# ASU Online CHM 343 – Fall 2025 Session-A

## *Physical Chemistry 'Cloud' Laboratory*

**Overview:** This molecular science 'cloud' laboratory will cover topics in modern physical chemistry. Emphasis is placed on molecular thermodynamics, kinetics, and spectroscopy, which parallels the topics covered in Elementary Physical Chemistry (ASU CHM 341).

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| **Recitations:** | Online Meetings (via Zoom) and Recorded Material. |
| **Labs:** | Experimental, Computational, and Data Science components available through online/remote ('cloud') access. |
| **Instructor:** | Prof. Jeffery L. Yarger, jeff.yarger@asu.edu<br>Pchem Email: biopchem@gmail.com<br>Zoom: https://asu.zoom.us/my/**yarger** |
| **Office Hours:** | Tuesday 6:00-7:30 pm; Thursday 10:00-11:00 am (UTC-7)<br>Sunday TBA on Canvas; or by appointment. (via Zoom). |
| **Web Site:** | ASU Canvas: https://canvas.asu.edu/ (2025FallA-X-CHM343)<br>https://biopchem.education/ (Prof. Yarger's Open Public Website) |

### Prerequisites

Introductory general chemistry and physics course and associated laboratory (ASU CHM 114, 116, or 118; and PHY 101, 112, or 121/131, with a C or better). Organic chemistry (ASU CHM 231 or 233/234 with a C or better). Calculus (ASU MAT 251, 265, or 270 with a C or better). Concurrent enrollment or completion of ASU CHM 341 (Elementary Physical Chemistry) or ASU BCH 341 (Physical Chemistry with a Biological Focus) or an equivalent physical chemistry college course.

### Required Material

- Modern desktop or laptop computer with webcam, audio/mic and good high-speed (> 5 Mbps) internet connection. HTML5 Web Browser (Chrome, Firefox), ASU VPN connectivity (Cisco SSL VPN), Remote Desktop Client (RDP/VNC, e.g., RustDesk, NoMachine, noVNC), pdf Reader (Adobe Acrobat), Zoom Video Conferencing, Google Web-Browser Apps (Drive, Docs, Sheets, and CoLaboratory), and scientific software that can be obtained from ASU myApps (https://myapps.asu.edu).
- All labs are designed to be performed remotely/online. However, if students are physically in laboratory, or doing optional DIY projects at home, a lab coat, safety goggles and closed toed shoes are required when handling any chemicals.

### Recitation

ASU CHM 343 is a remote and/or online course. All recitation material will be online. Recitation will be used for general announcements, laboratory exercise overviews and information, and the general discussion of experimental, computational and data/error analysis physical chemistry concepts for each laboratory.

### Lab

Students will perform remote/online/'cloud' experimental, computational, and data/error analysis labs. A remote accessibility laboratory experiment schedule will be provided on the official ASU-Online CHM343

Canvas website. Labs are designed to be asynchronous, remotely accessible, and can be independently performed or synchronized online/remote access groups can be organized to perform experiments.

**Safety**

All labs are designed to be online and/or remote, i.e., cloud labs. However, if students perform any experiments in-person at a chemical laboratory or at their local residence (DIY); lab coats, goggles and close-toed shoes are required. If students do attend an in-person laboratory at ASU, no food or drink are allowed in the chemistry laboratory.

**Learning Outcomes**

Upon successful completion of this course students will be able to remotely ('cloud') collect, process, analyze, and disseminate experimental and computational chemical data. This course is meant to provide experimental and computational laboratory skills to compliment fundamental molecular science concepts taught in physical chemistry (ASU CHM341).

**Course Evaluations & Grades**

To receive a grade in this class you must be registered on Canvas. All grades will be recorded on ASU Canvas LMS, and each student can view his or her individual laboratory scores. *Student's progress and understanding in this online laboratory course will primarily be done through laboratory notebooks/reports and online quizzes.* This is a letter graded course using the following scale: **(100% - 97%) A+; (96% - 94%) A; (93% - 90%) A-; (89% - 87%) B+; (86% - 84%) B; (83% - 80%) B-; (79% - 77%) C+; (76% - 70%) C; (69% - 60%) D; (59% - 0%) E.**

