CHM2047 — One-Semester General Chemistry — Fall 2014

Credits: 4; Prereq: AP, IB, AICE, or dual enrollment chemistry courses yielding credit for CHM2045/L; Coreq: CHM 2047L.

The course is designed for entering (not transfer) students who wish to move more quickly into advanced course work. Topics include electronic structure and bonding, gases, liquids, solids, kinetics, equilibria, acids and bases, thermodynamics, oxidation-reduction, metals and non-metals.

Instructor	Dr. Alexander Angerhofer (Dr. A)
Phone	392 9489 (office, CLB318A) or 392 2123 (lab, CLB303)
E-mail	alex@chem.ufl.edu
O.H.	T-8 (3:00-3:50pm), F-4 (10:40-11:30am) and by appointment, CLB318A or CLB313.

TAs	Justin Goodsell, all sections, jgoodsell@ufl.edu, O.H. W-8, F-3 (CLB 318), and by appointment.				
	Richard Li	Shreya Nirmalan	Thomas Caselli	Reagan McKendree	Larry Tesler
Sections	5636	8007	8010	8020	8023
E-mail	lirichard@ufl.edu	shreyan@ufl.edu	tcaselli@ufl.edu	reaganamckendree @ufl.edu	ltesler@ufl.edu
O.H.	T-9 (CLB 313), F-5 (CLC*)	T-10 (CLB 313), R-7 (CLC*)	M-8 (CLC*), R-4 (CLC*)	M-7 (CLC*), R-8 (CLC*)	M-6 (CLC*), F-8 (CLC*)

*Chemistry Learning Center, 3rd floor of Keene-Flint Hall Annex, room #258.

Class Meeting Times	T: periods 5+6, R: periods 5+6, 11:45am-1:40pm in Leigh Hall 207			
Discussion Sessions				
5636	8007	8010	8020	8023
W-5, Lei-142	W-4, Lei-104	W-6, Tur-2303	W-3, Dau-342	W-2, Tur-2303
Holidays	09/01 (Labor Day), 10/17 (Homecoming), 11/11 (Veterans Day), 11/26-28 (Thanksgiving), 12/11-12 (Dead Week, no classes).			
Class Text	Oxtoby, Gillis, Campion, Principles of Modern Chemistry, 7th Edition, Thomson Brooks/Cole, Belmont CA, 2008, ISBN: 0840049315, on course reserve at Marston Science Library.			
Homework	Homework will be assigned weekly except during weeks of mid-term exams,. Homework will be graded.			
Points Earnable	4 progress exams @ 200 pts. each for 800 pts. total. 1 cumulative final exam (optional) @ 400 pts. For 400 pts total. 10 homeworks @ 60 pts. each for 600 pts. total. 4 online quizzes @ 50 pts. each for 200 pts. total. 1 in-class participation grade (earned with clickers) @ 200 pts. for 200 pts. total 1 in-discussion participation grade @ 200 pts for 200 pts total.. Total earnable points are 2,400 pts, or 2,000 pts without optional final exam.			
Grading Scheme†	With final exam: A: ≥ 2040 pts. (85.0%) 2040 pts > A− ≥ 1980 pts. (82.5%) 1980 pts > B+ ≥ 1920 pts. (80.0%) 1920 pts > B ≥ 1800 pts. (75.0%) 1800 pts > B− ≥ 1740 pts. (72.5%) 1740 pts > C+ ≥ 1680 pts. (70.0%) 1680 pts > C ≥ 1560 pts. (65.0%) 1560 pts > C−‡ ≥ 1500 pts. (62.5%) 1500 pts > D+ ≥ 1440 pts. (60.0%) 1440 pts > D ≥ 1320 pts. (55.0%) 1320 pts > E.		Without final exam A: ≥ 1700 pts. 1700 pts > A− ≥ 1650 pts. 1650 pts > B+ ≥ 1600 pts. 1600 pts > B ≥ 1500 pts. 1500 pts > B− ≥ 1450 pts. 1450 pts > C+ ≥ 1400 pts. 1400 pts > C ≥ 1300 pts. 1300 pts > C− ≥ 1250 pts. 1250 pts > D+ ≥ 1200 pts. 1200 pts > D ≥ 1100 pts. 1100 pts > E.	

