



WISCONSIN
UNIVERSITY OF WISCONSIN-MADISON

Syllabus

CHEM 116 — CHEMICAL PRINCIPLES II

5 credits.

Continuation of Chemistry 115. Chemistry 115 and 116 satisfy the requirements for general chemistry and introductory analytical chemistry; lecture, lab, and discussion.
Enroll Info: CHEM 115 or cons inst. Open to Fr
Requisites: CHEM 116 Student Group Required

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S

CHEM 116 (Chemical Principles II) Spring Semester, 2020

Chemistry 116 is the second semester of a two-semester sequence on chemical principles. The course will begin with the laws of thermodynamics. All the standard thermodynamic functions (enthalpy, entropy, free energy, etc.) will be introduced and developed and applied to physical and then to chemical equilibria. The temperature dependence of physical properties, of the thermodynamic functions, and of chemical equilibrium constants, using multivariable calculus, will be emphasized. A sophisticated treatment of multicomponent aqueous equilibria will be given. This will include acid-base equilibria, solubility equilibria, complexation equilibria, and oxidation-reduction equilibria and electrochemistry. The treatment will involve extensive use of distribution coefficients for speciation, logarithmic plots, computer calculations and graphics. Electrochemistry will be covered in connection with the discussion of oxidation reduction equilibria. In each of these areas, we will apply thermodynamic principles to the relevant chemical phenomena.

Instructional Mode: Blended

Course Learning Outcomes:

- Apply a qualitative and quantitative understanding of aqueous equilibria using fundamental chemical concepts, founded in the laws of thermodynamics.
- Model chemical systems and experimental data using relevant quantitative, mathematical, and computational methods.
- Identify, formulate, and solve complex practical problems using appropriate information and approaches and the principles of thermodynamics.
- Participate in a creative individual research project in one of the science or engineering faculty research laboratories.
- Communicate scientific knowledge obtained in that project effectively through written reports and oral presentations with visual aids.
- Locate, evaluate, and use information in the chemical literature.

Instructor: Robert Claude Woods, 4337a Chemistry, 262-2892, rcwoods@wisc.edu.

Instructor Office Hour: Make an appointment or try just stopping by. Appointments can be arranged immediately after lecture or if necessary, by email.

Lab Director: Dr. Pamela Doolittle, 535 SMI, 262-9679, pam@chem.wisc.edu.

Teaching Assistant: Mr. Patrick Sullivan. EMAIL: ptsullivan@wisc.edu. Room 1201 Chemistry, desk #00.

TA Office Hour: Office hours will post on the Canvas page, or by appointment.

Primary Text: D.W. Oxtoby, H.P. Gillis, and A. Campion, Principles of Modern Chemistry, 6th edition, Thomson Brooks/Cole, 2008. (This can be found online as a .pdfdownload.)

Other Required Materials: (1) Lab notebook (on sale in Chemistry 1375, first week of classes).
(2) Industrial quality safety goggles for lab work (purchased at bookstore).
(3) A scientific calculator—keep in mind cell phones or internet connecting devices may not be used as calculators for an exam.

Lectures: MWF 8:50-9:40 am, 2373 Chemistry. *The lectures and discussion sections are an integral part of the class.* Attendance is essential! You should take your own notes as class notes are typically not posted regularly to the Canvas page.

Discussion Section: These are devoted to review of recent lecture material, the background for upcoming labs, and general problem solving. Your TA is in charge of content. Sections 591 and 592 meet Wednesday 7:45-8:35 AM in Room 2373 Chem.

Laboratory: For the first six weeks of the semester, you will have scheduled laboratory periods on Tuesday (section 602) or Thursday (section 601) from 7:45-10:45 AM. These first six experiments will be conducted in MSC Room 5360. The lab schedule is posted on the course website.