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|---|---|
| Laboratory Quizzes (4x25 pts ea.) | 100 pts (33%) |
| Laboratory Notebooks/Reports (3x100 pts ea., drop lowest) | 200 pts (67%) |
| TOTAL | 300 pts (100%) |

| Dates | Topic |
|---|---|
| Aug 21-24 | Syllabus Overview; Pchem Lab Intro (Literature Search, Data/Error Analysis, Quiz) |
| Aug 25-31 | Lab 1 – Molecular Thermodynamics - Properties of Gases (Quiz) |
| Sept 1-7 | Lab 1 – Molecular Thermodynamics - Properties of Gases (Notebook/Report) |
| Sept 8-14 | Lab 2 – Thermochemical Processes - Calorimetry (Quiz) |
| Sept 15-21 | Lab 2 – Thermochemical Processes - Calorimetry (Notebook/Report) |
| Sept 22-28 | Lab 3 – Chemical Equilibrium & Kinetics - Spectroscopy (Quiz) |
| Sept 29-Oct 5 | Lab 3 – Chemical Equilibrium & Kinetics - Spectroscopy (Notebook/Report) |
| Oct 6-10 | Lab X - Student Independent Research Project and/or Makeup Lab (optional) |

| Due Date | Quizzes | Due Date | Reports |
|---|---|---|---|
| 08/26 | Quiz – Data/Error Analysis | | |
| 09/02 | Lab 1 Quiz | 09/09 | Lab 1 Notebook/Report |
| 09/16 | Lab 2 Quiz | 09/23 | Lab 2 Notebook/Report |
| 09/28 | Lab 3 Quiz | 10/05 | Lab 3 Notebook/Report |
| 10/09 | Project-X and/or Makeup Lab Report(s) – Instructor Reviewed and Evaluated. | | |

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Potential Alternative ASU 'Cloud' Physical Chemistry Labs – Lab X

Students can substitute one of the three labs with a proposed remote experimental physical chemistry laboratory and/or computational chemistry exercise. If a student wants to propose a project X, they need to submit a 1-page outline proposal by Sept. 12th (and have it approved by Sept. 19th). Examples of past proposed projects include:

- Lab $X_1$ – Molecular Diffusion using NMR Spectroscopy.
- Lab $X_2$ – Vibrational Spectroscopy (IR and Raman) of Chloro-Methanes.
- Lab $X_3$ – Molecular Structure and Dynamics of a cyclic peptide - Gramacidin-S.
- Lab $X_4$ – Optical Diffraction using a Remote Laser Optical Setup.
- Lab $X_5$ – DIY Acoustic Interferometry to Determine $C_P(T)$ of Air.

Laboratory Notebooks / Reports

To evaluate student's ability to perform computational and/or remote experiments, process and analyze associated data, perform error analysis, and put the associated results into context of fundamental molecular physical chemistry concepts, students will be asked to submit a laboratory notebook or report. It is recommended that students use a modern notebook (i.e., Google Colaboratory / Jupyter Notebook). However, students are given the alternative option of writing and submitting a more traditional report. Written lab reports are a traditional way to summarize and convey the results from laboratory or computational experiments in chemistry, biochemistry and physics ('biopchem'). Notebook/Report deadlines are given above for each lab. Students will be expected to turn in a single electronic file of each lab notebook/report. An additional supplemental section is allowed for additional figures and showing detailed calculations for statistical and error analysis (e.g., propagation of error). If students submit a traditional lab report, it should be in the style and format (double column format with embedded figures and tables) of a scientific publication (e.g., American Chemical Society (ACS) - *Journal of Physical Chemistry, Journal of Chemical Education*).

Notebook / Report – General Rubric (100 pts Total):

- Title/Authorship – The title and authorship should be descriptive and should contain keywords that will allow others to search for your report. Authorship should include your full name, university, department/school, email address and any co-authors, if relevant. (5 pts)
- Abstract – This should briefly and clearly describe the purpose of the experiment, the principal results and the major conclusions. The principal results are typically numerical values with the associated errors. (5 pts)
- Introduction – The introduction should state the object and provide a concise summary of the relevant background information with appropriate citations. Because most of the labs/projects are well-researched and well-documented, the focus should be to provide the most relevant citations to books, reviews and journal articles that best cover the background material, with only very brief written descriptions (i.e., typically 2-3 paragraphs with 10-20 citations). (5 pts)
- Materials & Methods – A description of the chemicals, procedures and equipment used during the investigation. From this section, someone should be able to reproduce the experiments you performed in lab and/or using computational resources. Therefore, the simple evaluation of this section is 'can you reproduce the computational, experimental and data science (data and error analysis) components performed by the author'? (10 pts)
- Results & Discussion (Figures and/or Tables) – Present the results of the experiments, computation and/or simulations using tables and figures to illustrate all critical components of the lab. Include detailed figure

