This course is designed to illustrate and apply the principles and concepts of physical chemistry through experiments and to introduce techniques and instruments used in modern chemical research.

I. Learning Objectives
By the end of this course students will

1) Develop deeper understanding of concepts in physical chemistry through the analysis of experimental data.

2) Learn to compare quantitative measurements to one another and with theoretical predictions in order to justify quantitative experimental conclusions properly using error analysis and to consider critically the importance and veracity of others’ conclusions.

3) Synthesize well-organized post-lab reports of research results, with proper presentation of numeric data in appropriate formats (graphs, tables, etc.), clear presentation of calculations of derived numeric results from raw data, and well-crafted discussions contextualizing results relative to key physical/chemical concepts.

4) Become acquainted with a variety of laboratory instrumentation/apparatus, including instruments used in academia and industry.

II. Hours and meetings.

Lectures:
Sections 1-2, Mondays, 1:30 to 2:20 p.m., Remsen 233.
Sections 4-5, Tuesdays, 1:30 to 2:20 p.m., Remsen 233
(No Sections 3,6)
Lectures will cover topics on the quantitative analysis of experimental measurements. Discussions on quantitative analysis will closely follow Taylor’s An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements.

Laboratory:
2:30 p.m. to 6:30 p.m. on each section’s scheduled afternoon, UTL G86.
Sections 1,4 — Monday afternoon
2,5— Tuesday afternoon

- There is no lab period the week of Aug. 29th/Sept. 3rd.
- Sept. 9th/10th lab period will be used for a lecture on concepts behind experiments (this is in addition to the scheduled 1:30 p.m. lecture period).
- First experiments will be the week of Sept. 16th/17th.
•  Lab activity during the weeks of Nov. 18th/19th and Dec. 2nd/3rd involve a practical lab electronics module.

Experiments should be conducted during scheduled hours. No one is permitted in the lab during nonscheduled hours without instructor/T.A. approval and supervision. All experiments can be finished well within the scheduled period with proper pre-lab preparation. To ensure that you can finish lab work during the allotted period it is very important that you come to lab prepared to do your scheduled experiment: study the corresponding handouts, videos, and textbook sections beforehand and complete the pre-lab assignment in order to have a grasp of the background, procedures, and how you will do the appropriate data and error analysis for a given experiment. The T.A. is there to assist with – but not to lead you through – each experiment! However, you should take full advantage of the scheduled lab period as your primary opportunity to consult with T.A.s with questions relating to the experiments. Note – weeks with no schedule experiments are intended to be used for discussions with your T.A. about questions you have about your data analysis and post-lab assignment.

Office hours:  Drs. Bragg & Fairbrother – Fridays, noon-1 pm (see schedule for location)
By appointment with teaching assistants

III. Texts and materials:


Science Reference (MSEL, C level):

Additional resources: The course blackboard site is a critical repository of information, providing specific instructions for each experiment and assignment, background materials and recorded lectures, examples of written lab reports, and instructional videos for each experiment. The instructional videos will be particularly valuable for understanding our implementation of experiments described in Garland.

IV. Make-up Lab Policy:
In certain cases (religious holidays, scheduled interviews, sports events, or medical treatments) make-up labs can be scheduled when the regularly allotted time for an experiment will be missed. You much inform the instructor, the relevant T.A., and your lab mate of any such conflicts as soon as possible so that a make-up time can be scheduled. In the case of serious, unexpected illness, you must notify the instructor and your teammate of your absence and provide a medical excuse (note) at the next class
attendance. In the event of equipment failure during an experiment a make-up or substitute lab will be scheduled. *No more than two make-up labs will be scheduled for any student.*

V. Laboratory Rules:
1. **Safety glasses and closed toe shoes must be worn at all times when in the laboratory.**
2. No eating, drinking, or smoking is permitted inside the laboratory.
3. Use the coat rack for coats and jackets.
4. Please step outside of the laboratory to talk to visitors or make/receive phone calls.
5. Texting/Electronic devices – be mindful that you are working in a laboratory environment; for safety you should be aware of what is happening around you at all times.
6. No social media connection (Facebook, Instagram, Snapchat, etc.) with TA’s is permitted while you are taking the class and before you have received your grade.

**Regarding proper Attire for Individuals in Laboratories:** It is the policy of the Johns Hopkins University that all employees, faculty, students and visitors wear appropriate attire in all laboratory areas to eliminate or minimize skin contact with hazardous materials. Shorts, miniskirts or any apparel that does not cover the skin above the knee when seated should NOT be worn in the laboratory without appropriate over protection (e.g. a buttoned laboratory coat). Open toed shoes, sandals or shoes made of loosely woven material should not be worn in the laboratory. *If your attire is unfit for lab work, as described above, the T.A. or Instructor will ask you to address the situation before you can conduct your experiment.*

Gloves should be worn whenever there is a potential exposure of the hands to hazardous materials. The gloves should have the necessary resistance to the hazardous material being used. All gloves should be removed before handling cell phones, a computer keyboard or mouse, doorknobs, gas regulators, and any other equipment that is not used directly for handling or measuring chemicals.

