

SYLLABUS

Intensive General and Quantitative Analytical Chemistry Lab

CH111/181 - Fall 2016

Welcome to CH111/181 Intensive General and Quantitative Analytical Chemistry Lab. This is the first semester of a year-long laboratory course intended for chemistry concentrators, biochemistry concentrators, physical/biological science majors, and interested students who require a one-year intensive course in chemistry.

By the end of this course students will (i) be able to properly use analytical glassware and associated lab equipment, (ii) understand the basic principles and operation of absorption spectrophotometers, (iii) be able to use statistics and graphing software to analyze experimental data, (iv) start developing an understanding of the chemical principles behind various analytical methods (such as gravimetric analysis and titrations), and (v) have a good foundation in the process of scientific communication – preparing tables and figures, outlining an argument, and preparing a scientific report.

This syllabus is designed to answer many questions you may have. Please read it over and then keep it handy to use throughout the semester. Additionally, the first sections of the course lab manual contain detailed information about course policies.

Course Information and Policies

Course Staff

This course is given by Dr. Binyomin Abrams:

Office Hours: Monday 5-6pm and Thursday 9-10am (in SCI 270B)

Communication: abramsb@bu.edu (e-mail, preferred) and 617.353.2480 (office phone, emergencies)

Course Website: <http://learn.bu.edu/>

The lab teaching fellows and learning assistants (along with their office hours):

Richard Andino Mon 1-2pm in SCI 161

Kaitlynn Lopes Tues 8-9am in SCI 200B

Alexander Hino Fri 12-1pm in SCI 294

Shivani Mehta Fri 2-3pm in SCI 200B

Jacqui Theisen Thurs 3-4pm in SCI 200B

Vikram Vishwanath Tues 5-6pm in SCI 200B

All members of the course staff are available for consultation during their office hours (listed above) and by appointment. All students are welcome and encouraged to attend any of the office hours listed to discuss lab work and ask questions about the lab portion of the course (questions about the lecture/discussion portions of the course should be directed to those instructors). Any questions that you may have about the lab portion of the course can be sent to ch111-questions@bu.edu. E-mails sent to this address will reach all of the course staff simultaneously. Personal and sensitive matters should be emailed directly to the course instructor.

Texts and Equipment

The required materials for the course are available at the Boston University Bookstore:

1. Abrams, B. *Analytical Chemistry Lab Manual (2016-2017 edition)*; Kendall-Hunt: Dubuque, IA 2016.
2. Laboratory notebook, Hayden McNeil Publishing, ISBN 1-930882-23-8.
3. Lab coat and approved face-forming safety goggles (UVEX Futura)
4. Scientific (non-graphing, non-programmable) calculator (recommended: <http://goo.gl/uRZQ8K>)
5. *Recommended, but not required*: Harris, D. C. *Exploring Chemical Analysis, 5th ed.*; W. H. Freeman and Company.

All of the above items are required by all students, except for Harris. You must have procured these items *before* the first lab session. Harris is a good reference for analytical procedure and is highly recommended (either the 4th or 5th edition).

Classroom response system and other electronic devices in lecture/discussion

We will be using Top Hat (www.tophat.com) in CH201 for in-class quizzes, pre-lecture work, and other assessment. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets. You can visit the Top Hat Overview (<https://goo.gl/2VmNnI>) within the Top Hat Success Center which outlines how you will register for a Top Hat account, as well as provides a brief overview to get you up and running on the system. The course join code for the lab portion of CH111 in Fall 2016 is **828515**, and your account for Top Hat must use your BU email address (ending in @bu.edu) in order for you to get credit for your work on Top Hat.¹

We will use Top Hat for classroom engagement, periodic attendance, and some quizzes; that said, recent studies (see: <http://goo.gl/F0YKJj>) have shown that taking notes with electronic devices (computers, tablets, etc.) leads to **lower performance** by students on exams. For this reason, we **require** that you take notes using the traditional pen and paper mode. Similarly, while you will use your cellphones or tablets for answering Top Hat questions, make sure to keep them down when they are not in use so that you might best benefit from the lectures.

E-mail Correspondence

Periodic e-mails will be sent to the entire class using the BU-link (registrar's online information system). Make sure that you check your BU e-mail address regularly so that you do not miss any important messages.