captions for all tables and figures used in your notebook or report. The figures and figure captions should visually 'storyboard' the entire lab (50 pts). An analysis and discussion of error for the associated computational and/or experimental component should also be included in this section (10 pts). In a traditional written report, all detailed calculations for the data analysis can be put into a supplemental section, while in a modern electronic notebook these calculations are explicitly included as the 'code' cells used to generate figures and tables. (60 pts Total)

- Conclusion – Briefly summarize your results and interpretation. (5 pts)
- Acknowledgements - Acknowledge people who have helped in some way in the preparation of the written report or helped with the computational, experimental or data science components of data collection and/or analysis (for example if data was collected by a group/team). (5 pts)
- References – List citations in a corresponding order to their appearance in the text of your lab report. References need to be provided so that someone reading the report could look up all the references and have adequate background material and information. Reports should have a minimum of 10 references and include modern relevant journal articles, reviews and books (not just websites and the project handouts). (5 pts)
- Supplemental Information – Supplemental information has become a critical component to reporting scientific data and results. Modern scientific reporting allows for a more complete set of data and error analysis to be explicitly reported. To emphasize its importance, an extra 50 pts will be awarded to reports that provide a complete set of supplemental information for the computational and experimental data and associated processing and analysis (data/error analysis). In a traditional written report, the supplemental information section is appended to the end of the report. However, in a modern electronic notebook (e.g., google Colaboratory, Jupyter or Mathematica notebook) the data and associated processing and analysis (data/error analysis) is typically embedded in the 'code' cells of the notebook. Hence, a separate supplemental information section isn't required (in a sense it is already included in the notebook directly and would be redundant).

Artificial Intelligence (AI)

This 'cloud' lab encourages the use of AI tools. However, while the use of AI is at your discretion, you are expected to use these AI tools in an ethical and responsible manner. As a student, you are expected to comply with academic integrity standards, take full responsibility for any errors made by an AI tool, and cooperate by responding to any questions that may arise relating to the accuracy or integrity of any part of your work, including research, analyses, and written assignments. If AI tools are used in producing any parts of your assignments or in assisting with your learning process, you must include proper citation and acknowledgements. Students who use AI tools without proper acknowledgment may be subject to academic misconduct proceedings. Remember that AI-generated content does not replace your own critical thinking, analysis, and original contribution to the assignment.

## General ASU Policies

### Attendance and Participation

Attendance and participation in class activities is an essential part of the learning process, and students are expected to attend class regularly. Some absences are, however, unavoidable. Excused absences for classes will be given without penalty to the grade in the case of (1) a university-sanctioned event [ACD 304-02]; (2) religious holidays [ACD 304-04; a list can be found here https://eoss.asu.edu/cora/holidays ]; (3) work performed in the line-of-duty according [SSM 201-18]; and (4) illness, quarantine or self-isolation related to illness as documented by a health professional.

Anticipated absences for university-sanctioned events, religious holidays, or line-of-duty activity should be communicated to the instructor by email at least 1 day before the expected absence.

Absences for illness, quarantine or self-isolation related to illness should be documented by a health professional and communicated to the instructor as soon as possible by email.

Excused absences do not relieve students from responsibility for any part of the course work required during the period of absence. Faculty will provide accommodations that may include participation in classes remotely, access to recordings of class activities, and make-up work.

If there is a disagreement as to whether an absence should be accommodated, the instructor and student should contact the academic unit chair immediately for resolution.

### Grade Appeals

Grade disputes must first be addressed by discussing the situation with the instructor. If the dispute is not resolved with the instructor, the student may appeal to the department chair per the University Policy for Student Appeal Procedures on Grades.

