

Chemistry 201 “Advanced General Chemistry” Syllabus – Fall 2019

Instructor:	Professor Theresa Windus
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E-mail:	twindus@iastate.edu
Class Hours:	MTWThF 1:10-2:00 PM, Gilman 2205
Study Sessions:	Tuesdays 4:10-5:00, Wednesdays 12:10-1:00, Thursdays at 3:10-4:00 Gilman 1101 In addition, meetings can be scheduled by arrangement.
TA office hours:	Jan Borchers in the Martha E. Russell Chemistry Help Center, 1761 Gilman, 9:00-9:50 AM Fridays Akalanka Tennakoon in the Martha E. Russell Chemistry Help Center, 1761 Gilman, 2:10-3:00 Wednesdays

1. Learning Objectives and Outcomes: Chemistry 201 teaches advanced aspects of general chemistry. Students completing the class are expected to understand at an intermediate level:

- fundamental principles involving matter and measurements, and stoichiometric calculations;
- states of matter and phase transitions;
- electronic structure of matter and chemical bonding; and
- chemical equilibrium and kinetics.

*Chem 201 assumes mastery of knowledge that one should have attained in a good high school chemistry course. It is not a review, nor is it an accelerated version of Chemistry 177 and 178. Chem 201 and 201L are corequisite courses (meaning you must take both for credit at the same time). Students who drop 201L will be required to drop 201 and *visa versa*. Students who audit Chemistry 201 will be required to drop 201L. Students may not register to audit Chem 201 after 5:00 PM on Friday, September 6th, 2019. The audit does not count towards full-time student status. To add or drop recitation or lab sections during the first week of class, use AccessPlus. After the first week, please go to the Undergraduate Chemistry Office in 1608 Gilman (M-F 8 – 12 noon and 1 – 4 pm). The last day to drop Chem 201 is Friday, November 1st.*

Mathematics 165 or higher is a requirement for this course. Chemistry is a physical science and requires mathematics for proper understanding of its concepts. Chemistry 201 is a 4 credit course (**attendance is essential to success in the course since we will be using Team-Based Learning, TBL – see last pages of syllabus for more information on TBL**). Upon satisfactory completion of the course, students are ready to continue with the majors' sequence in chemistry (Chemistry 211/211L) and, if they wish, to take organic chemistry in the Spring semester.

2. Canvas: *Canvas* (<https://canvas.iastate.edu/>) will be central to disseminating information (such as Instructor notes, problem sets, solutions, and grades) and announcements for the class. *Canvas* will also be used to post supplementary information that can help with understanding the concepts of the course.

3. Required Materials: We will use Instructor notes that can be accessed via *Canvas*. You may print these out. The notes were largely written by Professor Gordon Miller, modified and augmented by Professor Jacob Petrich, and modified, augmented, and rearranged by Professor Theresa Windus. In addition to these notes, many internet resources will be made available in the notes and via *Canvas*.

Textbook: General Chemistry – Linus Pauling, Dover. For the student who is seriously interested about pursuing a career in chemistry, or any physical science, this book cannot be recommended too highly. It will serve as a valuable resource through your entire career. The first edition of this book appeared in 1947 and was used for the first-year chemistry course at Cal Tech, where Pauling was on the faculty. It has strongly inspired the class notes and problems that are in your electronically accessible materials.

Required: A scientific calculator (with the functions: $\ln(x)$, e^x , 10^x , y^x) is essential. Graphing calculators or those with text capabilities may **not** be used during exams or quizzes. If you attempt to use one of these calculators during an exam or quiz, you will receive a zero grade for that assessment.

Smart phone or laptop: During some of the TBL applications, it will be useful to have a smart phone or laptop. The instructor will clearly identify when these are needed.

Language translators and dictionaries are not allowed during quizzes and exams – no exceptions.

