

## Syllabus

### CHM327F Fall 2017 Experimental Physical Chemistry

Welcome to CHM327! This is a course meant to introduce you to the wonders of experimental physical chemistry. That means hands-on learning – making things, doing things – to investigate, make observations and measurements of physical phenomena. The course consists of a 1-hour lecture and a 4-hour lab period each week; you have to attend and actively participate in both. The bulk of the course is a “discovery labs” format, in which you, in a team, will design and implement a research project, engage in problem solving (many experiments do not work – so what will you do?), think it through, analyze data and communicate your results (and your struggles).

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*Office hours:* Wednesdays, 1-2 pm at McLennan Physics, room 331

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*Lectures:* Wednesdays 2 - 3 pm, LM 123

*Labs:* Fridays, 9 am - 1 pm, LM 206

The detailed schedule is given in the table below.

### Weeks 1 and 2: Open Labs

In the lab, you will be introduced to some types of experiments in physical chemistry. You will work in assigned teams. You will be given some minimum instructions with regards to the experiment and/or use of apparatus, but they are open-ended: it's up to you to decide on how to explore further. What you learn from these labs could serve as starting point for projects in the subsequent weeks. At the end of each lab period, there will be a quiz about what you had done.

### Weeks 3 to 10: Discovery Labs

The bulk of the work will be about a mini research project, which we call “Discovery Labs”. This will be carried out in teams of 4; you choose your team, and it's up to you to learn how to work together, and how to divide up the work, in order to reach your goals.

The work will involve choosing a project, creating a proposal, planning the experimental work, implementing it, troubleshooting and adjusting, analyzing results. You are given a firsthand experience in being an experimental physical chemist, introducing you to how research work is planned and done, as well as getting you familiar with modern day physical chemistry problems and approaches.

You will be provided with starting points for possible projects, although you may also come up with your own ideas from your own experience and curiosity about the world (although remember that you have limited time, so you have to be realistic). You are not allowed to work on something that you have done before (e.g., in a summer research project). Your proposed research project will be discussed in class, and needs to be approved by the course instructor/TAs.

### **Week 6 – midterm review**

Your TAs will talk to you individually during labs on Oct 20 to give you feedback on your performance. The goal of this is to help you improve as you move forward. You have to submit an interim report on Oct 25 to summarize what you have done so far, as well as to state adjustments on the project plan. You can take into account the feedback you had received in creating this report.

### **Reading week Nov 6 to 10**

There are no classes during Reading Week. This is a good time for reflection. However, if you need to access your experiments, let me know in advance so I can make arrangements.

**Marking scheme**

Paper critique	5 %
Open labs:	15 %
<i>Lab performance</i>	8 %
<i>quizzes</i>	7 %
Projects:	75 %
<i>Proposal (written, presentation)</i>	10 %
<i>Lab performance (individual)</i>	30 %
<i>Interim Report (individual)</i>	8 %
<i>Final presentation (team)</i>	12 %
<i>Final report and notebook (individual)</i>	15 %
Lecture participation and quizzes	5 %
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TOTAL	100 %

*Lab performance: individual, every Lab*

Your TAs will get to know you quite well during this term. During the lab session, TAs will talk to you to see how to ensure that you are knowledgeable about the topic (i.e., you came prepared), and that your mind is on the task at hand. Lab performance will be marked for each session. Unexcused absence means a zero for the session. Evaluation parameters include pre-lab preparation, critical thinking, hands-on skills, general knowledge on the chosen topic, attitude, and documentation in lab notebooks. Improper lab techniques, issues with safety and sloppiness will incur deductions.

*Paper critique: individual, present in Lab#2*

Each student will choose a paper and present to the class a summary and short critique (during Lab#2), with suggested follow-up experiments.

*Lab quizzes: individual, during Labs#1 and #2.*

There will be no lab reports submitted for the Open Labs. Instead, there will be quizzes administered during the lab period.