Course Schedule

The detailed course schedule can be found on the course website and at the end of this document. The lab portion of this course consists of three required components:

- Pre-lab lecture (M 12noon-1pm in SCI 117),
- Lab (W 1pm-5pm or 5:30pm-9:30pm in SCI 153/160 – even numbered sections are in SCI 160), and
- Writing conference (not yet on your schedule; this is scheduled with your writing assistant) – this component is **mandatory** given that CH111/112 counts for WR150.

You are **required to attend** all of the lab meetings of your registered section and all lab lectures (where important details that will not necessarily be disseminated at any other times will be discussed). Some recorded lectures will be posted to the *Echocenter* in the course blackboard website.

Safety, Pedagogy, and Course Policies

A discussion of lab safety guidelines, the course pedagogy, and course-specific policies can be found in the first part of your lab manual. All students are **required** to read through those sections and complete the “Course Policies Quiz and Safety Agreement” (on Top Hat) before the beginning of the first experiment. Additionally, helpful guidelines for preparing course assignments and laboratory notebooks are presented in Appendix B of the lab manual. All students are responsible for following the course policies and regulations at all times.

Academic Conduct

All students at Boston University are expected to maintain high standards of academic honesty and integrity. Details about academic integrity, including specific details about laboratory courses, are presented in the first part of the course lab manual. All students are **required** to read through those sections and complete the “Academic Conduct Quiz” (posted on Top Hat) before the beginning of the first experiment.

Copyright Laws and Protection

The syllabus, course descriptions, lab manual, and all handouts created for this course, and all class lectures, are copyrighted by the course instructor. The materials and lectures may not be reproduced in any form or otherwise copied, displayed or distributed, nor should works derived from them be reproduced, copied, displayed or distributed without the written permission of the instructor. Infringement of the copyright in these materials, including any

¹We've arranged a special deal for students entering BU in fall 2016: a lifetime Top Hat license is discounted for you to \$60. If you plan to take Organic Chemistry next year, this is likely the most economical choice.

sale or commercial use of notes, summaries, outlines or other reproductions of lectures, constitutes a violation of the copyright laws and is prohibited. Please note in particular that distributing, receiving, selling, or buying class notes, lecture notes or summaries, or similar materials both violates copyright and interferes with the academic mission of the College, and is therefore prohibited in this class and will be considered a violation of the student code of responsibility that is subject to academic sanctions.

Lab Components and Assessments

Pre-lab Assignments

Pre-lab assignments are at the end of the each lab in the lab manual. The completed sheets should be removed from the lab manual and must be submitted to the supervising TF *before* the beginning of the lab section. In general, pre-lab assignments will typically consist of a few calculations, or questions, that are relevant to the lab that is about to be performed. Doing well on these assignments is a good indicator of preparedness for the lab – make sure to work on them in advance (and it is advisable to keep copies of your work for reference when doing the post-lab).

Lab Notebooks

Use of the lab manual in lab is not permitted. All work in the lab must be done directly from your notebook - the correct academic, and industrial, lab practice. The duplicate notebook pages must be submitted before leaving the lab, and the use of proper lab notebook technique will be part of your assessments. **Detailed instructions** for preparing lab notebooks to be used in lab can be found in the Appendix of the lab manual.

Quizzes

There will be unannounced quizzes given at the start of some labs and in pre-lab lecture. They will test you on the labs that you've just completed or are about to complete (based on the pre-lab lecture material). Late arrivals will not be allowed extra time for the quiz.

Post-lab Assignments

Post-labs are submitted on Blackboard and are due 2 hours before the beginning of your scheduled lab period² of the following week (unless otherwise announced). These assignments will be either (1) a series of questions related to the lab and your data, or (2) a formal lab report. Detailed instructions and guidelines for preparing post-lab assignments can be found in the Appendix of the lab manual. Students names and section numbers need to be included on all pages of the submission.

Lab material on lecture exams

Lab questions will be included in all lecture exams (approximately 20% of each exam) and they will cover the material covered in pre-lab lecture, the lab manual, the lab textbook, and in the laboratory (including post-lab assignments).