4. Assignments: There will be daily reading and homework problems to help with reading comprehension. These will need to be completed outside of the class. Problems (iAPPs – see TBL discussion on the last two pages) will be due before class with most work to be turned in at the beginning of class and some submitted through *Canvas*. If the iAPP is to be turned in at the beginning of class, the assignment may be typed or handwritten. If the latter, it must be legible to be accepted. No credit will be received for homework handed in late. Feel free to work with other students on the homework, but you must turn in your own individual set of solutions – no plagiarism is allowed. Answers to problem sets will be posted to *Canvas* after the class when the assignment is due. An occasional quiz may be given in class (these will be announced at least a day before the quiz). These quizzes will be part of the iAPPs portion of the grade.

Note: Illegible exams or problem sets will NOT be graded. All work must be presented reasonably neatly and logically. The sheets in your assignment should be stapled together. The graders and instructor are not responsible for losing material that has not been securely assembled.

5. Exams: There will be four 50 minute exams (the first on a Monday and the rest on Fridays during the regular class time) and a *comprehensive* final exam. The first exam will occur after the end of the first two weeks of the course (**Sept. 9 in 2205 and 3354 Gilman Hall**). This first exam will be based upon material that you should have mastered in high school. Students scoring 40% or less are strongly encouraged to move to Chemistry 177. The examination will be comprised of, among other topics:

Conversion of units, for example, moving between molecules or atoms to grams or moles

Balancing chemical equations:

nonredox and redox

reaction in acid or base

Stoichiometry:

e.g., for a reaction $aA + bB \rightarrow cC + dD$, if so many grams of D were made, how many molecules of A were there? And other variants on this theme...

Limiting reagents and yield problems

Empirical formula determination

The other three 50 minute exams are scheduled for

Sept. 27, Oct. 25, Nov. 22

Note that these three 50 minute exams will be held in rooms 1221, 1222, and 1227 of Hach Hall. You will be assigned a room as you show up to the exam (these three rooms are right next to one another).

Make-up exams will not be administered. The date/time for the final exam is Tuesday, Dec. 17 at 2:15 PM. Please note that the final exam date and time are set by the University and will not be changed, so do not plan to leave the University before the exam date. If you have 3 final exams on one day, you may ask the instructor of the course with the *smallest enrollment* to arrange a different time for the exam. Any student wishing to make this change must make this request to me no later than, Friday, December 6, the last day of classes before the beginning of “dead week”. Note that the grade for the final exam **cannot** be dropped.

6. Paper: During the class you will be talking to a professor about their research. You will also be provided with several papers related to their research. Based on this material and the material in the class, you (as an individual, not as a team!) will write a 2-page paper that will be due no later than 1:10 P.M. (start of lecture), Monday, December 9, the first day of “dead week”. *No late papers will be accepted.* (Early papers will obviously be accepted.). The paper must conform to the following points:

- (a) Length: 1.5-2.5 pages (ca. 500-600 words).
- (b) Typed or prepared with a word processing program (e.g., MSWord) that I can edit – not Google docs
- (c) Double-spaced, 12 pt font;
- (d) **Proper English grammar and spelling** (I will read and grade them carefully);
- (e) Include your name and a title on the paper;
- (f) The content should include at least these 3 segments:
 - (i) A brief description of the person: his or her research interests, and educational and professional background;
 - (ii) A description of the research topic addressed in class in your own words: you may use 1-2 figures, but these do not count toward the page limit. Define any specific terminology, symbols, or abbreviations you mention. Do not summarize the entire research portfolio of the faculty member; stick to the problem he or she discussed in class.
 - (iii) Your *own* impression of the research and its significance: what questions do you think the work addresses; how do you think this work benefits society, chemistry, or another science area in some way?
- (g) A complete listing of all references you used in American Chemical Society (ACS) format: include websites/webpages with complete URL addresses, and any articles or books. These references do not count toward the page limit. (<https://pubs.acs.org/doi/pdf/10.1021/bk-2006-STYG.ch014>)

7. Grading: The final letter grades will not be graded harder than a standard grading scale. Prof. Windus reserves the right to lower the scale for the grades, but will not curve the grades. The grade percentages for this class will be determined by representatives from the student teams in the second week of the class. These team representatives will also decide on the relative weights of the categories within the individual performance area. The procedure for setting grade weights will be as follows:

- 1) Teams decide on weights and select a member to meet with the other teams’ representatives.
- 2) Team representatives will meet in the front of the room during class and develop a consensus about the grade weights for the class as a whole, following the limitations listed in the table below.

