

Credits: 3; Prereq: MAC 1147 or the equivalent, and a minimum score of 'B+' for CHM2045; Coreq: CHM 2046L.

The second semester of the CHM2045/2045L and CHM2051/2046L sequence. This course is open to students with superior performance in CHM2045 or its equivalent. Topics include Acids and bases, additional aspects of chemical equilibria, thermodynamics, electrochemistry, complex ions, descriptive chemistry, and instructor-chosen topics.

Meeting Times	TR Period 2+3 (8:30 AM - 10:25 AM) in FLI 050	
Class Numbers	21788, 21789	
Instructor	Leslie J Murray	
Email:	Preferred: message through Canvas (for FERPA compliance) (murray@chem.ufl.edu)	
Phone:	392-0564 (office, CLB 410B)	
Office hours:	<i>face-to-face</i> M – 6, W – 9, R – 7 periods and by appointment	
Grad TAs	Subhadeep Bera	OH on Zoom M–9, M–10, F–4 periods
UG TAs	Syed Shaheer Ali	OH on Zoom T–8, F–8 periods
	Muhammad Shayan Abbas	OH on Zoom T–10, F–10 periods
	Christopher Hamlin	OH on Zoom T–9, W–7 periods
	Michelle Lee	OH on Zoom M–8, T–6 periods
	Puja Mudam	OH on Zoom M+W 10:00 – 11:00 AM
	Pavithra Ramachandria	OH on Zoom M–2, F–3 periods
	Rafi Rammoo	OH on Zoom W–6, F–6 periods
	Isabelle Ruan	OH on Zoom R–9, F–7 periods
OH Zoom Link	https://ufl.zoom.us/j/97324511568?pwd=cFJlZXhDZHJCT0xOdzF1WmlPaFBScz09	
TA Email Contacts	message through Canvas	
Course Objectives	<p>To provide an overview of the fundamentals of chemistry, specifically thermodynamics, equilibrium phenomena such as acid/base and solubility equilibria, electrochemistry, and a brief introduction into organic and inorganic chemistry in part as preparation for subsequent chemistry courses (<i>i.e.</i>, Organic, Inorganic, and Physical Chemistry). (P).</p> <p>The course allows the instructor to enrich the curriculum with additional topics of current interest. See also General Education Subject Area Objectives for the Physical Sciences</p> <p>CHM 2051 serves to teach the scientific method, skills for problem solving general chemistry knowledge, and connections to the principles that govern the natural world. Specifically, students will be able to:</p> <ol style="list-style-type: none"> 1. Clearly communicate in writing information derived from course related readings/lectures about the major concepts and themes in the chemical sciences. 3. Apply knowledge of the fundamental principles of chemical, acid/base and aqueous equilibria to perform related calculations and make predictions of system behavior. 4. Describe and apply the fundamental principles of thermodynamics and electrochemical systems. 5. Describe the properties of complex ions and coordination compounds; this objective may include an introductory understanding of electronic structure and reactivity of complexes with applications to synthetic and biological systems. 6. Analyze connection between the fundamental chemical principles presented relate to sub-disciplines inc. nuclear and organic chemistry. 	
Textbook	Chemistry: Atoms First 2e by OpenStax . ISBN: 978-1-947172-63-0. Page references refer to the updated web version of the text that can be downloaded here .	

Any reasonable recent General Chemistry textbook can be an additional optional resource.

Required Equipment 1. A laptop, tablet, smartphone, or other electronic device with an internet connection
2. A non-graphing non-programmable scientific calculator

Canvas UF's elearning platform, Canvas, can be found at <http://elearning.ufl.edu>. You will find the syllabus, gradebook, files, class announcements, and other pertinent info for the course. Check Canvas often for important announcements and accuracy of your gradebook.