BU Chemical Writing Program

Through a joint initiative of the Chemistry department and the CAS Writing Program, students completing the CH111/112 sequence will receive equivalency for the WR150 course - research based writing. The writing assignments are an integral component of the CH111 course and students are *required to complete them* in order to pass the course.

Lab Practical

The lab practical is a special in-lab exercise designed to evaluate you on your learning of proper lab techniques, basic statistical analysis, and analytical thinking. Details will be supplied at a later date.

²In many cases, the system will take submissions after the due date. Late submissions will either not be graded or will receive a substantial penalty.

Grading

Overall Lab Grade

In addition to the lab material that will be featured in the exams, the lab is worth 25% of the overall CH111 course grade. The **approximate** breakdown of the points is:

Component	Points
Labs and Writing	750
Quizzes and Participation	150
Performance	100
Total	1000

Letter grades **are not** assigned to individual labs or to the lab component of the course. Course letter grades are assigned based on your total score for the course. Do not expect “High School”-type scores; in other words, an “A” is not a 93, an “A-” is not a 90, etc... Moreover, there can be a relatively steep learning curve when starting analytical chemistry. The most important thing is that you should work as hard as you can and strive to continually improve your **learning** and performance throughout the course. In the lab, an “A” grade would represent excellence and consistently meeting the expectations of the lab portion of the course on assignments; a “B” corresponds to a good mastery of the material and mostly meeting the course expectations; a “C” represents being consistently below expectations; and a “D” corresponds to insufficient mastery of the course material.

Individual Labs

Typical experiments will be graded based on some, or all, of the following components: pre-lab assignment, notebook pages, data, and post-lab assignment. Exact breakdowns will be lab-dependent.

Performance

Your performance during the labs will be evaluated by your lab instructor (TF). These assessments will include proper lab etiquette, following course policies, demonstrating proficiency with techniques that are taught, and instrumentation use. It is important to remember that you should work efficiently and safely at all times. Exceptional performance will lead to an increased assessment score. Infractions in lab safety and etiquette will result in a lowered assessment score. Repeated infractions may result in your ejection from the lab.

Note: not following explicit instructions of a TF or LA, or talking back to them, is completely unacceptable. Students not following the instructions of their TF will be ejected from the lab. This is unsafe and irresponsible. If you feel that your TF is wrong/incorrect: have them contact the course instructor immediately.

Questions Regarding Grades

Any question concerning the grading of a lab must be brought to the attention of the grading TF within a reasonable amount of time (usually 1 week) of when it is returned to you; material will not be accepted for regrading after a long delay. If, after having met with grading TF you are still uncertain about your grade, you should bring the graded work to the lab course instructor. Be sure that you have made no alterations in your work.

Tips and Hints

While many students enter college already well-versed in chemical theory, they often find themselves lacking in some of the most basic fundamentals of experimental techniques. This course is designed to walk a student through the basics of analytical chemistry. There is no pre-requisite knowledge of lab techniques, but they build-up quickly.

Make sure to use the course staff (and their office hours) and study groups to get the answers to any questions that you have. The best approach is to always make sure that you know what you are doing, and why you are doing it, and if you don't understand something then ask questions.

In the past, students have best been able to manage their workload with good time management. Students should be reading the textbook and lab manual before their lecture on Mondays. Pre-lab assignments, and notebook pages, are best completed soon after lecture in order to be prepared for lab. Break-up working on the post-lab assignment:

consider doing the data analysis before the Monday lecture, and then polishing/completing the assignment in the days leading up to the lab section.

Tutorial sessions (a.k.a. office hours)

You are strongly encouraged to attend office hours frequently. They are a great opportunity to work through problem in groups, get support from course instructors, and ask questions. **Note:** you do not need to have a question or an appointment to attend these open hours. Rather, come frequently and maximize your effort by getting support. These tutorial sessions are helpful for all students.

An important note about getting answers to your questions: e-mail is not a replacement for office hours. While instructors will certainly respond to personal, private, and urgent matters by email, they will **not** be regularly answering content-related questions by email. To get answers from instructors, please attend any of the office hours listed above.