There are three major performance categories that will be used to determine grades:

Performance Category	Within Category	Out of Total
Individual performance (minimum = 30% out of total)		32.5%
Paper (5-15%)	15%	
Individual Readiness Assessment Tests - iRATs (5-20%)	10%	
Individual Applications - iAPPs	10%	
Exam 1	10%	
3 Exams (30-50%)	35%	
Final Exam (20-50%)	20%	
Team performance (minimum = 20% out of total)		47.5%
Team Readiness Assessment Tests - tRATs	30%	
Team Applications - tAPPs	70%	
Team contribution (minimum = 10% out of total)		20.0%

NOTE: The team points will only count toward your course grade if your average score on the individual in-class exams and the final exam is above passing (as defined by the final cutoff determination for the course). In other words, if you cannot pass the exams, then you cannot pass the course.

The iRATs, iAPPs, tRATs, tAPPs, and Team contribution parts are all discussed in detail in the last 2 pages of the syllabus.

8. Teaching assistant and substitute instructor: Jan Borchers is the TA for the course and will have an **office hour** at 9:00-9:50 AM on Fridays in the Martha E. Russell Chemistry Help Center, 1761 Gilman.

9. Electronic communication: Students are encouraged to use the discussion boards in *Canvas* since this will help all students. If you do send an e-mail, please put **Chem 201:** at the beginning of the subject line for e-mail. This will help Prof. Windus and Jan Borchers see your questions in their mailboxes and to put priority on answering these e-mails.

10. Additional office information: Prof. Windus' office is in an Ames Lab building. The building is locked between 5:30 pm and 7:00 am weekdays, and also 24/7 whenever the nation is on orange security alert or higher. Otherwise, you are free to enter Ames Lab to visit with Prof. Windus. If you wish to see Prof. Windus while the building is locked, please make an appointment beforehand in order for her to let you in at one of the doors, or to meet you in a room in Gilman Hall.

11. Classroom etiquette: It is expected that you will respect your fellow students, TA and the instructor during the class. Cell phone and other electronic communication devices must be used only as part of the classroom activities. Unless Prof. Windus has said otherwise, cell phones and other electronic communication devices are not to be used during the class. However, there will be times when they will be useful/necessary for the TBL applications. Prof. Windus will clearly indicate these times. These devices must **not** be used during formal quizzes and exams, and usage during these times will result in a zero grade for that assignment. People who engage in distracting behavior during class will be asked to leave. Examples include reading materials and discussing topics that are not related to the class.

12. Dead Week: This class follows the Iowa State University Dead Week policy as noted in section 10.6.4 of the Faculty Handbook: <http://www.provost.iastate.edu/resources/faculty-handbook>. Daily problem sets **will** be due during dead week. Also, the paper will be due on the Monday of dead week and the final peer assessment will be due on the Friday of dead week.

13. Special academic needs: Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. Students requesting accommodations for a documented disability are required to work directly with staff in Student Accessibility Services (SAS) to establish eligibility and learn about related processes before accommodations will be identified. After eligibility is established, SAS staff will create and issue a Notification Letter for each course listing approved reasonable accommodations. This document will be made available to the student and instructor either electronically or in hard-copy every semester. Students and instructors are encouraged to review contents of the Notification Letters as early in the semester as possible to identify a specific, timely plan to deliver/receive the indicated accommodations. Reasonable accommodations are not retroactive in nature and are not intended to be an unfair advantage. Additional information or assistance is available online at www.sas.dso.iastate.edu, by contacting SAS staff by email at accessibility@iastate.edu, or by calling 515-294-7220. Student Accessibility Services is a unit in the Dean of Students Office located at 1076 Student Services Building.

