

# Course Syllabus

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Chem 126.04: Nanoscience Lab

Spring 2008

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## Class Meetings

R: 1:00p – 4:00p  
Tomsich 103

## Instructor

Simon Garcia  
Tomsich 108  
garcias@kenyon.edu

## Required Materials

Laboratory goggles  
Laboratory notebook  
Introductory chemistry textbook:  
Chang, *Chemistry*, 9th edition, or Zumdahl, *Chemical Principles*, 5th edition

## Office Hours

TBA, please check the course website (below).

## Course Website

<https://moodle.kenyon.edu/course/view.php?id=1980>

## Important Dates

Exam 1: **February 28**  
Exam 2: **May 1**  
Final Project: **May 6** (due at 6:30p)

## Course Description and Goals

**What is this course about?** This laboratory course will introduce you to the techniques of modern chemistry in the context of nanoscience and materials chemistry. These techniques will include the modern analytical instrumentation, the synthesis and analysis of materials, the use of numerical tools to simulate and analyze natural phenomena, and the fabrication of working devices. You will also develop and refine your experimental skills and intuition as you work on experiments.

**What will you get from this course?** The course will start with three standard projects that focus on the qualitative analysis of organic materials. The principles and methods you learn in these experiments will prepare you for basic work in organic and advanced chemistry laboratories.

This section of 126 differentiates in the fourth week and includes several types of experiments. In each experiment, focus on: principles underlying the experiment, careful preparation of materials, accurate and precise measurements, and rigorous analysis of data in terms of theory. By the end of the term, you should be able to prepare, design, and implement your own experiment in a final research project.

In addition to learning standard problem-solving skills and methods, you will also encounter *novel problems that you have never seen before*. True mastery of chemistry is marked by the ability to solve these problems as best as you can, using your knowledge of chemical principles, other fields of study, creative thinking, and stubborn, unyielding persistence.

## Requirements

**Prerequisites.** Chem 123. **Co-requisites.** Chem 124 or Chem 125.

This course is intended primarily for 1<sup>st</sup> and 2<sup>nd</sup> year students. 3<sup>rd</sup> and 4<sup>th</sup> year students should consult with the Chemistry department chair for permission to enroll.

## Laboratory Policies

**Attendance.** You are expected to attend every lab section. If you need to miss a section, you must notify me *in advance* to schedule a make-up exam or experiment, and obtain an excused absence with the Dean of Academic Advising (Jane Martindell). **If your schedule for this semester requires you to miss more than one experiment, then you must either drop this course or change your schedule.**

**Safety.** Laboratory experimentation is fun, but it also carries an inherent risk of injury. I know very cautious, capable chemists who have lost fingers and burnt out a third of their alveolar lung capacity. Please minimize laboratory risks as much as possible. Basic rules:

- Wear shoes that cover your toes
- Wear protective eyewear in the lab
- Never bring in food, drink, or gum

In the laboratory, I expect you to *maintain and enforce* a safe working environment. This means that you will practice safe laboratory techniques, and that *you will remind your fellow labmates to work safely and show them how to do so if necessary*.

**Any unauthorized experiments or unsafe behavior will result in immediate dismissal from the section and possible expulsion from the course.**

## Preparing for Experiments

For each experiment, your instructor will post: (a) a cover sheet, containing suggested readings from your chemistry text and other instructions, (b) a supplementary text, and (c) the experimental procedure. Download and read these materials before you take the prelab quiz. You may print and bring these documents into the laboratory if you want. You may find it useful, however, to summarize the procedure or write down preliminary calculations in your notebook before lab. (This approach tends to make you faster and more efficient in the lab.)

## Quizzes

Before each experiment, you must complete the corresponding quiz at the Moodle page for Chem 126.04. The quiz will include questions about previous experiments as well as the forthcoming experiment. Quiz questions are fair game for both examinations.

## Laboratory Notebook

You will use your laboratory notebook for three purposes:

1. To prepare for the experiment
2. To record experimental actions, results, and data
3. To record calculations and present the analysis of data

Calculations, analyses, and procedures require a standard format. Please see the *Laboratory Notebook Guide* for details. Your lab manual will provide examples for experiment-specific guidelines.

Before you leave the laboratory each week, please make sure that your instructor signs each page of your notebook as a witness. When you turn in your analysis the next week, remove the *yellow carbon copies* from your notebook (all pages for that experiment) and attach any graphs or spectra to the back.

If you write in your notebook *before* coming to lab, please keep these prelab notes on a separate page from notes taken in lab.

## Laboratory Reports

Laboratory reports will consist of carbon copies from your lab notebook and attached graphs and illustrations. At the end of each experiment, you will see a list of questions to answer in your lab report. Your instructor will pick a few of these items at random for grading.

Reports should follow several conventions for displaying results, calculations, conclusions, and graphs. Please see the *Laboratory Notebook Guide* for details.