Grades **A minimum grade of C is required for general education credit.**

Based on the following division:

Higher two During Term Exams (DTEs)	40%
Lowest DTE	10%
Final Exam	25%
Problem Sets (each equally weighted)	15%
Participation	10%
Total	100%

For information on UF's Grading Policy, see:

<https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

Course grades will be assigned with the following percentages used for guidance:

90-100% = A	80-84.9% = B+	65-69.9% = C+	50-54.9% = D+	45% > E
85-89.9% = A-	75-79.9% = B	60-64.9% = C	45-49.9% = D	
	70-74.9% = B-	55-59.9% = C-		

Exams All exams are free response and cumulative and require a non-graphing non-programmable scientific calculator with log, ln, root, and exponent functions.

During Term Exams (DTEs): The lowest exam will count for 10% whereas the remaining two higher DTEs will each count 20% to the final grade. Effectively, the lowest DTE score will be halved. For example, if Nolwenn receives scores of 60%, 80%, and 90% on the three DTEs, the contribution to the final grade would be $(0.8 \times 20\%) + (0.9 \times 20\%) + (0.6 \times 10\%) = 40\%$ of the maximum 50% allocated to DTEs.

DTE format #1 – The Default: DTEs will be free-response and administered as follows. Each DTE will be submitted as the collaborative effort of three students **only**, with each student in the group receiving the grade their single group submission. Collaboration between different groups of three is **expressly forbidden**; each group must work independently of other groups. As an estimate, DTEs are expected to require 2 h to complete, but there will be no formal time limit. Notes and textbooks will be allowed. Use of any other resource (e.g., Chegg, online forums) is **expressly prohibited**.

DTE format #2 – The Sad: If there is substantial concern regarding the integrity of the DTEs as take-home exams (e.g., collaboration between students from different groups, accessing online resources), remaining DTEs will revert to in-class (115 min time limit) on the noted distribution dates in the proposed schedule and the work of each individual student (no collaboration). For the sad format, all formulae and constants necessary for the exam will be provided.

Final Exam: The Final Exam will be the work of each individual student (i.e., no collaboration) and closed notes and closed textbooks. No papers, cell phones, smart watches, or other electronic devices can be in view during exams. All formulae and constants necessary for the exam will be provided. The Final Exam is cumulative for the course.

Posted Grade Disputes Should a student wish to dispute any grade received in this class, the dispute must be in writing and submitted to the instructor ***through Canvas within one week*** of the grade being posted to Canvas. After one week has passed from when the grade was posted and since all students were made aware of the posting of the grade(s) through an announcement on Canvas, the instructor considers those grades final.

Private or Grade Related Questions Direct these concerns to your instructor via the mail function in Canvas. Do not email outside of Canvas to your instructor's external email address – we are not permitted to discuss grade related questions outside of Canvas. You will be asked to resend the query through Canvas. Instructor response time to email queries is <48 h during the workweek, or the first business day for emails received Friday or over the weekend.

Important Dates	Event	Date	Time
	Exam #1	Thursday, February 15	take-home or in-class
	Exam #2	Thursday, March 21	take-home or in-class
	Exam #3	Tuesday, April 23	take-home or in class
	Final Exam	Thursday, May 2 in FLI 50	12:30 PM – 2:30 PM

Attendance, Extensions, and Exam Conflicts Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: <https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/> Regular attendance is ***very strongly recommended***. Repeated absence in class will make it very difficult to earn full participation points. Exam absences will be handled in accordance with official UF academic regulations. For more information, see <https://catalog.ufl.edu/UGRD/academic-regulations/> . See below for further clarification for two different types of situations.

(1) Conflicts with other events: acceptable reasons may include religious holidays, military obligations, special curricular requirements (*e.g.*, attending professional conferences), or participation in official UF-sanctioned activities such as athletic competitions, etc. For more information on such absences see the official UF Policy at <https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/#absencestext>). If you must be absent for an exam due to a documented and approved conflict known in advance, you must e-mail your instructor (within Canvas) the documentation at least one week prior to the scheduled exam and an early conflict exam will be scheduled for you.

