

CHEM 142: PRINCIPLES OF MODERN CHEMISTRY II Summer II 2025

UA Catalog name: **GENERAL CHEMISTRY LECTURE II: QUANTITATIVE**

Course description: CHEM 142 is the second part of a two-semester lecture series introducing students to the central principles of modern chemistry using a quantitative atoms-first approach. The course is intended for students who require a strong foundation in general chemistry, rooted in a technical (mathematical) approach to the discipline. It specifically targets science and engineering majors and other students interested in a systematic development of modern chemistry.

Credits 3 credit hours (lecture only)

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Lecture Completely online

Office Hours Times varied, via zoom – watch for announcements on D2L.

Prerequisites Appropriate math placement level OR Proctored/Prep for College Algebra 88+ OR Proctored/Prep for Calculus 65+ OR MATH 109C, 110, 112, 113, 120, 120R, 124, 125, 129, 223. *These requirements are identical to those for CHEM 151.*

Relationship to Other Courses CHEM 142 is the second-semester lecture component of the two-semester general chemistry lecture-lab sequence CHEM 141-144. The complete sequence consists of 4 separate courses:

CHEM 141: General Chemistry Lecture I: Quantitative (3 units)

CHEM 142: General Chemistry Lecture II: Quantitative (3 units)

CHEM 143: General Chemistry Quantitative Laboratory I (1 unit)

CHEM 144: General Chemistry Quantitative Laboratory II (1 unit)

The independent lecture-lab architecture allows for flexibility in plans of study.

Course Objective The objective of CHEM 142 is to introduce the students to the fundamental principles and quantitative applications of modern chemistry.

Expected Learning Outcomes After successfully completing CHEM 142, students will:

- have a working knowledge of the quantitative principles controlling chemical equilibria and the rates of chemical reactions;
- be able to calculate equilibrium concentrations for a wide variety of chemical reaction systems;
- understand and be able to use the pH and pKa scales;
- have a fundamental understanding of the laws of Thermodynamics and a working knowledge of the main thermodynamic functions, such as enthalpy, entropy, and Gibbs free energy;
- be able to use thermochemistry data tables to calculate the heat exchange and equilibrium constants of chemical reactions;
- be able to integrate the conceptual understanding and quantitative problem solving skills to describe and analyze common chemical processes.

These outcomes apply to students of all majors and are also part of the integrated learning outcomes of the undergraduate programs in Chemistry and Biochemistry, described at <http://assessment.arizona.edu/sci/chembio>.

Text Brown, LeMay, Bursten, *Chemistry: The Central Science*, 14th ed. (required).

The textbook is a useful reference and study guide, but is only a tool. Lectures will not be strictly based on the textbook and the presentation of the material in lecture will deviate from the book's outline.

Outline

Lecture topics and the corresponding textbook chapters (chapter numbers are based on the 14th edition):

- Thermochemistry (Chapter 5).
- Properties of solutions (Chapter 13).
- Chemical Equilibrium: Equilibrium constants and their application (Chapter 15).
- Acid-Base Chemistry (Chapter 16).
- Aqueous equilibria (Chapter 17).
- Chemical Thermodynamics: Energy exchange in chemical reactions and the First Law; Entropy and the Second Law; Enthalpy and the Gibbs free energy; Relationship between Gibbs Free Energy and the equilibrium constant (Chapter 19).
- Introduction to Electrochemistry: Redox reactions; Voltaic cells and batteries (Chapter 20).
- Chemical Kinetics: Reaction rates; Types of rate laws; Activation energy and the Arrhenius equation; Reaction mechanisms; Catalysis (Chapter 14).
- Nuclear Chemistry (Chapter 21).

See the separate Schedule document on D2L for specific dates of various topics.

D2L

All course materials, such as the syllabus, schedule, lecture slides, etc., will be posted on D2L (<http://d2l.arizona.edu>). Please **do not** use D2L email to contact the instructor. Use the individual email address given above.

Inclusive Access

Course materials (including all homework assignments and your electronic text) are being delivered digitally via D2L through the Inclusive Access program.

Inclusive Access materials can be reached from the CHEM 142 D2L site through the VitalSource app on D2L is entitled: HOMEWORK and TEXTBOOK (VitalSource App). The link to this app is found under Content/eText & Homework.

VERY IMPORTANT: Please follow the instructions provided under the VitalSource app link on D2L under Content/eText & Homework. Hint for following the instructions: BrightSpace and D2L are for all intents and purposes the same thing.

Please access the material through D2L on the first day of classes to make sure there are no issues in the delivery, and if you are having a problem or question, it can be addressed quickly.

You automatically have FREE access to the course materials through July 17, 2025.

Notification to students mandated by the University: You **must** take action (even if you have not accessed the materials) to opt-out if you do not wish to pay for the materials, and choose to source the content independently. **The deadline to opt out is 9:00 pm MST, July 17, 2025.** If you do not opt-out and choose to retain your access, the cost of the digital course materials will appear on your Bursars account.