If you require accommodations, please contact me as soon as you can (preferably during the first week you are enrolled in the course) so that we can make appropriate arrangements to meet your needs as soon as possible.

14. Academic Misconduct: Academic Misconduct in any form is in violation of Iowa State University Student Disciplinary Regulations and will not be tolerated. This includes, but is not limited to: copying or sharing answers on tests or assignments, plagiarism, and having someone else do your academic work. Depending on the act, a student could receive an F grade on the test/assignment, F grade for the course, and could be suspended or expelled from the University. See the Student Disciplinary Regulations at <http://www.policy.iastate.edu/policy/SDR> for more details and a full explanation of the policy on Academic and Research Misconduct by students.

15. Right to Privacy: The Federal Right-to-Privacy Act prohibits the instructor from public disclosure of exam scores. You may obtain your exam scores in person from your instructor or TA or from the *Canvas* grade book. The instructor and the TA are prohibited from giving grades over the phone or e-mail.

16. Harassment and Discrimination: Iowa State University strives to maintain our campus as a place of work and study for faculty, staff, and students that is free of all forms of prohibited discrimination and harassment based upon race, ethnicity, sex (including sexual assault), pregnancy, color, religion, national origin, physical or mental disability, age, marital status, sexual orientation, gender identity, genetic information, or status as a U.S. veteran. Any student who has concerns about such behavior should contact his/her instructor, Student Assistance at 515-294-1020 or email dso-sas@iastate.edu, or the Office of Equal Opportunity and Compliance at 515-294-7612.

17. Religious Accommodation: If an academic or work requirement conflicts with your religious practices and/or observances, you may request reasonable accommodations. Your request must be in writing. The instructor will review the situation in an effort to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the earliest possible time. You or your instructor may also seek assistance from the Dean of Students Office at 515-294-1020 or the Office of Equal Opportunity at 515-294-7612.

18. Issues associated with the guidelines: If you are experiencing or have experienced a problem with a violation of any of the university guidelines above, please contact Professor Windus to discuss the issue or, if that alternative does not seem viable to you, email academicissues@iastate.edu. This email will put you in touch with the Associate Provost for Academic Programs. This email address may be used for any course, not just Chem 201.

19. Order of Events: This is a *tentative* schedule and will be updated as the course progresses. Appropriate reading will be discussed in class and be available in the preparation guides on *Canvas*.

Date	Chapter
Week 1	Orientation and Review (Module 1)
Aug. 30	Last day to change a full-semester course from audit to credit
Sept. 2	NO CLASSES, LABOR DAY AND UNIVERSITY HOLIDAY
Week 2	Orientation and Review, continued (Module 1)
Sept. 6	Last day to choose to audit a course for the Fall. (I must approve the audit)
Sept. 9	EXAM 1 (1:10 PM in of 2205 and 3354 Gilman Hall)
Week 3	Electronic Structure of Atoms and Periodicity (Module 2)
Week 4	Electronic Structure of Atoms and Periodicity, continued (Module 2)
Sept. 20	Due date for practice peer assessment
Week 5	Chemical Bonding and States of Matter (Module 3)
Sept. 27	EXAM 2 (1:10 PM in 1221, 1222, and 1227 of Hach Hall)
Week 6	Chemical Bonding and States of Matter, continued (Module 3)
Week 7	Chemical Reactions and Thermodynamics (Module 4)
Week 8	Chemical Reactions and Thermodynamics, continued (Module 4)
Week 9	Chemical Reactions and Thermodynamics, continued (Module 4)
Oct. 25	EXAM 3 (1:10 PM in 1221, 1222, and 1227 of Hach Hall)
Week 10	Chemical Equilibrium (Module 5)
Nov. 1	LAST DAY TO DROP CLASS
Week 11	Chemical Equilibrium, continued (Module 5)
Week 12	Chemical Equilibrium, continued (Module 5)
Week 13	Phase Changes and Phase Diagrams (Module 6)
Nov. 22	EXAM 4 (1:10 PM in 1221, 1222, and 1227 of Hach Hall)
Week 14	NO CLASSES, THANKSGIVING BREAK (Nov. 25-29)
Week 15	Chemical Kinetics (Module 7)
Week 16	Chemical Kinetics, continued (Module 7)
Dec. 9	Due date for paper
Dec. 13	Due date for peer assessment
Dec. 17 at 2:15 PM	FINAL EXAM (1:10 PM in 1221, 1222, and 1227 of Hach Hall)