### Student Conduct and Academic Integrity

Academic honesty is expected of all students in all examinations, papers, laboratory work, academic transactions and records. The possible sanctions include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of E), course failure due to academic dishonesty (indicated on the transcript as a grade of XE), loss of registration privileges, disqualification and dismissal. For more information, see http://provost.asu.edu/academicintegrity. Additionally, required behavior standards are listed in the Student Code of Conduct and Student Disciplinary Procedures, Computer, Internet, and Electronic Communications policy, and outlined by the Office of Student Rights & Responsibilities. Anyone in violation of these policies is subject to sanctions. Students are entitled to receive instruction free from interference by other members of the class. An instructor may withdraw a student from the course when the student's behavior disrupts the educational process per Instructor Withdrawal of a Student for Disruptive Classroom Behavior. The Office of Student Rights and Responsibilities accepts incident reports from students, faculty, staff, or other persons who believe that a student or a student organization may have violated the Student Code of Conduct.

### Prohibition of Commercial Note Taking Services

In accordance with ACD 304-06 Commercial Note Taking Services, written permission must be secured from the official instructor of the class in order to sell the instructor's oral communication in the form of notes. Notes must have the notetaker's name as well as the instructor's name, the course number, and the date.

## Accessibility Statement

In compliance with the Rehabilitation Act of 1973, Section 504, and the Americans with Disabilities Act as amended (ADAAA) of 2008, professional disability specialists and support staff at the Student Accessibility and Inclusive Learning Services (SAILS) center facilitate a comprehensive range of academic support services and accommodations for qualified students with disabilities.

Qualified students with disabilities may be eligible to receive academic support services and accommodations. Eligibility is based on qualifying disability documentation and assessment of individual need. Students who believe they have a current and essential need for disability accommodations are responsible for requesting accommodations and providing qualifying documentation to the SAILS. Every effort is made to provide reasonable accommodations for qualified students with disabilities.

Qualified students who wish to request an accommodation for a disability should contact SAILS by going tohttps://eoss.asu.edu/accessibility, calling (480) 965-1234 or emailing Student.Accessibility@asu.edu. To speak with a specific office, please use the following information:

**ASU Online and Downtown Phoenix Campus**
University Center Building, Suite 160
602-496-4321 (Voice)

**Polytechnic Campus**
480-727-1165 (Voice)

**West Campus**
University Center Building (UCB), Room 130
602-543-8145 (Voice)

**Tempe Campus**
480-965-1234 (Voice)

## Disability Resources

As discussed above, students who feel they will need disability accommodations in this class but have not registered with the Student Accessibility and Inclusive Learning Services (SAILS) should contact them immediately. For additional information, contact SAILS by going to https://eoss.asu.edu/accessibility, calling (480) 965-1234 or emailing Student.Accessibility@asu.edu.

## Title IX

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

As mandated reporters, course instructors (including TAs) are obligated to report any information they become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish to discuss any concerns

confidentially and privately. ASU online students may access 360 Life Services, https://goto.asuonline.asu.edu/success/online-resources.html.

## Academic Integrity

Academic honesty is expected of all students in all examinations, papers, and laboratory work, academic transactions and records. The possible sanctions include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of E), course failure due to academic dishonesty (indicated on the transcript as a grade of XE), loss of registration privileges, disqualification and dismissal. For more information, see http://provost.asu.edu/academicintegrity

## Policy Against Threatening Behavior

All incidents and allegations of violent or threatening conduct by an ASU student (whether on-or off campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students. If either office determines that the behavior poses or has posed a serious threat to personal safety or to the welfare of the campus, the student will not be permitted to return to campus or reside in any ASU residence hall until an appropriate threat assessment has been completed and, if necessary, conditions for return are imposed. ASU PD, the Office of the Dean of Students, and other appropriate offices will coordinate the assessment in light of the relevant circumstances. For more information, please visit:
https://eoss.asu.edu/dos/safety/ThreateningBehavior.

## Policy on Sexual Discrimination

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information. As a mandated reporter, the instructor and TAs are obligated to report any information we become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish to discuss any concerns confidentially and privately.

## Copyrighted Materials

Students must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

## Syllabus Disclaimer

The syllabus is a statement of intent and serves as an implicit agreement between the instructor and the student. Every effort will be made to avoid changing the course schedule, but the possibility exists that unforeseen events will make syllabus changes necessary. Please remember to check your ASU email and the course site often.