† see **https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx** for more info on UF grade policies.

‡ please note that a 'C-' is not considered a passing grade for majors requiring a General Chemistry course.

Course Schedule (tentative):

Date	Day	Chapter	Topic	Reading
08/26/14	T	4	Disc. of Syllabus and Introduction to Quantum Mechanics	pp. 139-157
08/27/14	W		Discussion: Introduction and The Photoelectric Effect	pp. 157-161
08/28/14	R	4	Atomic Structure, Line Spectra, Bohr Model, Rydberg, de Broglie, Heisenberg,	pp. 161-188
09/02/14	T	4	Schrödinger Equation, Particle in a Box Model	pp. 193-215
09/03/14	W		Discussion: HW #1 is due	
09/04/14	R	5	Atomic Structure, H-Atom, many-electron atoms	pp. 193-215
09/09/14	T	5	electron spin, Aufbau rules, periodic chart	pp. 215-231
09/10/14	W		Discussion: HW #2 is due	
09/11/14	R	3	Chemical Bond, Lewis Structures, VSEPR Theory	pp. 63 - 107
09/16/14	T	3	MO Theory, LCAO, H_2^+ ion,	pp. 107-131
09/17/14	W		Discussion: HW #3 is due	
09/18/14	R	6	Simple Diatomics, VB Theory	pp. 235-267
09/23/14	T	6	Orbital Interaction Diagrams	pp. 268-303
09/24/14	W	1—5	Discussion: Exam Review, 1st During-Term Exam (during E2-E3 periods, place tba)	
09/25/14	R	6	Hückel Theory, Aromaticity	
09/30/14	T	7	Organic Chem., Lewis Structures for organics, isomerism, stereoisomerism, curved arrow notation	pp. 307-319
10/01/14	W		Discussion: HW #4 is due	
10/02/14	R	7+8	Conjugation, Aromaticity, TM bonding, hybridization	pp. 319-343
10/07/14	T	8	oxidation numbers, electron counting, *d*-electron configuration, carbonyl complexes, Lewis A/B chemistry, chelation	pp. 347-367
10/08/14	W		Discussion: HW #5 is due	
10/09/14	R	8	coordination compounds, isomerism, crystal field theory, symmetry, ligand field theory	pp. 367-388
10/14/14	T	8+9	carbonyl complexes, back bonding, metal-metal bonding, ideal gas equation, real gases	pp. 395-410
10/15/14	W		Discussion: HW #6 is due	
10/16/14	R	9	Kinetic Gas Theory, Equipartition Theorem, motional degrees of freedom, Maxwell distribution	pp. 410-435
10/21/14	T	12	1st Law of Thermodynamics, Heat, Work, State Functions, Enthalpy, Heat Capacity	pp. 516-542
10/22/14	W	6—9	Discussion: Exam Review, 2nd During-Term Exam (during E2-E3 periods, place tba)	
10/23/14	R	12+13	Thermochemistry, Hess' Law, 2nd Law of Thermodynamics, Entropy, Statistical and Thermodynamic interpretations, Carnot Engine	pp. 542-563
10/28/14	T	13	Carnot Engine, Mathematical Form of the 2nd Law, Refrigeration, 3rd Law of Thermodynamics, Spontaneity, Gibbs Energy	pp. 571-607
10/29/14	W		Discussion: HW #7 is due	
10/30/14	R	14	Chemical Equilibrium, van't Hoff equation, Clausius-Clapeyron equation, Le Chatelier	pp. 613-658
11/04/14	T	11	Solutions, IMFs, molar quantities, ideal solution, Raoult's Law, real solutions, Henry's Law, Gibbs Energy again, colligative properties	pp. 443-497
11/05/14	W		Discussion: HW #8 is due	
11/06/14	R	11+15	Osmotic Pressure, A/B Chemistry	pp. 498-501, 669-680.