Tentative Course Schedule

Date	Details	Harris Reading Section (pages*)
M 9/5	Labor day - no classes	
W 9/7	Check-in, Safety tour, Lab orientation WR #0: Writing Program description	
M 9/12	First pre-lab lecture Measurements and units Basic stats: mean, standard deviation, RSD Preparing effective exhibits (Writing Chapter 2)	Ch. 1 (13-21b, 23-26m) 4-1 (77-80t)
W 9/14	Safety, Policy, and AC Quizzes due before lab Lab #1: Excel tutorial	Ch. 3 (3.5-3.6)
M 9/19	Math tools: significant figures, types of error Tools: waste, lab notebook, balances, micropipettes The 'Real' rule for significant figures	3-1, 3-2, 3-3 (55-62) 2-1, 2-2, 2-3, 2-6 (35-39t, 45) (66m-68t)
W 9/21	Lab #2: Avogadro's number	
M 9/26	Tools: pipets, filtration, drying Gravimetric Analysis	2-6 (44-45t), 2-7, 2-8 (46-48) 7-1, 7-2 (145, 147b-149, 151b, 154)
W 9/28	Lab #3: Gravimetric determination of calcium (Post-lab for lab #3 is due 10/5 at 9am)	
F 9/30	Lab lecture during normal lecture slot (9am) More stats: Student's <i>t</i> , Grubbs WR: Students select writing assistant by lecture today WR #1: Preparing to make strong arguments (due 10/12) [†]	4-3 (83-85t), 4-5 (89-90t)
M 10/3	Regular lecture in pre-lab	
W 10/5	Post-lab for lab #3 is due Feedback from TFs and LAs on first-part of semester	
F 10/7	Lab lecture during normal lecture slot (9am) Light and spectroscopy Spectrophotometers	18-1, 18-2, 18-3 (387-399t) 19-1 (409-411)

*Page number details: b = bottom, m = middle, and t = top; PDFs posted on blackboard.

[†]Writing assignments (WR) are due (uploaded to Blackboard) by 9am on the date listed, writing conferences happen during the scheduled times in the days following the due date, and final draft is due at the same time the following week.

Date	Details	Harris Reading Section (pages*)
M 10/10	Columbus day – no classes M, T is Monday's schedule	
T 10/11	Regular lecture in pre-lab	
W 10/12	Lab #4: Molecular Spectroscopy Tutorial Lab	
F 10/14	Lab lecture during normal lecture slot (9am) Applying the particle-in-a-box model to conjugated systems WR #2: Structure of scientific papers (due 10/26) Argument, exhibits, and critical thinking	
M 10/17	Regular lecture in pre-lab	
W 10/19	Lab #5: Modeling Conjugated Dyes – particle-in-a-box lab	
F 10/21	Lab lecture during normal lecture slot (9am) Solution preparation Tools: volumetric flasks Colorimetry, complex ions Linear regression, calibration curves Uncertainty from linear regression	1-4 (23-26m) 2-5 (43-44) 4-6 (90-93), 4-8 (95b-97m) 4-7, 4-8 (93-97m)
M 10/24	Regular lecture in pre-lab	
W 10/26	Lab #7: Colorimetric determination of iron	
M 10/31	Atomic spectroscopy Standard Additions WR #3: Voice and style of scientific papers (due 11/9)	20-1 (435-437t), 20-5 (446) 5-3 (111b-112t, 114m-115t)
W 11/2	Lab #8: Iron in breakfast cereal	
M 11/7	Ideal gas law, Dalton's law Tools: buret Titrations Back-titrations	2-4 (40b-42) 6-1, 6-2 (123-127) 6-1 (125t)
W 11/9	Lab #9: Gas laws – oxidation of magnesium	
M 11/14	Two-sample t-tests and comparing distributions WR #4: Conventions in technical writing (due 11/30)	
W 11/16	Analysis and work session for Lab #9 and WR #4	
M 11/21	Heat and enthalpy Calorimetry	
W-F	No classes - Thanksgiving	
M 11/28	Thermochemistry and first law Temperature vs. times graphs	
W 11/30	Lab #10: First law and calorimetry	
M 12/5	Discussing the lab practical exam Reviewing course content	
W 12/7	Lab practical	
M 12/12	Last day of classes	

*Page number details: b = bottom, m = middle, and t = top; PDFs posted on blackboard.

This is a tentative syllabus and is subject to change at any time. Students are expected to conform to these instructions and any other instructions given throughout the semester.