(2) Missing an exam due to an emergency or sudden illness: If you are absent for an exam due to an unpredicted documented medical reason or family emergency, you must contact the instructor as soon as possible, and will need your excuse verified by the Dean of Students Office (DSO). Your instructor will follow UF academic regulations regarding the notification and/or documentation received from the DSO on your behalf. Once your instructor is satisfied with the validity of your exam absence, a make-up exam will be scheduled after a reasonable amount of time, *i.e.*, before the end of the semester. If your documentation is deemed insufficient to excuse your absence, you will receive a zero on the missed exam.

Accommodations for Students with Disabilities Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester. Accommodations are not retroactive; therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations. The student is responsible for scheduling the exam dates with the DRC according to [DRC policies](#).

Problem Sets Students are strongly encouraged to work in small groups on problem sets. Problem sets will be assigned at intervals of approximately one week, **due on Fridays at 11:59 PM**, and submitted

through the course Canvas page. Problem sets submitted after the due date and time but within 24 h (i.e., before Saturdays at 11:59 PM) have a maximum possible grade of M (5 pts). Problem sets handed in after the due date will not be graded (0 pts). Timestamps for late submission are as marked by Canvas. Solutions will be provided.

Each student is given **one free pass** on the 24-h penalty (e.g., submit after a Fri 11:59 PM deadline but before the following Sat 11:59 PM). The non-transferrable one free pass means that that one late problem set meeting the criteria will be graded as though on-time. Use the **one and only one free pass** wisely.

Problem sets will be graded as **Satisfactory** (10 pts), **Marginal** (5 pts), or **Unsatisfactory** (0 pts).

Satisfactory or **S**: all problems attempted and understanding of content evident (>75% correct)

Marginal or **M**: all problems not attempted or a significant portion (> 25%) incorrect

Unsatisfactory or **U**: majority (> 75%) of the problem set incorrect or not attempted

Participation

Participation points (up to 10% of your total grade) will be earned through participation in lecture and completion of pre-lecture assignments using iClicker. To earn participation points requires a wifi-enabled device (smartphone, tablet, notebook PC, etc.) to respond to questions asked by the instructor during lectures and to complete pre-lecture assignments (see **iClicker** below). Pre-lecture assignments are due **before** the start of that class, pertain to the reading assignments (see proposed course schedule below), and will typically be available a full day before a lecture. Please note that the total iClicker points that can be achieved will only be known by the end of the semester. To achieve 100% of the participation grade (10% of your final grade), you must answer 75% of all iClicker questions correctly. Below 75% correctness on all iClicker questions, your participation score will be prorated accordingly (see below). Additional mechanisms for participation (e.g., team-based exam prep as in CHM 2050) may be introduced into the course.

iClicker

This course will require access to iClicker for your digital device to respond to questions and earn valuable points toward your grade. Instructions will be posted to Canvas. Each student is required to bring at least one wifi-enabled digital device to class for this activity. If you don't have access to a digital device, please contact the instructor.

Questions will be assigned as the semester progresses and the total number is not yet known. A minimum of 75% of all available iClicker points are required to achieve 100% of the earnable participation points (10% of your final grade). If you finish the semester with less than 75% of the available iClicker points your participation points will be prorated. For example, if Nigel (a fictitious student) earns 60% of the available iClicker points (let's say 100 in the course), his total participation points amount to $60(100/75) = 80$, which counts for 8.0% toward his final grade.

Chemistry Learning Center

In addition to the graduate and undergraduate TAs assigned to the course, there is free help available from graduate student teaching assistants in SFH 105 (usu. M-F 8:30 AM–6 PM).

University Academic Honesty Policy

All students enrolled at the University of Florida are committed to uphold the Honor Code, which includes the following pledge: ***"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."*** Each student is expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida. The following pledge is either required or implied: ***"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*** It is assumed that students will complete all work independently in each course unless the instructor provides explicit permission for collaboration on course tasks (e.g., assignments, papers, quizzes, exams). Furthermore, as part of the obligation to uphold the Honor Code, students should report any condition that facilitates academic misconduct to appropriate personnel. ***It is each student's individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code.*** Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the

Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, see: <http://www.dso.ufl.edu/SCCR/honorcodes/honorcode.php>

In-class Recordings Lectures will be recorded using Mediasite Course Capture and made available as the course develops. Independent these recordings, students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor. A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session. Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third-party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under [UF Regulation 4.040 Student Honor Code and Student Conduct Code](#).