Instructor's note: If you opt out of Inclusive Access, you will not be able to complete any of the homework assignments and will receive zeros for all of them. This will

severely impact your grade for the course. DO NOT OPT OUT WITHOUT TALKING TO THE INSTRUCTOR FIRST!!!

Please refer to the Inclusive Access FAQs at <https://shop.arizona.edu/textbooks/Inclusive.asp> for additional information.

IMPORTANT: Course instructor is not able to provide technical support for the online homework system hosted by the publisher (Pearson's Mastering Chemistry). In case of any technical/computer issues related to the homework assignments, please contact Support at Pearson.com: <https://support.pearson.com/getsupport/s/>

After submitting an assistance request, please make sure to capture your Pearson Tech Support Case Number ID for your reference.

Homework This course uses the online homework system *Mastering Chemistry* hosted by the textbook publisher (Pearson). See Inclusive Access instructions below.

There will be 12 graded homework assignments (HW1-12). The main objective of the homework is to guide you in the study of the material and help prepare for the exams. The HW due dates are indicated in the Tentative Schedule available on D2L, as well as in the table below.

<u>Homework due dates</u>	
HW1-3	All due on Sun, 7/20
HW4-6	All due on Wed, 7/30
HW7-10	All due on Sun, 8/10
HW11-12	All due on Tues, 8/12

Note that HW1-3 are due the night before the first exam, HW4-6 – before second exam, etc. However, **students are strongly encouraged not to wait until the due date to complete the assignments** but follow the *suggested* plan of study included in the Schedule document.

Exams There will be three midterm exams, each 1 hour in duration, and a final exam, 2 hours in duration. The exams will be administered via the Quizzes section of the D2L site. Exams can be taken at any time within the 24-hour period on the day of the exam (midnight to midnight). However, **once you start the exam, you will have one hour (for midterms) or two hours (for the final) to complete it.**

The exam schedule for 2022 Summer Session II is:

Midterm Exam 1: Monday, July 21

Midterm Exam 2: Thursday, July 31

Midterm Exam 3: Monday, August 11

Final Exam : Wednesday, August 13

Topics and format of the exams: The first midterm exam will cover the material of HW 1-3. The second exam will be based on HW 4-6, the third – HW 7-10. The final exam will be cumulative covering the material of the entire course. All exams will be open book but must be solved by each student individually. Any discussion or interaction with others (either in person or by electronic means) while taking an exam will be viewed as an academic integrity violation.

Missed and Make-up Exams You can take each exam anytime during the 24-hour window when the exam is open. **THERE WILL BE NO MAKE-UP EXAMS** outside of the stated exam windows. Missed exams will be graded as zeros.

Calculators Scientific (non-graphing, non-programmable) calculators with standard exponential, trigonometric, power/root, log, etc. functions are recommended for this class.

Grading Course letter grades will be based solely on the total number of points earned. The maximum possible points for the course are:

Homework assignments 1-12:	180 points (15 points each)
Three midterm exams:	300 points (100 points each)
Final exam:	<u>170 points</u>
TOTAL:	650 points

The above are the only sources of points that can be earned in the class. No extra credit will be awarded for any additional work. No requests for extra-credit assignments to improve grades will be considered, because granting such requests would be in violation of this syllabus and unfair to other students.

The letter grades will be nominally based on the University of Arizona standard A/B/C/D/E = 90/80/70/60 per cent scheme. The exam/HW/assignment scores will not be “curved”. However, **the instructor may revise the letter grade cutoffs** (in the easing direction only) based on the final point distribution. This means that earning 90% of the total points will guarantee you an ‘A’, while earning slightly less may result in either a lower grade or an ‘A’, depending on where the actual cutoffs are drawn. Similar for other grades. The cutoff adjustment is at the instructor’s discretion; it is neither promised nor guaranteed. Different cutoffs may be adjusted by different amounts, while some cutoffs may be left unchanged (for example, the D/E and C/D cutoffs may be lowered, while A/B and B/C held firm – or vice versa.)

GUIDELINES FOR GRADE CUTOFF ADJUSTMENT: At the instructor’s discretion, the A/B/C/D/E = 90/80/70/60 grade cutoffs may be adjusted (in the easing direction only).

The following guidelines will be used to determine the adjusted letter grade cutoffs.

- 1) The cutoffs will be based the total number of points earned in the semester.
- 2) The B/C cutoff will be set approximately 1/3 of the standard deviation above the class average of the total, $\langle \text{Total} \rangle$.
- 3) The C/D cutoff will be $\sim 2/3$ of the standard deviation below $\langle \text{Total} \rangle$.
- 4) The A/B and D/E cutoffs will be typically set approximately one standard deviation above and below the respective B/C and C/D cutoffs.
- 5) Under no circumstances will the adjusted cutoffs be higher than the levels prescribed by the UA standard 90/80/70/60 per cent scheme.