11/12/14	W		Discussion: HW #9 is due	
11/13/14	R	15	Acid-Base Chemistry	pp. 681-693
11/18/14	T	15	Buffer Solutions and Ordering of Acid Strengths	pp. 693-725
11/19/14	W	10—15	Discussion: Exam Review 3rd During-Term Exam (during E2-E3 periods, place tba)	
11/20/14	R	16	Solubility Equilibria	pp. 733-744
11/25/14	T	16	Solubility and pH	pp. 744-757
12/02/14	W		Discussion: HW #10 is due	
12/03/14	R	17	Introduction to Electrochemistry	pp. 763-822
12/11/14	T	18	Introduction to Chemical Kinetics	pp. 835-855
12/02/14	T	18	Arrhenius Law	pp. 856-881
12/03/14	W	15—18	Discussion: Exam Review 4th During-Term Exam (during E2-E3 periods, place tba)	
12/11/14	R	1—18	Cumulative Final Exam 5:30—7:30pm	

Further Important Information:

1. **Overview and Goals:** CHM 2047/2047L is a one-semester General Chemistry program for entering students with strong backgrounds in chemistry, normally reflected by high AP or IB chemistry test scores. This program allows students to move more quickly into advanced work. The goals of the course are to give an overview of basic chemistry in one semester and to prepare the students for subsequent work (organic, analytical, and physical chemistry).
2. **General Chemistry Learning Objectives:** The course will provide instruction in the basic concepts, theories, and fundamental terms of chemistry. At the very core of chemistry is the concept of the atom, its structure and bonding interactions with other atoms. The course therefore takes an 'atoms-first' approach in order to lay a conceptual foundation for the many aspects of 'macroscopic' effects. Approximately one third of the course is devoted to atomic and molecular structure and bonding. In later parts of the course the manifold connections between the atomic/molecular structure of compounds and their behavior in chemical reactions under lab conditions will be emphasized. This allows the student to comprehend and predict the behavior of chemical systems rather than to memorize a potpourri of diverse facts which is often the case when students study for the AP or similar examinations. Major scientific developments will be reviewed and their impacts on society, science, and the environment examined. Focus will be placed on the relevant processes that govern biological and physical systems. With what they learn students will be able to formulate empirically-testable hypotheses derived from their study of physical and life processes, apply logical reasoning skills through scientific criticism and argument, and apply techniques of discovery and critical thinking to predict and evaluate outcomes of experiments. Upon successful completion of CHM2047 each student will:
   - have a working knowledge of the basic concepts, theories, and fundamental terms of Chemistry, and understand the relevant processes that govern chemical systems,
   - grasp the major scientific developments that have led to the current state-of-the-art in the field,
   - be able to assess impacts chemistry has and will have on society, science, and the environment,
   - be familiar with and capable of using the scientific method when discussing scientific facts as they relate to Chemistry,
   - know how to formulate empirically-testable hypotheses derived from the study of physical and chemical processes,
   - apply logical reasoning skills through scientific criticism and argument, and apply techniques of discovery and critical thinking to predict and evaluate outcomes of experiments.

   To achieve these objectives students are required to actively participate in all class activities, specifically:
   - Regular attendance of lectures (2 double periods per week) in which the course material will be discussed and demonstrated. Lecture attendance requires active participation on the students' part. Large sections of class time will be spent in scientific dialog between teacher and students and among students where they will practice the art of scientific reasoning.
   - One period of small group discussions is held each week in which students will discuss and apply the concepts learned in class. The discussion sessions focus on homework problems and further explore difficult concepts that need additional explanation beyond the lectures. These sessions will be taught by a teaching assistant. Students are expected to participate actively. They will work out homework problems on the board and participate in their discussion. This will not only give students helpful feedback on their own work but also train their logical reasoning skills through scientific criticism and argument.
   - Weekly graded homework assignments typically include up to ten conceptual and numerical

problems that require the student to apply the learned concepts on specific examples. Problems are taken from different areas of experimental and theoretical chemistry including physical and life processes. Homework problems may also includes reading material, typically a topically related original research article requiring the student to summarize and comment on in their own words.

- 4 quizzes and 4 mid-term exams will be administered throughout the semester. Due to time constraints they can not be as detailed and time-intensive as the homework problems. Emphasis is placed on testing the students' reasoning skills and their understanding of the material rather than rote memorization of facts. On their exams, students will receive all pertinent equations. They are also allowed a single hand-written page of their own to take into the exams on which they can put any information they consider important. On online quizzes students are allowed to work in groups but will be required to take ownership of their own quiz submission.
- Participation points are available to students throughout the semester and can be earned both in the lectures and the discussion sessions through answering clicker questions, active participation in the class discussion, and through working out problems on the board (for more information see below item #8).
- Approximately 14 weekly office hours are offered by instructor and TAs, conveniently spread out over the whole week. Students are strongly encouraged to seek help and feedback on all concepts and problems encountered in class. While office hour attendance is completely voluntary, it is an important activity that will help solidify students' understanding of the material and make them successful in the course.