**All lab reports are due one week after the corresponding experiment. They must be turned in at the beginning of class on Thursday.**

## Laboratory Awesomeness

Laboratory awesomeness is behavior, displayed in the laboratory, that encompasses experimental skills, scientific thinking, efficient use of time, good citizenship toward your fellow classmates, and working safely. Your instructor, the TA, and outside observers will evaluate your behavior in the laboratory for awesomeness. Being awesome in the laboratory is not difficult; it simply requires you to think ahead about the consequences of your actions for you and for others. Consider the example situations below:

You make a solution of HCl with a precise concentration of 0.1045 M and decide to store it in a bottle, but your bottle is dirty. *Do you clean it out? Once it's been rinsed, do you pour the solution directly into the wet bottle? If not, why not, and what do you do instead?*

You are trying to weigh out 3.40 g of  $\text{RuCl}_3$  into a weigh boat. Unfortunately, you weighed out 3.74 g. *Do you put the excess back into the stock bottle? If not, do you leave the excess in a beaker for someone else to use? Do you label it? At the end of the day, do you leave the beaker out for someone else to clean up?*

## Examinations

Exams will include questions about experimental methods, the theory and principles of each experiment, proper experimental technique and data analysis, and experimental details. Exams are scheduled for the first two hours of the usual class time (1:10p – 3:10p).

## Final Project

At the end of the semester, you will have two weeks to carry out an experiment that you plan yourself. Your instructor will provide you a selection of possible experiments. You will also get some resources (articles/protocols) to get started, but it is your job to propose an experimental procedure. Ultimately, you will turn in a description of your experiment as a lab manual experiment (complete with introduction, procedure, instructions for analysis, and quiz questions) and summarize your results. Your project materials are due at the time designated (by the Registrar) for the final exam.

## Academic Honesty

Please read the College's statement on Academic Honesty in the *Course of Study*, pages 26–29. Pay special attention to the definition of plagiarism and to the list of activities that violate the standards of academic honesty. I expect you to avoid plagiarism and to avoid even the mere appearance of plagiarism in anything that you submit for a grade.

## Evaluation

- 10% Quizzes (*Best 8 Quizzes*)
- 30% Laboratory Reports (*Best 8 Reports*)
- 10% Laboratory Awesomeness (*Skill, Citizenship, Safety*)
- 20% Exam 1
- 20% Exam 2
- 10% Final Project (including project proposals and final report)

## Grades

- A: *Exceptional Work*
- B: *Good Work*
- C: *Adequate Work*
- D: *Inadequate Work*
- F: *Poor Work*

## Excused Absences

**Planned Absence.** If you cannot attend a class or exam or finish an assignment because of an athletic, religious, or other event, you can make it up *before* the scheduled date, not afterward. I need at *least 2 weeks advanced notice* (let me know earlier if possible).

You are allowed a **maximum of one (1)** planned, excused absence. Please check your commitments for this semester and find any possible conflicts. **If your schedule for this semester requires you to miss more than one experiment, then you must either drop this course or change your schedule to avoid the conflict.**

**Unplanned Absence.** If you miss class or an exam or a problem set due to an unexpected event, such as illness, depression, bereavement, or dueling with a Sith Lord, notify a Student Support specialist:

- Physical health: Dr. Tracy Schermer (College physician)
- Mental health: Patrick Gilligan (Director of Counseling)
- Other: Jane Martindell (Dean of Academic Advising)

Tell me which person above you talked to, and I will verify your situation with this person. **The people above will maintain confidentiality. They will not discuss the reason for your absence with me, but will simply verify that your reason is good.** *Without verification, I will not accept late work and I will not schedule a make-up for the work.*

## Disability Services

**Accommodations.** If you have a learning disability or physical disability, or think that you might, please schedule an appointment with Disability Services *as soon as possible*. Only the Coordinator of Disability Services is authorized to review your documentation and to recommend an accommodation. I will work with you and with them to arrange an accommodation tailored to your situation *within two weeks*.

**Coordinator of Disability Services.** Erin Salva is the Coordinator of Disability Services. You can reach her by phone at 427-5453 or by email at [salvae@kenyon.edu](mailto:salvae@kenyon.edu).

## Late Work

I do not accept any late work without an official, excused absence (see above). If you have an *unofficial* reason for late work, I will accept it if you agree to forfeit 20% of its value for every 24 hrs that it is late.

## Experiment Schedule

Week	Date	Experiment	Due
1	Jan 17	1: Organic Nomenclature	
2	Jan 24	2: Infrared Spectroscopy	Report 1
3	Jan 31	3: Proton Nuclear Magnetic Resonance Spectroscopy	Report 2
4	Feb 07	4: Numerical simulation of a pH-indicating dye	Report 3
5	Feb 14	5: Design of a pH-indicating dye, <i>or</i> 6: Luminescence of quantum dots	Report 4
6	Feb 21	6: Luminescence of quantum dots, <i>or</i> 5: Design of a pH-indicating dye	Report 5, <i>or</i> Report 6
7	Feb 28	Exam 1 (Experiments 1–6)	Report 6, <i>or</i> Report 5
<i>Spring Break</i>			
8	Mar 20	7: Synthesis of nanoscale materials, <i>or</i> 8: Excited-state kinetics	Project Proposal, 1 <sup>st</sup> draft
9	Mar 27	8: Excited-state kinetics, <i>or</i> 7: Synthesis of nanoscale materials	Report 7, <i>or</i> Report 8
10	Apr 03	9: Dye-sensitized solar cell I	Report 7, <i>or</i> Report 8
11	Apr 10	9: Dye-sensitized solar cell II	Project Proposal, 2 <sup>nd</sup> draft
12	Apr 17	10: Final Project I	Report 9
13	Apr 24	10: Final Project II	
14	May 01	Exam 2 (Experiments 1–9)	
Finals	May 05		Final Project Report (6:30p)