UF Course Evaluation Process Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via [GatorEvals](#). Guidance on how to give feedback in a professional and respectful manner is available at. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from [GatorEvals](#) or in their [Canvas](#) course menu under GatorEvals. Summaries of course evaluation results are available to <https://gatorevals.ua.ufl.edu/public-results/>.

Campus Resources ***U Matter, We Care:*** If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit [U Matter, We Care website](#) to refer or report a concern and a team member will reach out to the student in distress.
Counseling and Wellness Center: Visit the [Counseling and Wellness Center website](#) or call 352-392-1575 for information on crisis services as well as non-crisis services.
Student Health Care Center: Call 352-392-1161 for 24/7 information to help you find the care you need or visit the [Student Health Care Center website](#).
University Police Department: Visit [UF Police Department website](#) or call 352-392-1111 (or 9-1-1 for emergencies).
UF Health Shands Emergency Room / Trauma Center: For immediate medical care, call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608. Visit the [UF Health Emergency Room and Trauma Center website](#) for more details.
GatorWell Health Promotion Services: For prevention services focused on optimal wellbeing, inc. Wellness Coaching for Academic Success, visit the [GatorWell website](#) or call 352-273-4450.

Academic Resources ***E-learning technical support:*** Contact the [UF Computing Help Desk](#) at 352-392-4357 or via e-mail at helpdesk@ufl.edu
Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services

Library Support: Various ways to receive assistance pertaining to the libraries or related resources
Teaching Center: Broward Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring.

Writing Studio: 2215 Turlington Hall, 352-846-1138. Help with brainstorming, formatting, and writing papers.

Student Complaints On-Campus: Visit the [Student Honor Code and Student Conduct Code webpage](#) for more information.

On-Line Students Complaints: View the [Distance Learning Student Complaint Process](#).

Instructor's Advice ***Study Habits:*** Read assigned pages from the textbook and the Assigned Reading Material before class; the class will not be taught 'by the book.' The instructor will build on this material in lecture, expecting that the reading has been completed. The course demands a regular sustained effort throughout the semester. Most importantly, **do not allow yourself to fall behind!** If you find that you are not grasping essential material by reading the textbook and following in-class discussion, **seek help!** Visit the instructor's and/or TAs' office hours, talk to other students in your class, compare notes, form a study group, consult other textbooks, *etc.*

Study Groups: It is strongly encouraged to form study groups and meet with them regularly to discuss course material, work on problem sets, and prepare for exams. The course assessments have a collaborative, group-learning dynamic; however, the Final is you on your own. Be certain that you fully understand your own HW submissions and submitted group DTEs. Not understanding the material will haunt you on the Final Exam.

Disclaimer This syllabus represents the current plans and objectives. If needed as the semester progresses, changes to the objectives/plans will be communicated to the class clearly during lecture announcements, on Canvas, and in updates to the syllabus.

Student Learning Outcomes The course objectives align with the UF General Education student learning outcomes and physical science area learning outcomes:

General Education SLO	Physical Science SLO	Alignment to Course Objectives	Assessment
Content	Identify, describe, and explain the basic concepts, theories and terminology of natural science and the scientific method; the major scientific discoveries and the impacts on society and the environment; and the relevant processes that govern biological and physical systems.	2 – 6	Students demonstrate competence in the terminology, concepts, methodologies, and theories used within the discipline. <i>Tools:</i> iClicker questions, Problem Sets, and Exams
Critical Thinking	Formulate empirically testable hypotheses derived from the study of physical processes or living things; apply logical reasoning skills effectively through scientific criticism and argument; and apply techniques of discovery and critical thinking effectively to solve scientific problems and to evaluate outcomes.	1 – 6	Students analyze information carefully and logically from multiple perspectives, using discipline specific methods, and develop reasoned solutions to problems. Students apply mathematical knowledge and reasoning to solve chemical problems <i>Tools:</i> Problem Sets and Exams
Communication	Communicate scientific knowledge, thoughts, and reasoning clearly and effectively.	1 – 6	Students communicate knowledge, ideas, and reasoning clearly and effectively in written or oral forms appropriate to the discipline. <i>Tools:</i> in-class discussion, free-response exam questions,