3. **Exam Policies:** Four during-term exams will be given (see schedule above). These exams will be evening exams. Exam duration will be approximately 2 hours. Making up a missed exam is a serious and exceptionally burdensome problem. Consequently, a makeup exam will require that you have a legitimate excuse, and that you have brought this to the attention of the instructor before the missed exam. Legitimate excuses include sickness or a conflict with another exam for a higher numbered class. If you are not sure whether your excuse is valid, talk to the instructor before missing an exam. If you have an emergency that prevents you from letting the instructor know ahead of time that you are missing an exam, an excused absence and rescheduled make-up exam will be granted after official documentation about your emergency (doctor's notes, *etc*.) deemed appropriate by your instructor has been presented.
   The final exam is optional. If a student is happy with his/her grade at the end of the semester (see grading scale without final exam above) he/she may skip the final exam. Since the final exam is cumulative, the instructor reserves the right to consider assigning a letter grade above that which the student would receive based strictly on total points earned (as listed above). This will only take effect if the final exam is taken and the performance on the final exam is significantly above the student's overall performance for the semester, and if the student shows clear improvement in his/her exam grades over the course of the semester. This qualification cannot lower your grade and will depend on the instructor's evaluation of the student's performance on the final exam.
   A student contending that an exam or quiz has been mis-graded or mis-scored must report this to the TA responsible for grading within one week of receiving the original grade or score. Failure to follow this policy results in no reconsideration of the contended grade or score. For all questions on grades or grading, please consult with the TA first in person. If this does not resolve the issue you may talk to the instructor about it. Except for problems with on-line quizzes (see below), emailed questions on grades or grading will not be answered.
4. **On-line Quizzes:** There will be 4 on-line quizzes (1 quiz = 50 points max.). They will be given through the canvas interface to the class. Quiz duration is generally 60 minutes. For your convenience, the web format will allow for an extended period of time (typically an extended weekend) during which you can take the quiz. Once a quiz has been started the clock starts running and you have to finish it in the allotted time. All quizzes may be taken twice with the best result counting toward your grade.
5. **Textbook:** The listed textbook is only one of many reference and study tools you should use to learn chemistry. “Oxtoby, Gillis, Campion, Principles of Modern Chemistry” was chosen because of its combination of scientific rigor and accessibility. Unfortunately, it is also one of the more expensive texts on the market. Feel free to substitute it with the cheaper International Version or the electronic version. There is a copy on course reserve at the Marston Science Library, too. There is no need to bring the textbook to class. Occasionally, problems from the book will be used for homework, quiz, or exam problems. Posted reading assignments ought to be completed before coming to class to allow for better comprehension of the material during lecture.
6. **Canvas:** You will need to access your e-learning account by following the instructions on the web site, http://lss.at.ufl.edu/ (choose the Canvas link) where you will have to supply your Gatorlink ID and password in the appropriate boxes in the login area. Please, log in at your earliest convenience and make yourself familiar with the site. Furthermore, canvas will be primarily used by TAs and instructor to communicate with the class. Please make sure to monitor the announcements on a regular basis. There may also be occasional assignments on canvas that need to be completed before class.