What is Team-Based Learning (TBL) and Why Use It?

Team-based learning (TBL) is one type of a FLIPPED CLASSROOM. Rather than sitting in your chairs, passively listening to a lecture and to a few students answering questions now and then, the goal of a flipped classroom is to ENGAGE you in thinking, integrating, and applying the content. For flipped classrooms to work, you *need to come to class prepared*. Most of the content is covered individually with readings and short problems completed outside of class and most of the application activities, conventionally done as out-of-class homework and group projects, are done in teams during class. The quality of your experience will depend on the quality of your preparation *prior* to class. Thus, there are *Canvas problem sets (iAPPs) to be completed and submitted prior to many classes*.

TBL is a specific type of flipped classroom in which you will be placed in permanent teams of 5 to 7 students. These teams will be formed on the second day of class, and formed on a principle of heterogeneity, primarily based on different career paths. So, for example, most teams will have one or two people headed into chemistry, one or two people headed into biochemistry, one or two people headed into chemical engineering, and one or two people who are still deciding on their major. A secondary consideration in generating the groups are results of the initial survey for the class.

All team work is DURING class – there are NO outside team assignments or projects. Your team may wish to meet outside of class to study, but there is no requirement to do so. Most classes will include questions that are answered by your team – your team must come up with one answer. These questions may be content questions, or they may require integration or application. They will vary based on that day's content. Your team will have the opportunity to discuss the options and come to a TEAM ANSWER. (Note –a smart phone or laptop can be useful for this course. If you do not have this type of device, there are other options that are available.)

Overall class structure: The class is broken down into 7 Modules. During the course, there will also be 4 hourly exams (usually covering several Modules), one final exam and two peer assessments (one that is informative only and the other to be counted toward the grade).

Modules: For each of the 7 Modules there will be a set of Instructor Notes, one individual readiness assessment test (iRAT), one team readiness assessment test (tRAT), daily individual applications (iAPPs), and daily team applications (tAPPs). Each of these Modules builds on the concepts of the previous Modules in an atom first approach (starting in Unit 2). Some of the Modules are longer than others depending on the topic at hand.

iRATs and tRATs: There are 7 individual readiness assessment tests (iRATs) and 7 team readiness assessment tests (tRATs) total across the semester and they occur at the beginning of each Module. During a given class period, you will take the iRAT on your own, and turn in your answers. These iRATs will be graded after class and you will be awarded an individual score. Then together, your team will do the same assessment (tRAT). **The team must come up with one answer per question.** Thus, if team members have differing answers, your team will have to discuss the evidence and decide on one answer. **NOTE that individually you must get at least 50% on the iRAT for your team's performance on the tRAT to count for your tRAT score.** The rationale is that, if you cannot get at least 50% of the questions right, then you will not provide much help for your team on the tRAT. If you get lower than 50%, then you may participate and learn from the tRAT process, but your iRAT grade will also become your tRAT grade. It is also important to note that it is not uncommon for iRAT scores to be lower than tRAT scores.

