tr>
<tr>
<td>30 ppm</td>
<td>0.003</td>
<td>95</td>
</tr>
<tr>
<td>40 ppm</td>
<td>0.004</td>
<td>90</td>
</tr>
<tr>
<td>50 ppm</td>
<td>0.005</td>
<td>88</td>
</tr>
<tr>
<td>60 ppm</td>
<td>0.006</td>
<td>82</td>
</tr>
</tbody>
</table>
Course Grading scale*:

Mean grade for the class will be in the C range

Important: Grade for safety quiz is not included in the points for the laboratory

<table>
<thead>
<tr>
<th>No</th>
<th>Experiment</th>
<th>Maximum points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gravimetric determination of Calcium (% w/w)</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Total hardness (ppm)</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Calcium only titration (% w/v)</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>Phosphates (% w/v) titration with pH meter</td>
<td>200</td>
</tr>
<tr>
<td>5</td>
<td>Calibration of pH electrode</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>Preparation of 500 mL of pH 7.0 buffer solution (calculations only)</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>Manganese in steel (% w/w)</td>
<td>150</td>
</tr>
<tr>
<td>8</td>
<td>HPLC (High Performance Liquid Chromatography) determination of limonin in orange juice (ppm)</td>
<td>100</td>
</tr>
<tr>
<td>9</td>
<td>HPCE (High Performance Capillary Electrophoresis) analysis of drug formulation (ppm)</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>Vitamin C in juice (voltammetry) mg/250 mL,</td>
<td>100</td>
</tr>
<tr>
<td>11</td>
<td>Calibration of one instrument</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td><strong>Total points for experiment</strong></td>
<td><strong>1020</strong></td>
</tr>
<tr>
<td>12</td>
<td>Daily laboratory reports</td>
<td>28</td>
</tr>
<tr>
<td>13</td>
<td>Laboratory notebook (electronic lab notebook)</td>
<td>50</td>
</tr>
<tr>
<td>14</td>
<td>3 quizzes</td>
<td>300</td>
</tr>
<tr>
<td>15</td>
<td>Technique</td>
<td>25</td>
</tr>
<tr>
<td>16</td>
<td><strong>FINAL EXAM</strong></td>
<td><strong>200</strong></td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL POINTS FOR THE LAB</strong></td>
<td><strong>1623</strong></td>
</tr>
</tbody>
</table>

Again, if you grade on participation, specify how participation will be assessed. Attendance per se shall not be used as a criterion for grading according to University Policy F-69-24 located at http://www.sjsu.edu/senate/docs/F69-24.pdf.
Note that “All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades.” See University Policy F13-1 at http://www.sjsu.edu/senate/docs/F13-1.pdf for more details.

ALL THE GRADES WILL BE POSTED ON CANVAS FOR EACH STUDENT TO SEE ONLY HIS OR HER GRADES.

Classroom Protocol

Penalties are imposed if an analysis must be repeated because of poor reported results (10 points out of 100) or if results are reported after announced deadline dates (10 points out of 100). Adequate time is allotted to complete the assignments and to repeat some determinations. If because of illness or other reason a student falls behind, she or he may work during the second lab section if permission is obtained from the instructor and if there is a space available. HOWEVER, A STUDENT SHOULD NEVER WORK ALONE, AND AN INSTRUCTOR SHOULD BE WITHIN CALLING DISTANCE.

PLEASE NO USE OF CELL PHONES IN THE LAB.

University Policies

General Expectations, Rights and Responsibilities of the Student

As members of the academic community, students accept both the rights and responsibilities incumbent upon all members of the institution. Students are encouraged to familiarize themselves with SJSU’s policies and practices pertaining to the procedures to follow if and when questions or concerns about a class arises. See University Policy S90–5 at http://www.sjsu.edu/senate/docs/S90-5.pdf. More detailed information on a variety of related topics is available in the SJSU catalog, at http://info.sjsu.edu/web-dbgen/narr/catalog/rec-12234.12506.html. In general, it is recommended that students begin by seeking clarification or discussing concerns with their instructor. If such conversation is not possible, or if it does not serve to address the issue, it is recommended that the student contact the Department Chair as a next step.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester’s Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlines can be found on the current academic year calendars document on the Academic Calendars webpage at http://www.sjsu.edu/provost/services/academic_calendars/. The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/. Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.

