Course Syllabus CHEM150
Structure & Properties

Course Information

Consult OPUS for the instructor of your section.
Course Meeting Pattern: Consult OPUS for the meeting time of your section.

Technology

The campus learning management system (LMS) is Canvas. This system is an integral part of the organization of this course and is required for all students.

Safety glasses or safety goggles are required.

Federal law (rule 10 CFR 1910.133) requires the use of eye protection for all individuals in a laboratory. This applies to everyone occupying a lab, not just those working at any given moment. The rules is: "When one person is working, everybody wears eye protection."

Academic Honesty

All of your assignments and experiments must be your original work. Students are encouraged to collaborate (discussing thoughts, concepts, and ideas) while you work on post-lab assignments, but everything you submit must be wholly your own work – your own words. You may not submit (for instance by copy-and-paste) pictures, chemical structures, illustrations or graphics you copy from the web, or any other source. Cheating includes copying or using any data from another person without attributing credit, and falsifying data by alteration or invention. If you need to use data collected by another student, you can avoid dishonesty by being sure to give that student credit for his / her data.

Textbook & Other Items

The lab manual with a carbon-copy type notebook is available in the University Bookstore.

Communal Spirit

The success of a laboratory course of this size depends on the cooperation of each individual. For example, if you see a person without safety glasses, remind them to wear safety glasses. They would much rather hear this message from you then the instructor. Be cooperative! Help the people who are having a tough time. This is not a place for competition. We must be sensitive to the crowded conditions and the need for everyone to maintain a reasonable pace in order to complete the experiments. For example, the balances must be kept clean. Stock solutions must be left in their proper place (uncontaminated) so that fellow students do not waste time looking for them.

Supportive Laboratory and Classroom Environment

The purpose of this class is to learn chemistry. Please treat your classmates with respect both in and out of the classroom. In particular, it is unacceptable to judge your fellow students by gender, race, or any other irrelevant factor. If you have any concerns please talk with the instructor (mmccorm@emory.edu (mmccorm@emory.edu)), the department chair, Prof. Stefan Lutz (stefan.lutz@emory.edu) (Stefan.lutz@emory.edu)) , or the Office of Equity and Inclusion (http://equityandinclusion.emory.edu (http://equityandinclusion.emory.edu)).

Attendance

You are expected to attend all sessions and to be on time. To this end, you are graded on attendance and punctuality. You must arrive on time to hear the pre-lab lecture including

instructions on safety. If you have an excused absence from lab then you must carefully follow the directions found in the course LMS.

Disabililities

Students with disabilities who believe that they may need accommodations in this class / laboratory are encouraged to visit the Access, Disability Services, and Resources (ADSR) as soon as possible to ensure that such accommodations are implemented in a timely fashion. When your accommodations are documented, please submit your documentation via email to Professor McCormick. When I have received your documentation, I will schedule an appointment to follow up with you if this is necessary. Visit the Emory ADSR web site for more information.

Schedule

Meeting	Activity	Due
1	Experiment 1 – The Fuel in a Lighter	
2	Experiment 2 – Fascinating Phenomena Safety Quiz	Fuel Assignment
3	Experiment 3 – Alum Synthesis	Phenomena Assignment
4	Experiment 4 –Analysis of Alum and Quality Check 1 Start "The Great Crystal Growing Contest"	Alum Synthesis Assignment, quality check Alum Analysis
5	Experiment 5 – Coke Density (Quality Check 2)	Excel Assignment, Quality Check Density
6	Experiment 6 – Stoichiometry – The Job's Plot	Density Assignment
7	Experiment 7 – Neutralization Equivalent (Quality Check 3)	Jobs Plot Assignment
8	Experiment 9 – Vitamin C	Quality Check Neutralization Equivalent
9	Experiment 9 – continued	Vitamin C
10	Experiment 10 – Retention of Metal Cations by Soil	Vitamin C
11	Metal Cations (continued) Course evaluation Crystal Contest Ends (submit crystal)	Submit Crystal
12	Test on Theory and Practice	Cation Retention Assignment

Grading Policies

Notebook: 20%
Theory & Practice Test: 30%
Quality Checks: 20%
Postlab Assignments: 20% (10% + 10% by bonus).

Specific details regarding the content of postlab assignments are given on Canvas for each week. Postlab assignments vary in format and are tailored to suit the learning goals of each particular laboratory exercise. Late assignments are accepted at the discretion of your lab instructor. You may not submit pictures, chemical structures, illustrations or graphics copied from the web, or any other source. Postlab assignments will be checked and errors marked. Acceptable assignments will receive a grade. Assignments below this standard will be returned to you without a complete grade. You must correct all major errors, attaching an appendix to your original assignment if necessary, and the resubmit to your instructor at the start of the following lab period. The semester score for the post lab assignment category carries an all-or-none "bonus" for the satisfactory completion of

all of the reports and corrections. In this system, failure to turn in even one report or corrected report results in the loss of this bonus.

Lab Attendance & Clean Up: 8%.

You will be evaluated on attendance, whether the lab is kept clean, and adherence to safety protocol. See the previous section for an explanation of the clean up points, but the rule of thumb that if there is anything left at the end of lab that your TAs must clean up then you have lost point in this category.

TA Grade: 2%.

Your TA will evaluate your general skill in solving the laboratory problem at hand. You should endeavor to prepare thoroughly, work independently, show consideration for others, and in general develop a worker-supervisor relationship of a professional nature.