Proposed Course Schedule:

Date	Day	Chap.	Topic	Reading
01/09/23	T		Disc. of Syllabus and brief review of General Chemistry 1	
01/11/23	R	12	Thermodynamics, Spontaneity, Entropy, and Microstates	pp. 599 – 608
01/16/23	T	12	2 nd and 3 rd Law of Thermodynamics, Work, Gibbs Free Energy, Rxn Direction	pp. 609 – 618
01/18/23	R	13	Chemical Equilibrium, Definitions, Law of Mass Action, Equilibrium Constant, Homogeneous/Heterogeneous Equilibrium	pp. 627 – 638
01/23/23	T	13	Le Châtelier's Principles, Effects of Concentration, Pressure, and Temperature Changes, Direction of Change	pp. 639 – 656
01/25/23	R	14	Acid/Base Definitions and Equilibria, pH, pOH	pp. 669 – 678
01/30/23	T	14	pK _a , pK _b , Relative Acid/Base Strengths, Quantitative Analysis Molecular Structure, Binary/Ternary Acids, Graphical Analysis	pp. 678 – 692
02/01/23	R	14	Hydrolysis of Salts, Polyprotic Acids, Buffers, Titrations, Indicators, Applications	pp. 692 – 713
02/06/23	T	15	Precipitation Equilibria	pp. 725 – 739
02/08/23	R	15	Lewis Acid/Base Chemistry, Coupled Equilibria	pp. 739 – 747
02/13/23	T	12–15	Exam review	
02/15/23	R	12–15	Atmospheric Chemistry (AC), composition, upper atmosphere, ozone chemistry, CFCs and their implications Exam #1 Distributed (Due 02/20, before start of class)	ARM ¹
02/20/23	T		The greenhouse effect, CO ₂ and other greenhouse gases	ARM
02/22/23	R		Acid rain, NO _x and SO _x chemistry	ARM
02/27/23	T	16	Electrochemistry, redox rxns, electrochemical cells, half-rxns, electrical work, standard cell potential	pp. 759 – 772
02/29/23	R	16	Equilibrium, Free Energy, Nernst Equation, Batteries, Fuel Cells, Corrosion, Electrolysis	pp. 772 – 790
03/05/23	T		Predominance Diagrams	ARM
03/07/23	R		Pourbaix Diagrams	ARM
03/19/23	T	18	Metallurgy, Metalloids, Nonmetals	pp. 862 – 889
03/21/23	R	16, 18, AC	Exam review - Exam #2 Distributed (Due 03/22, before start of class)	
03/26/23	T	19	Transition metals, Coordination Chemistry	pp. 939 – 966
03/28/23	R	19	Crystal Field Theory, Spectroscopy, Magnetism	pp. 966 – 974
04/02/23	T	20	Nuclear Chemistry, Nuclear Structure and Stability, Nuclear Reactions, Radioactive Decay, Radiometric Dating	pp. 981 – 1001
04/04/23	R	20	Transmutation and Energy, Uses of Radioisotopes, Biological Effects	pp. 1002 – 1026
04/09/23	T	21	Organic Chemistry, Types of Organic Molecules, Nomenclature, Lewis Structures	pp. 1037 – 1073
04/11/23	R	21	Classes of Organic Rxns, Functional Groups, Properties, Reactivities, Curved Arrow Notation	
04/16/23	T	21	Isomerism, Molecular Orbitals, Aromaticity	ARM
04/18/23	R	19–21	Exam review; Exam #3 Distributed (Due 04/23, before start of class)	
04/23/23	T	19–21	Course review	
05/02/23	R		Comprehensive Final Exam 12:30pm – 2:30pm	in FLI 050

¹ ARM = additional reading material supplied by the instructor.