Consent for Recording of Class and Public Sharing of Instructor Material

University Policy S12-7, http://www.sjsu.edu/senate/docs/S12-7.pdf, requires students to obtain instructor’s permission to record the course and the following items to be included in the syllabus:

- “Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor’s permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings
are the intellectual property of the instructor; you have not been given any rights to reproduce or
distribute the material.”
  o It is suggested that the greensheet include the instructor’s process for granting permission,
    whether in writing or orally and whether for the whole semester or on a class by class basis.
  o In classes where active participation of students or guests may be on the recording, permission of
    those students or guests should be obtained as well.
- “Course material developed by the instructor is the intellectual property of the instructor and cannot be
  shared publicly without his/her approval. You may not publicly share or upload instructor generated
  material for this course such as exam questions, lecture notes, or homework solutions without instructor
  consent.”

**Academic integrity**

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The
University Academic Integrity Policy S07-2 at http://www.sjsu.edu/senate/docs/S07-2.pdf requires you to be
honest in all your academic course work. Faculty members are required to report all infractions to the office of
Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available
at http://www.sjsu.edu/studentconduct/.

**Campus Policy in Compliance with the American Disabilities Act**

If you need course adaptations or accommodations because of a disability, or if you need to make special
arrangements in case the building must be evacuated, please make an appointment with me as soon as possible,
or see me during office hours. Presidential Directive 97-03 at http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf requires that students with disabilities requesting accommodations must register with the Accessible Education Center (AEC) at http://www.sjsu.edu/aec to establish a record of their disability.

**Accommodation to Students’ Religious Holidays**

San José State University shall provide accommodation on any graded class work or activities for students
wishing to observe religious holidays when such observances require students to be absent from class. It is the
responsibility of the student to inform the instructor, in writing, about such holidays before the add deadline at
the start of each semester. If such holidays occur before the add deadline, the student must notify the instructor,
in writing, at least three days before the date that he/she will be absent. It is the responsibility of the instructor to
make every reasonable effort to honor the student request without penalty, and of the student to make up the

**Student Technology Resources**

Computer labs for student use are available in the Academic Success Center at http://www.sjsu.edu/at/asc/
located on the 1st floor of Clark Hall and in the Associated Students Lab on the 2nd floor of the Student Union.
Additional computer labs may be available in your department/college. Computers are also available in the
Martin Luther King Library. A wide variety of audio-visual equipment is available for student checkout from
Media Services located in IRC 112. These items include DV and HD digital camcorders; digital still cameras;
video, slide and overhead projectors; DVD, CD, and audiotape players; sound systems, wireless microphones,
projection screens and monitors.
SJSU Peer Connections

Peer Connections, a campus-wide resource for mentoring and tutoring, strives to inspire students to develop their potential as independent learners while they learn to successfully navigate through their university experience. You are encouraged to take advantage of their services which include course-content based tutoring, enhanced study and time management skills, more effective critical thinking strategies, decision making and problem-solving abilities, and campus resource referrals.

In addition to offering small group, individual, and drop-in tutoring for a number of undergraduate courses, consultation with mentors is available on a drop-in or by appointment basis. Workshops are offered on a wide variety of topics including preparing for the Writing Skills Test (WST), improving your learning and memory, alleviating procrastination, surviving your first semester at SJSU, and other related topics. A computer lab and study space are also available for student use in Room 600 of Student Services Center (SSC).

Peer Connections is located in three locations: SSC, Room 600 (10th Street Garage on the corner of 10th and San Fernando Street), at the 1st floor entrance of Clark Hall, and in the Living Learning Center (LLC) in Campus Village Housing Building B. Visit Peer Connections website at http://peerconnections.sjsu.edu for more information.