7. **Homework (HW):** Do your HW! By doing HW problems you will collect essential points toward your grade and will be better prepared to deal with problems on exams. Be ready to work out HW problems on the board during discussion sessions. You will earn up to 20 'participation points' for each HW problem you work out on the board (see item #8 below). You are expected to work out at least three different HW problems throughout the semester for a total of 60 participation points. The remaining 140 participation points may be earned by active participation in the discussion during the W small group sessions. Homework problems come from many different sources, including the instructor's own personal list of problems.
8. **Participation Grade:** Participation points (up to 400) will be earned through active participation in class and in the small group discussion sessions. 200 points can be earned in W discussion session and 200 points can be earned with clickers (see item #9) in class.
    - W Discussion Sessions: 60/200 participation points are reserved for working out HW problems on the board during W discussion sessions. The remaining 140/200 points can be earned through active participation which includes, but is not limited to, responding to questions the TA will ask during class/discussion session, asking questions of the TA or the student working out a HW problem on the board, actively participating in the exam review sessions, working out additional HW problems on the board, *etc*. Your TA will keep track of your in-class participation points.
    - During Lecture: 200 participation points can be earned by actively participating in class. This is primarily done by using the learning catalytics app on your digital device (smartphone, tablet, notebook PC, *etc*.) to respond to questions asked by the instructor throughout the lectures (see further explanation below under #9).
9. **LearningCatalytics (LC):** In this course, we will use LC for your digital device for you to respond to the instructor's questions and earn valuable points toward your grade. An access code will be distributed to you through your canvas account. You will need to create a student account on https://learningcatalytics.com/ using that access code. Follow instructions on the web site to activate your account and link it to our course, CHM2047. You are required to bring at least one wifi-enabled digital device to class to use for this activity. If you don't have access to a digital device, please contact the instructor.
10. **Calculators:** You must have your own scientific calculator. Calculators may be used on quizzes and exams but may not be shared. You may **not** use graphing calculators or any calculators that are capable of information storage or communication on any exam. Simple inexpensive scientific calculators such as the TI-30 series or the Casio fx-260 are acceptable and sufficient for any problem encountered on exams.
11. **Class Attendance:** Class attendance is essential for your success in this class. However, we will not do roll-calls. Repeated absence in class and discussion session will make it very difficult to earn full participation points. For further information on UF's attendance policies which are in effect for this course, see: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx .
12. **Study Habits:** The course demands on average 8 – 10 hours/week of work outside of class. Regular lecture attendance is essential. The class will not be taught 'by the book.' It is expected that you read the assigned pages from the textbook (or corresponding chapters in other textbooks) in advance before coming to class. The instructor will build on this material and you are expected to be able to follow in-class discussion. The course demands a regular sustained effort throughout the semester. Most importantly, do not allow yourself to fall behind! The material builds up and you need to stay ahead of the game. If you find that you are not grasping essential material by reading the textbook and following in-class discussion, **seek help!** Visit your instructor's and/or TA's office hours, talk to other students in your class, compare notes, form a study group, consult other text books, go to the CLC (Chemistry Learning Center) in Keene/Flint Hall 258, *etc*.
13. **Office Hours:** The instructor, four alumn-TAs, and two graduate student TAs offer a total of 14 office hours spread over the whole week. The detailed times and locations are listed on the first page of this syllabus. This is time we set aside for you. Take advantage of it. Please note that the instructor and TAs are available to help students in any of the five sections. You are not limited to only the TA assigned to your section.
14. **Students with Disabilities:** Students requiring special accommodations should register with the Dean of Students Office (http://www.dso.ufl.edu/) and present documentation from that office to the instructor.
15. **Counseling Services:** The University of Florida provides counseling services for students, staff, and faculty. See http://www.counsel.ufl.edu/ or call (352) 392-1575 during regular service hours (8am – 5pm). For other hours or weekends call the Alachua County Crisis Center, (352) 264-6789. Students may also call the clinician on-call at Student Mental Health for phone callback and consultation at (352) 392-1161.
16. **Emergency Numbers and Web Sites:**
    - UFPD (UF Police Department): In case of emergency dial 911. The UF campus police non-emergency number is (352) 392-1111. Their web site: http://www.police.ufl.edu/ .
    - Infirmary (student health center): (352) 392-1161, http://shcc.ufl.edu/ .
    - EH&S (Environmental Health & Safety): (352) 392-1591, http://www.ehs.ufl.edu/ .

17. **Cell Phones:** Please put all cell phones or pagers on "**silent mode**" during all class and discussion periods. Thank you!
18. **Facebook Page:** One of the alumn-TAs will set up a facebook page for the class. Participating through reading and posting is voluntary but will enhance the course community.
19. **Honors Code:** This class will operate under the policies of the student honor code which can be found at: https://catalog.ufl.edu/ugrad/current/advising/info/student-honor-code.aspx . The students, instructor, and TAs are honor-bound to comply with the Honors 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.**

If you have further questions, please contact me. Have a great semester!

Sincerely,

Alexander Angerhofer
(Dr. A)