For the next seven weeks of the semester, you will work in faculty research labs for at least 8 hours per week. The procedures for selecting and beginning a particular research project will be described in class. This research experience will culminate in a written research report and a class presentation on your research project. Class presentations will occur during the Tuesday and Thursday laboratory periods and the Wednesday discussion time during the last week of class. All students are expected to attend the presentations of all of their classmates, except when they have an unavoidable conflict with another class.

Web Page: I will post problem sets, exam and problem set answer keys, reading assignments, etc., on the course Canvas page. You can log in at: <https://my.wisc.edu/>.

Grading: A student must complete the laboratory, including the research project, to pass the course. Cut-offs for various final semester letter grades will be made at the end of the semester, but in no case will the final letter grades be determined in a different order from the point totals shown below. The instructor fully understands that the student group in this course has been highly selected and expects that the distribution of final letter grades will reflect this by being narrow and high. There are no predetermined numbers corresponding to any particular grade. The teaching staff will to the best of their ability assign letter grades that fairly and accurately correspond to each student's performance in the class. (In other words: If you make an A, you'll get an A.)

Intended distribution of points:

Three exams (120 points each)	360 points
Final exam	240
Problem sets	100
First six weeks of lab	100
Research laboratory	200
<u>(work/report/presentation)</u>	
TOTAL	1000 points

Problem Sets: You will receive problem sets at between one to two week intervals throughout the semester. The TA will grade your solutions, and solution sets will be supplied after the problem sets are turned in. You may work with other students on the problems, but you must hand in and take responsibility for your own solutions. The problem set grades are counted in the final semester grade. More importantly, the exams will be closely related to the problem work that has been assigned, so a firm grasp of the problem sets will be highly important for doing well on the exams. It is required that students will use software, such as Excel or Mathematica, for many of the problems.

Examinations: There will be three mid-term examinations and a final examination. The three mid-terms will be at 7:15 pm on dates to be given later and will last about two and a half hours. The final exam is scheduled for May 3, from 7:45 AM to 9:45 AM.

Individual Research Project Written and Oral Presentations: A research paper is due on the last day of the last week of class, May 1. The paper should be 8-10 pages long (about 2500 words) and should describe your eight week individual research project. Please include the relevant citations. You will also give a 15 minute oral PowerPoint presentation about your research project in the lab sections during the last week of classes.

RULES, RIGHTS & RESPONSIBILITIES

See the Guide to [Rules, Rights and Responsibilities](#).

ACADEMIC INTEGRITY

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to studentconduct.wiscweb.wisc.edu/academic-integrity/.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform Dr. Woods and their TA of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. We will work either directly with you or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA.

DIVERSITY & INCLUSION

Institutional statement on diversity: “Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.” <https://diversity.wisc.edu/>

Laboratory Schedule for Chem 116, 2020 Spring Semester

Laboratory Director:

Dr. Pamela Doolittle

pam.doolittle@wisc.edu

Office phone: 608-262-9679

Teaching Assistant:

Patrick Sullivan

ptsullivan@wisc.edu

Stockroom Manager:

Dominic Colosi

dcolosi@wisc.edu

Labs meet once a week either Tuesday (Section 302) or Thursday (Section 301) for the first six weeks of the semester. For the rest of the semester you should use this time block to forward progress on the research project. Your TA may schedule study and review sessions during this time as well, so do not schedule work hours or other commitments after the initial six week formal lab period is finished. You can find the Experimental descriptions in the Lab section of the content on Learn@UW. The lab schedule:

Week 1 (January 21/23)	Molecular Modeling
Week 2 (January 28/30)	Fluoride Ion Selective Electrode *(Individual lab exercise)
Week 3 (February 4/6)	Synthesis of Biodiesel*
Week 4 (February 11/13)	High Pressure Liquid Chromatography*
Week 5 & 6 (February 18/20 & February 25/27)	A Study of an Unknown Acid * (Individual lab exercise)

**Complete the online laboratory quiz BEFORE coming to lab. Access to the quiz will close at the lab start time.*