SJSU Writing Center

The SJSU Writing Center is located in Clark Hall, Suite 126. All Writing Specialists have gone through a rigorous hiring process, and they are well trained to assist all students at all levels within all disciplines to become better writers. In addition to one-on-one tutoring services, the Writing Center also offers workshops every semester on a variety of writing topics. To make an appointment or to refer to the numerous online resources offered through the Writing Center, visit the Writing Center website at http://www.sjsu.edu/writingcenter. For additional resources and updated information, follow the Writing Center on Twitter and become a fan of the SJSU Writing Center on Facebook. (Note: You need to have a QR Reader to scan this code.)

SJSU Counseling Services

The SJSU Counseling Services is located on the corner of 7th Street and San Fernando Street, in Room 201, Administration Building. Professional psychologists, social workers, and counselors are available to provide consultations on issues of student mental health, campus climate or psychological and academic issues on an individual, couple, or group basis. To schedule an appointment or learn more information, visit Counseling Services website at http://www.sjsu.edu/counseling.

SAFETY: Strict adherence to laboratory safety rules is required. You must pass a quiz on safety rules. Wearing eye protection is mandatory. See, ADDENDUM TO ALL CHEMISTRY DEPARTMENT GREENSHEETS.

EMERGENCIES/EVACUATIONS

If you hear a continuously sounding alarm or are told to evacuate by Emergency Coordinators (colored badge identities), walk quickly to the nearest stairway (end of each hall). Take your personal belongings with you as you may not be
immediately allowed to return. Follow instructions of Coordinators. Be quiet so you can hear. Once outside, move away from the building. Do not return to the building unless the Police or Coordinators announce that it is permissible. If an alarm should occur during an exam or quiz, please attempt to give your instructor the paper or if taking test on line please attempt to save the test.

Safe and Respectful Community

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a) Persistent interruptions or using disrespectful adjectives in response to the comments of others.
b) The use of obscene or profane language.
c) Yelling at classmates and/or faculty.
d) Persistent and disruptive late arrival to or early departure from class without permission.
e) Physical threats, harassing/bullying behavior, or personal insults (even when stated in a joking manner).
f) Use of personal electronic devices such as pagers, cell phones, PDAs in class, unless it is part of the instructional activity.
The schedule is subject to change with fair notice, announced in the class and on CANVAS web site.