Following the tRAT and outside of class, your team can write appeals for questions you missed. The appeals must be based on either disagreement with the question answer or question wording or a claim of ambiguous information in the readings. If the issue is a disagreement with the question answer, provide the reason that the answer is wrong (with reference to source material describing why the answer is wrong) and an alternative answer. If the issue is in question wording, provide the issue with the wording and suggested alternative wording for the question. If the issue is ambiguity of information in the reading, describe the ambiguity and provide a reference to the ambiguous material with the appropriate quote. Appeals must be well written and clearly explain the issue associated with the appeal. Appeals must be received no later than 2 “school” days after the RAT. The instructor will review the appeals outside of class time and report the outcome of your team appeal within two class meetings. Only your team is allowed to appeal questions (no individual appeals are considered). The instructor reserves the right to deny

an appeal if she cannot read or understand the basis of the appeal. Only the teams who appeal can benefit from an appeal. If a change is made in the tRAT score for a team, it will also be reflected in the iRAT score for the team members of that team.

iAPPs and tAPPs: Before most classes, you will be responsible for daily reading and homework problems to help with reading comprehension. These assignments will be available in Canvas as Preparation Guides (PG) and will need to be completed outside of the class. The problems are individual-applications (iAPPs) that will give you an idea of how prepared you are for the tAPPs. The iAPPs will be due before class with most work to be turned in at the beginning of the class and some submitted through *Canvas*. No credit will be received for homework handed in late. Feel free to work with other students on the iAPPs, but you must turn in your own individual set of solutions – no plagiarism is allowed. Answers to problem sets will be posted to *Canvas* after the assignment is due.

There will also be tAPPs (team-applications), which are larger, more involved questions that apply and integrate the content. tAPPs will be the majority of the work during the class periods. These questions start out more straightforward and increase in complexity with the course content to help you learn, integrate, and apply the content prior to the exams. Most of the time, your team will indicate a specific choice publicly through answer cards and the decisions are subject to cross-team discussion/critique. Teams will often be asked to report the rationale for their answer to the rest of the class.

NOTE that individually you must get at least 50% on the iAPP for your team's performance on the tAPP to count for your tAPP score. If you miss class, you will receive the grade for the tAPP for up to 5 missing classes, if you have completed the iAPP. After 5 missed classes, you will receive a zero grade for the tAPPs.

Team contribution/Peer Assessment: Finally, the team contribution grade will be determined by Peer Assessments, so there is accountability within the team. If someone is not coming to class prepared and is not engaging in a quality manner in the team process, then team members will have the opportunity to inform a team member of any concerns, and then, ultimately, grade them accordingly if they do not up their game. There will be two Peer Assessments: the first one due on September 20 is for information purposes only and the second one due December 7 will be applied to the grade.

In the Peer Assessment, each individual will evaluate the contributions of all the other members of their own team by assigning an average of 10 points to the other team members. For example, with members of a 6-person team:

- Split 50 points among the other 5 members based on each member's contribution.
- Must give at least one score >10 (with a maximum of 15) and at least one score < 10.

Team contribution scores will be the average of the scores received. Team members cannot help everyone in their team get an "A" by giving each team member high peer assessment scores; the only way for everyone in a team to earn an "A" is by doing an outstanding job on individual and team tasks. In addition, you will be required to provide constructive comments on the performance of each individual in the team to aid them in continuing or improving their participation in the team.

Why use TBL? 1) It engages students in ACTIVE LEARNING, which is a key component in long-term, substantive learning. Active learning helps one consolidate the content. Through this active process you learn the material better and engage in higher level thinking processes. And, after all, problem-solving and thinking is what life is about, including what we engage in during professional work. 2) You will learn some team skills of communication and negotiation, which are important skills for life – most of you will be a part of a team in your home life as well as your professional career, so this is good practice. 3) It is much more interesting and engaging for students. Most students find that they enjoy the team process, and much prefer it over passive lecture-format classes. (Note – TBL is much more challenging for the professor, so the motivation for this format is very student-need-centered!)