*Proposal: team, draft on Sept 27, final version on Oct 6*

Each team will come up with a proposal of what they intend to do for the Discovery Labs. You can choose your own team (4 people to a team); this has to be finalized by Friday, Sept 22 by the end of the lab period. Each student is encouraged to discuss proposal ideas with the course instructor/TAs from the beginning of course – the instructor/TAs may be able to help connect you with teammates.

An initial version of the proposal should be handed in at the lecture on Sept 27. It should include: a title, a brief intro and the goal(s) of the project, a rough timeline of activities, the expected responsibilities of each team member, a list of resources needed (equipment, materials), their sources and cost. Each team will present their proposal (10 mins) to the lab class on Friday, Sept 29. During that class, each team will be joined by TAs and visiting scientists who will provide feedback and advice to help in finalizing the project plan. You can then revise the proposal based on all the feedback and advice. Note: you may get different advice from different people – the final decision is of course up to your team. You should take into consideration issues of interest (what the goals are, why is this interesting and/or important) as well as practicality (should be possible in the allotted time and resources). We hope you will learn to have judgement!

The revised project proposal should be submitted during the lab on Friday, Oct 6.

*Interim report: individual, submit during Lecture, Oct 25*

Each individual is required to submit an interim report on their Discovery Labs. This report should include the motivation and background of the project, work done to date, issues encountered, and plans for the remainder of the semester.

In addition, each individual should explain the team dynamics of their group and how each individual contributed to the project (250 words max.).

*Final Presentations: individual and team, November 24*

Each team will present their Discovery Labs project in an oral format. 15 mins presentation + 5 mins Q&A. Grading will take into account content (80%) as well as presentation skills (20%). Make sure you let each team member participate.

*Final Report: individual, Nov 26*

You are required to submit an individual final report on your Discovery Labs as a brief formal report. Instructions on formal reports will be given separately.

In addition, each individual should explain the team dynamics of their group and how each individual contributed to the project (250 words max.).

*Lecture participation & quizzes:*

Student participation in discussions will be evaluated for all lectures. Quizzes may be given on occasion.

***No make-up quizzes will be given. Penalty for late reports: 5% per day.***

**Detailed Schedule for CHM 327 (2017)**

<b>Week</b>	<b>Lecture (2 days before lab)</b>	<b>Lab Date</b>	<b>Lab</b>	<b>Comments</b>
<b>1</b>	Course intro. How to read a paper. Assign paper critique.	<i>Sept 15</i>	Lab orientation; intro to techniques of imaging, scattering and spectroscopy. Open Labs #1	Quiz in Lab
<b>2</b>	Experimental design; research project topics	<i>Sept 22</i>	Paper critique presentation & Open Labs #2	Quiz in Lab
<b>3</b>	Experimental design continued	<i>Sept 29</i>	Project consultations; Presentation of proposals; project approval; prepare orders	Proposal due Sept 27 at lecture
<b>4</b>	Experimental plan	<i>Oct 6</i>	Discovery Labs, session 1	Revised proposal due during lab
<b>5</b>	Special topics	<i>Oct 13</i>	Discovery Labs, session 2	
<b>6</b>	Group meeting 1	<i>Oct 20</i>	Discovery Labs, session 3; TAs to meet with each student to give feedback	
<b>7</b>	Group meeting 2	<i>Oct 27</i>	Discovery Labs, session 4	Interim report due Oct 25 during lecture
<b>8</b>	Group meeting 3	<i>Nov 3</i>	Discovery Labs session 5	Nov 6 – last day to drop
<b>9</b>	<i>Reading week</i>	<i>Nov 10</i>	Reading week	Extra time allowed by request
<b>10</b>	Making a presentation	<i>Nov 17</i>	Data analysis; Discuss with TAs	
<b>11</b>	Term wrap up	<i>Nov 24</i>	Oral Presentation; submit notebooks	15 min talk, 5 min questions Final report due Nov 26.
<b>12</b>		<i>Dec 1</i>	Clean up	