Grades Scored Will Equal

94% and above	A
90% and less than 94%	A-
86% and less than 90%	B+
82% and less than 86%	B
78% and less than 82%	B-
74% and less than 78%	C+
70% and less than 74%	C
66% and less than 70%	C-
62% and less than 66%	D+
58% and less than 62%	D
0% and less than 58%	F

Learning Goals

Inquiry

1. Asking questions -- A basic practice of the chemist is formulating empirically answerable questions about phenomena, establishing what is already known, and determining what questions need answers., and then planning and carrying out investigations to address these questions.
2. Analyzing and interpreting data, visualization, and statistical analysis, and using mathematics and computational thinking are fundamental tools for representing physical variables, systems, and their relationships.
3. Constructing explanations and engaging in argument from evidence; Developing and using models; Obtaining, evaluating, and communicating information.

Skills and Competencies

1. Every substance (see Topics 1 below) has observable or measureable properties. These properties are used to identify chemical substances. These properties have a predictive value, which can then be applied to the understanding of other substances and even to the understanding of entire categories of substances.
2. Chemical reactions (see Topics 2 below) are accompanied by changes in observable or measureable properties. These changes can be used to characterize reactivity. These changes have predictive value that can be applied to the understanding of new chemical systems.

3. Observing and measuring chemical properties (see Topics 3 below) is therefore essential to the understanding of substances and reactivity.
4. The application of atomic theory gives rise to systems that allow us to count atoms and molecules, and track their quantities through the processes of chemical change. This is the discipline that chemists call stoichiometry.

Topics

1. The representative set of substances studied in the course includes: states and general categories of matter (solid, liquid, gas, solutions, mixtures, pure substances, ionic solids, molecular substances, polymers, etc.); Group 1, 2, 8, and 10-13 metals or ions; common monoatomic, polyatomic, and some complex ions, acids, bases, and salts.
2. The representative set of chemical reactions (and phase or state changes) studied in significant depth in the course includes: precipitation (double displacement or metathesis reactions); redox; dissolution; multi-step syntheses (both alum and calcium chloride); dehydration of inorganic hydrates; hydrogel formation, synthesis of compounds containing complex ions of iron and copper and aluminum.
3. The representative set of methods for the measurement of properties and determining change includes: mass measurements with an analytical balance, mass measurements with a lower-precision centigram balance, volume measurements with pipettes and a variety of other low-precision tools, spectrophotometric measurement of absorbance in the visible region for concentration, gravimetric titrations for the determinations of concentration and also for molecular weight, stoichiometry determination by Job's plot using visible absorbance measurements, collection of gas by water displacement, and density determination of liquids. The importance of direct (visual) observation of properties and changes should not be underestimated and includes: color to indicate a chemical change or stoichiometric point, temperature changes, state changes (liquid to gas, solid, gel, etc.), as well as the formation of precipitates and gasses.

Techniques List

1. Measuring gas volume by water displacement
2. Preparing solutions of approximate concentration from a solid*
3. Preparing solutions of approximate concentration by dilution*
4. Lighting and adjusting a Bunsen burner*
5. Using a pan balance*
6. Using an analytical balance*
7. Heating to a constant weight*
8. Reading a graduated device (cylinder at the bottom of the meniscus, for example)*
9. Determining pH (using a pH meter done Exp 4, bromothymol blue, pH paper done Exp 4)*
10. Using a reagent dispensing pump*
11. Practicing The Pipette Rule*
12. Measuring absorbance using a Genesys 20 or Genesys 30 Spectrophotometer*
13. Gravity filtering*
14. Vacuum filtering*
15. Heating on a hot plate, in a water bath*
16. Magnetic stirring*
17. Cooling in an ice/water bath*
18. Using a volumetric pipette - done Exp 5*

19. Using a graduated pipette - done Exp 6*
20. Determining the density of a liquid- done Exp 5
21. Preparing solutions with an accurate concentration by dilution - done Exp 6*
22. Standardizing NaOH (determining of the concentration of an unknown solution by titrating against a primary standard) - done Exp 7*
23. Determining the neutralization equivalent of an unknown acid (by titrating with a standardized base) - done Exp 7*

*an asterisk indicates that you will practice this technique multiple times.

Chemical Concepts

1. Oxidation reactions (calcium with water, aluminum with KOH)
2. "Double Displacement" (or metathesis) reaction (calcium hydroxide with HCl, sulfate with barium,)
3. Acid - Base reactions (alum with KOH, calcium hydroxide with HCl, bromothymol blue with base, vitamin C with NaOH)
4. Dehydration of inorganic hydrates (alum losing waters of hydration)
5. Amphoteric reactions of aluminum (III)
6. Sodium hydroxide is hygroscopic and reacts with CO2 (in the atmosphere)
7. Cross-linking of polymers (alginate) produces a change in physical properties
8. Combustion reaction (methane with oxygen, your Bunsen burner)
9. Using the ideal gas law to calculate molecular weight of a gas.
10. Beer-Lambert Law
11. Le Chatlier's principle (calcium alginate, bromothymol blue)
12. Using the method of continuous variation (Job's plot) to determine stoichiometry
13. Determining accuracy and precision of a measurement
14. Determine error in a measurement
15. Recognize systematic and random error
16. Analyze results of a t test to compare the means of two groups
17. Apply stoichiometry concepts to understand laboratory data
18. Understand concentration units -- molarity, moles/kg of solution, %(w/w), %(w/v), ppm.
19. Prepare solutions. Understand the difference between preparing a solution of an approximate concentration and preparing a solution of precisely known concentration.