<table>
<thead>
<tr>
<th>Date</th>
<th>Topics, Readings, Assignments, Deadlines</th>
</tr>
</thead>
<tbody>
<tr>
<td>M January 27</td>
<td>Check-in and preliminary operations &amp; Safety orientation.&lt;br&gt;IMPORTANT: Safety quiz has to be taken and passed on Canvas website before Wednesday 02-29 (First experimental day)</td>
</tr>
<tr>
<td>W February 29</td>
<td>General explanation: proper use of laboratory materials and LabArchives platform&lt;br&gt;Training in proper use of laboratory materials: pipetting, micropipetting, digital precision balance)</td>
</tr>
<tr>
<td>M February 3</td>
<td>EDTA determination of total hardness, calcium, and magnesium in brine sample</td>
</tr>
<tr>
<td>W February 5</td>
<td>EDTA determination of total hardness, calcium, and magnesium in brine sample</td>
</tr>
<tr>
<td>M February 10</td>
<td>EDTA determination of total hardness, calcium, and magnesium in brine sample</td>
</tr>
<tr>
<td>W February 12</td>
<td>EDTA determination of total hardness, calcium, and magnesium in brine sample</td>
</tr>
<tr>
<td>M February 17</td>
<td>EDTA determination of total hardness, calcium, and magnesium in brine sample&lt;br&gt;Manganese determination in steel sample.</td>
</tr>
<tr>
<td>W February 19</td>
<td>Manganese determination in steel sample.</td>
</tr>
<tr>
<td>M February 24</td>
<td>REPORT DUE: EDTA Total Hardness &amp; Calcium (200 points).&lt;br&gt;Manganese determination in steel sample.</td>
</tr>
<tr>
<td>W February 26</td>
<td>Manganese determination in steel sample.</td>
</tr>
<tr>
<td>M March 2</td>
<td>Manganese determination in steel sample.</td>
</tr>
<tr>
<td>W March 4</td>
<td>Quiz 1 (study time + test)</td>
</tr>
<tr>
<td>M March 9</td>
<td>Manganese determination in steel sample.</td>
</tr>
<tr>
<td>W March 11</td>
<td>Manganese determination in steel sample. Gravimetric determination of calcium in a solid sample.</td>
</tr>
<tr>
<td>M March 9</td>
<td>Manganese determination in steel sample. Gravimetric determination of calcium in a solid sample.</td>
</tr>
<tr>
<td>W March 11</td>
<td>Manganese determination in steel sample. Gravimetric determination of calcium in a solid sample.</td>
</tr>
<tr>
<td>M March 16</td>
<td>REPORT DUE: Manganese determination (150 points).&lt;br&gt;Gravimetric determination of calcium in a solid sample.</td>
</tr>
<tr>
<td>W March 18</td>
<td>Gravimetric determination of calcium in a solid sample.</td>
</tr>
<tr>
<td>M March 23</td>
<td>Gravimetric determination of calcium in a solid sample.&lt;br&gt;Group experiment: HPLC, report due: next lab after experiment is done.</td>
</tr>
<tr>
<td>W March 25</td>
<td>Gravimetric determination of calcium in a solid sample.&lt;br&gt;Group experiment: HPLC, report due: next lab after experiment is done.</td>
</tr>
<tr>
<td>M March 30</td>
<td>SPRING RECESS – CAMPUS CLOSED</td>
</tr>
<tr>
<td>W April 1</td>
<td>REPORT DUE: Gravimetric report (100 points).&lt;br&gt;Group experiment: HPLC, report due: next lab after experiment is done. Phosphates titration.</td>
</tr>
<tr>
<td>M April 6</td>
<td>REPORT DUE: Gravimetric report (100 points).&lt;br&gt;Group experiment: HPLC, report due: next lab after experiment is done. Phosphates titration.</td>
</tr>
<tr>
<td>Date</td>
<td>Topics, Readings, Assignments, Deadlines</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>W April 8</td>
<td><strong>Quiz 2</strong> <em>(study time + test)</em></td>
</tr>
<tr>
<td>M April 13</td>
<td>Phosphates titration.</td>
</tr>
<tr>
<td>W April 15</td>
<td>Phosphates titration</td>
</tr>
<tr>
<td>M April 20</td>
<td><strong>Group experiment: HPCE, report due: next lab after experiment is done.</strong></td>
</tr>
<tr>
<td>W April 22</td>
<td>REPORT DUE: Phosphates report <em>(200 points).</em></td>
</tr>
<tr>
<td></td>
<td><strong>Group experiment: HPCE, report due: next lab after experiment is done.</strong></td>
</tr>
<tr>
<td>M April 27</td>
<td><strong>Group experiment: HPCE, report due: next lab after experiment is done.</strong></td>
</tr>
<tr>
<td>W April 29</td>
<td>Group experiment: Vitamin C determination, calibration of the instrument: reports due: next lab after experiment is done.</td>
</tr>
<tr>
<td>M May 4</td>
<td>Group experiment: Vitamin C determination, calibration of the instrument: reports due: next lab after experiment is done.</td>
</tr>
<tr>
<td>W May 6</td>
<td>Study time and questions <em>(Exam prep)</em></td>
</tr>
<tr>
<td>M May 11</td>
<td>CHECK OUT DAY</td>
</tr>
</tbody>
</table>

**Final EXAM**

<table>
<thead>
<tr>
<th>Final Exam</th>
<th>Friday May 15th</th>
<th>Final exam is on <strong>Friday, May 15th</strong> 2018, 9:45 am – 12:00 (Noon).</th>
</tr>
</thead>
</table>