VI. Grading:
Your grade will be determined from the following:
**24%** from the total score on pre-lab reports
**70%** from the total score on post-lab assignments
**6%** from the quantitative analysis problem set

Six experiments (conducted in a round robin format) and a two-week lab electronics module at the end of the course will be conducted. All post-lab assignments require a series of data calculations and written responses (paragraph form) to discussion questions.

*There will be no final examination for this course, but the deadline for submitting all work is 5 pm Friday December 6th, 2018.* With consistent conscientious effort on post-lab calculations and laboratory write-ups it is possible to complete all assignments in advance of this final deadline.
VII. Assignments:

A. Problem set: During the first month we will discuss quantitative (error) analysis critical for your post-lab calculations during the 1:30 p.m. lectures. A single problem set consisting of a few problems from the ends of the chapters in Taylor will be assigned, and all solutions will be due on **Friday October 11th**. These problems are intended to sharpen your skills with data calculations for lab experiments. *It is critical that you demonstrate the calculation procedure for arriving at your answers* (that is, “show your work”), as demonstrating that you know the process is central to the spirit of these assignments. Reduced credit will be given for mere statements of numeric results/answers, right or wrong.

B. Pre-labs: At the beginning of each lab period, each student must turn in responses to the pre-laboratory assignment (found on Blackboard) to the responsible T.A. These assignments are comprised of a series of questions that should be answered in sentence format and with details of appropriate calculations. Questions are designed to ensure that you understand the ultimate goal of the experiment, what data will be collected, how specific instrumentation will be used in measurements, how that data will be processed and analyzed, and what **specific** sources of error can be anticipated for a given experiment.

The pre-lab is as much a preparation for the experiment as it is an assignment. Your TA, at his or her discretion, may quiz you on the lab protocol for that day – most certainly if you come to lab without a completed pre-lab assignment. If you come completely unprepared for your experiment you create a burden for your partner and the T.A. need not walk you through the lab.

C. Post-lab assignments: Each student will complete post-lab assignments *independently*, but based on data collected jointly by his or her group.

*Specific instructions are given in the text and handouts on what calculations must be carried out, what figures should be plotted, and what questions should be answered in relation to your findings.* Written responses to discussion questions/topics should be presented clearly in paragraph format. The text of your report must be typed. Drs. Bragg and Fairbrother and the teaching assistants are available to discuss general questions pertaining to the experiments and report format.

*With some exceptions, finished reports are due by midnight (11:59:59 p.m.) on the day that falls two weeks and two days after the experiment was performed. In general, Monday post labs are due by midnight on the third Wednesday after the experiment was conducted, Tuesday post labs are due by the third Thursday. Some exceptions to this rule will occur around the Thanksgiving break.*

*Your post-lab assignment should include any data or hand written calculations that illustrate your error analysis procedures; please make copies of these extra pages before handing in your report. At the top of your post-lab you should list your name, section, and group number.*

*You must turn in an electronic copy of your post-lab by midnight of the due date; the hard copy must be handed in first thing the following day. Electronic copies should be uploaded through the course Blackboard site as Microsoft Word, Open Office, or PDF documents; instructions for uploading electronic copies and handing in hard copies will be provided separately. The contents of your electronic and hard copies should match exactly!***
Do not procrastinate or ask the T.As for more time. **There will be a 5-percent reduction in the grade for EACH DAY a report is late - no exceptions.**

Every effort will be made to return graded reports in a timely manner (< 2 weeks).

**VIII. Statement on Student Ethics endorsed by The Johns Hopkins University**

(------TAKE THIS SECTION VERY SERIOUSLY!------)

The strength of the University depends on academic and personal integrity. In this course you must be honest and truthful. Cheating is wrong. Cheating hurts our community by undermining academic integrity, creating mistrust, and fostering unfair competition.

Violations can include cheating on exams, plagiarism, reuse of assignments without permission, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Ignorance of these rules is not an excuse.

In addition, the specific ethics guidelines for this course include:

1. Class members – especially teammates – are permitted and encouraged to collaborate on data analysis calculations used in laboratory reports, but preparation of post-lab contents (data representation, writing, etc.) must be the work of each individual student – no reproductions!

2. **Plagiarism absolutely is not tolerated!** Students should be aware that close paraphrasing of texts, articles, and other peoples’ written work is or dangerously approaches plagiarism, and therefore must be avoided. Students should communicate key ideas in their own language. Reference resources, such as textbooks, typically contain far more information than should be presented in a pre-lab assignment or laboratory report. The student is responsible for carefully discriminating between critical and non-critical concepts and communicating his or her understanding of the material.

3. Incidents of cheating/plagiarism will be handled strictly according to the Ethics Board’s guidelines. When such incidents involve the sharing of materials such as current or past years’ assignments (so-called **“back-labbing”**), graded or ungraded, all parties (i.e. both material “Donors” and “Acceptors”) will be treated as culpable for the offense and prosecuted. Note that this policy applies to students who have previously taken this course.

For more information, see the guide on “Academic Ethics for Undergraduates” and the Ethics Board website (http://ethics.jhu.edu).

*This official course syllabus was discussed in class on Aug. 29th, /Sept. 3rd 2019. Some logistical details provided here may be subject to change as deemed necessary for course administration. Any such changes will be announced in lecture and via the Blackboard sites.*