Example:

Assume also that the class total average for the semester is $\langle \text{Total} \rangle = 72\%$, with a standard deviation of 12% . The grade cutoffs are likely to be set as follows:

$$\begin{aligned} B/C &= 72\% + \frac{1}{3} \times 12\% = 76\% & A/B &= B/C + 12\% = 88\% \\ C/D &= 72\% - \frac{2}{3} \times 12\% = 64\% & D/E &= C/D - 12\% = 52\% \end{aligned}$$

SPECIAL NOTE ABOUT “THE CURVE”: No extra points or percentages will be added to any of the exam or assignment scores or to the total number of points earned in the

class. Your letter grade will be based only on the points you've EARNED. Thus, in a sense many students are accustomed to since high school, there will be no "curve".

The instructor will aim to ensure that the grade distribution is aligned with the National norms by adjusting the letter grade cutoffs, as explained above. The cutoff adjustment may have an effect similar to "curving", the distinction being that different grade cutoffs may be adjusted by different amounts, while some of the cutoffs may even be left unchanged.

SPECIAL NOTE ABOUT REQUESTS TO "DISCUSS" GRADES: The grades will be based solely on your quantitative performance in the class and are not up for subjective negotiation. No other factors in addition to those described above may be considered (including, but not limited to, the need to get a certain grade to maintain a scholarship or get into a certain professional school). Since the grades are determined by objective mathematical factors only, the instructor will not respond to requests for higher grades or to requests for meetings to discuss or negotiate grades, except if a grading error has been made. The instructor is available to review the subject matter, learning strategies, and the grading policy.

SPECIAL NOTE ABOUT POSTED LETTER GRADES: It is always disappointing to find yourself just below the cutoff for the grade you really wanted or needed. The University requires that specific grades be assigned in accordance with the grading policy and the grade cutoffs have to be drawn somewhere. Unfortunately, no matter where they are drawn, no matter how much thought goes into determining the reasonable levels, *someone* will always be at the top of any grade range – and there is nothing that can be done about it. Bumping someone from the top of a lower grade range to the next grade level will result in someone else turning up at the top of the lower range. Please do believe that faculty have every desire to satisfy reasonable request from their students – after all, we work for your success – but requests for higher grades without any basis in the syllabus only create undue stress for everyone. This class will adhere strictly to the following policy:

**ONCE POSTED, THE LETTER GRADES ARE FINAL AND NOT SUBJECT TO DISCUSSION
OR NEGOTIATION**

With the exception of extremely rare cases of grade miscalculation, the instructor reserves the right not to respond to communications about the posted letter grades.

University policy regarding grades and grading systems is available at <http://catalog.arizona.edu/policy/grades-and-grading-system>

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively. A grade of "Incomplete" can only be obtained when all but a minor portion of the course work has been satisfactorily completed and a valid argument can be made as to why an Incomplete should be awarded. For example, missing the final exam due to a documented emergency (assuming satisfactory performance for the duration of the semester) will likely result in an Incomplete. To the contrary, realizing at any point during the semester that you are in danger of a failing grade is not a valid reason for granting an Incomplete.

Syllabus Content

Students are responsible for knowing the content of this document. Questions about the Syllabus content may appear on some of the in-class participation quizzes and/or exams. The instructor reserves the right not to respond to emails with questions explicitly addressed in the Syllabus. For example, any and all emails inquiring about the “curve” for the class will not be answered, because this question is explicitly addressed in the above grading policy. Similarly, the instructor will not respond to requests for additional points or opportunities to raise your grade, or other similar requests to discuss or negotiate grades (except if a grading error has been made), as such requests violate the grading policy stated in this Syllabus.

Absence and Class Participation Policy

Students are responsible for all information and materials presented in the lecture

The UA’s policy concerning Class Attendance, Participation, and Administrative Drops is at <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>.

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>. In accordance with the University policy, the instructor will provide reasonable accommodations for students observing religious holidays, if the dates of observed holidays overlap with the exams in the class.

The calendar of the religious holidays recognized by the University of Arizona is posted at <https://www.registrar.arizona.edu/religiousholidays/calendar.htm>. In order to receive accommodation, the students are required to inform the instructor in writing (by email) about the potential conflict between the observed holiday(s) and the scheduled exam dates.

Accommodation requests for all holidays that occur during the semester **must be received by the instructor during the first week of classes**. The instructor is not obligated to provide accommodation for exams missed due to holidays, if the request is not submitted during the first week of the semester.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures. If you anticipate being absent, are unexpectedly absent, or are unable to participate in class activities, please contact the instructor as soon as possible. *To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu*. If you are experiencing unexpected barriers to your success in your courses, the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office is located in the Robert L. Nugent Building, room 100, or call 520-621-7057.

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this

behavior. Those who continue to disrupt the class will be asked to leave lecture and may be reported to the Dean of Students.

This also applies to online classes.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See

<http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Accessibility and Accommodations

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation. All testing accommodations must be arranged through DRC.

If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See:

<http://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity>

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-Harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at

<http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Confidentiality of Student Records

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

Subject to Change Statement

Information contained in the course syllabus may be subject to change with advance notice, as deemed appropriate by the instructor.