

# ASU Sync/Online - CHM 343 - Spring 2021

## *Elementary Physical Chemistry Laboratory*

January 11, 2021

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

**Recitation:** Mon. (8:00 - 8:50 AM, PSH135), Recitation, Online (Zoom, YouTube)

**Lab:** Mon. 9:05 AM – 12:05 PM Laboratory Section, Online/Remote.

Mon. 3:05 PM – 6:05 PM Laboratory Section, Online/Remote.

Tues. 9:00 AM – 12:00 PM Laboratory Section, Online/Remote.

ASU-Tempe Labs: Physical Sciences Building (PS), PS-H532 (Pchem Lab).  
ISTB1 L2-63 (NMR, DSC), 49 (Spectroscopy).

**Instructors:** Professor: Jeffery L. Yarger, ISTB1 470  
Phone: (480) 727-9824 (office)  
jeff.yarger@asu.edu  
<https://asu.zoom.us/my/yarger>

Teaching Assistants: Benjamin Boyd  
bmboyd2@asu.edu  
<https://asu.zoom.us/j/8898287303>

Omar Loza  
oloza@asu.edu  
<https://asu.zoom.us/j/7501993278>

**Office hours:** Announced on ASU Canvas for TA's and Instructor  
or by appointment. All office hours are virtual and will use Zoom.

**Web Site:** ASU Canvas: <https://canvas.asu.edu/> (CHM 343: 2021Spring)  
All course material will be posted on ASU's Canvas Site.  
<https://biopchem.education/> (Prof. Yarger's Public Website)

### **Prerequisites**

Concurrent enrollment or completion of ASU CHM 341, Elementary Physical Chemistry.

### **Required Material**

- Modern desktop or laptop computer with webcam, audio/mic and good high-speed (> 5 Mbps) internet connection. HTML5 Web Browser (Chrome, Firefox), pdf Reader (Adobe Acrobat), Office Suite (Microsoft, Libre) and analysis software that can be obtained from ASU myApps (<https://myapps.asu.edu>)
- CHM 341 Textbook and optional lab textbook (Experiments in Physical Chemistry by Garland & Shoemaker).
- All labs are designed to be performed remotely/online. However, if students are physically in laboratory, a lab coat, safety goggles and closed toed shoes are required when handling any chemicals.

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### Recitation

ASU CHM 343 is a sync, remote, 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 analysis physical chemistry concepts for each laboratory.

### Lab

Students will attend one laboratory section that meets for 3 hours every week. The lab times are listed on page 1 of this document. Two or three laboratory periods will be given to complete each of the experiments. A laboratory experiment schedule is provided at the end of this syllabus. While some of the experiments and data collected for labs will be done in groups, all data analysis, computational experiments and reporting will be done individually.

### Safety

All labs are online and/or remote. Hence, students will not have to worry about the typical safety concerns of a typical in-person chemical laboratory. If students perform any experiments in-person at a chemical laboratory or at their local residence, safety in chemistry labs is critical and lab coats, goggles and close-toed shoes are recommended. If students do attend an in-person laboratory at ASU, no food or drink are allowed in the chemistry laboratory and all ASU laboratories require that person wear a lab coat, goggles and close-toed shoes.

### Learning Outcomes

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

### Course Evaluations & Grades

Student's progress and understanding in this laboratory course will primarily be done through standard laboratory reports. This is a letter graded course using the following scale:

(100% - 90%) A; (89% - 79%) B; (78% - 65%) C; (64% - 50%) D; (49% - 0%) E.

To receive a grade in this class you must be registered on Canvas. All grades will be recorded in the ASU Canvas LMS system and each student can view his or her individual laboratory scores.

Lab Reports (100 pts each lab)	400 pts (~70%)
Peer Evaluations (25 pts each lab, Quality of Peer Reviews)	100 pts (~15%)
Lab Participation (ASUdig, YellowDig)	100 pts (~15%)

### Course Learning Objectives:

Upon completion of this course, participants should be able to:

1. Practical aspects of performing thermochemistry experiments and computations, along with associated analysis of data and error.
2. Understand physical chemistry data collection, analysis and standard reporting via laboratory reports.

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<u>Date</u>	<u>Tentative Schedule</u>
Jan-11	Syllabus Overview; ASU-Sync, Remote and Online Pchem Lab Introduction.
Jan-25	Project 1 – Properties of Gases - Computational (Simulations) and/or Experimental.
Feb-1	Project 1 – Properties of Gases - Data and Error Analysis.
Feb-8	Project 2 – Thermochemistry – Molecular Simulations and Computational Chemistry
Feb-15	Project 2 – Thermochemistry – Experimental (Calorimetry)
Feb-22	Project 2 – Thermochemistry – Data and Error Analysis
Mar-1	Project 3 – Chemical Equilibrium & Kinetics - Computational Chemistry
Mar-8	Project 3 – Chemical Equilibrium & Kinetics – Experimental (Spectroscopy)
Mar-15	Project 3 – Chemical Equilibrium & Kinetics – Data and Error Analysis
Mar-22	Project 4 – Atomic & Molecular Motion: Translational, Rotational, Vibrational
Mar-29	Project 4 – Atomic & Molecular Motion: Translational, Rotational, Vibrational
Apr-5	Project 4 – Atomic & Molecular Motion: Translational, Rotational, Vibrational
Apr-12	Project X – Student Proposed Computational or Experimental Project (Instructor must approve)
Apr-19	Project X – Student Proposed Computational or Experimental Project
Apr-26	Makeup Lab(s)

### Potential 'Additional' ASU Remote, Online and/or Computational Physical Chemistry Projects

Students can substitute one of the four projects with a proposed remote experimental physical chemistry laboratory or computational chemistry exercise. If a student wants to propose a project X, they need to submit a 1-page outline proposal by April 1st. Examples of past proposed projects include:

- Project X<sub>1</sub> – Predicting the Strain Energy of Cyclopropane, Cyclobutane and Cyclopentane Using Computational Thermochemistry (Electronic Structure Methods).
- Project X<sub>2</sub> – Using Electronic Structure Computational Methods to understand the molecular mechanism and Substituent Effect of Keto-Enol Tautomerism.
- Project X<sub>3</sub> – Molecular Structure and Dynamics of a cyclic peptide - Gramacidin-S.
- Project X<sub>4</sub> –Quenching of Tryptophan Fluorescence in Cytochrome-C.
- Project X<sub>5</sub> – Kinetics of a Photochromic Reaction
- Project X<sub>6</sub> – Nanoparticle 'Quantum Dots' Electronic Structure

<u>Due Date</u>	<u>Project # Due for Peer Review</u>
2/3	Project-1 Report Due
2/24	Project-2 Report Due
3/17	Project-3 Report Due
4/7	Project-4 Report Due
4/28	Makeup Lab Report or Project-X

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### Lab Reports

Lab reports are a traditional way to summarize and convey the results from laboratory or computational experiments. Every student will turn in his or her own report. Individuals that turn in late lab reports will not be included in the anonymous peer review process and late lab reports will have to be evaluated by teaching assistants separate from the peer review evaluation process. Furthermore, lab reports will be penalized 10% every week they are late. There is a 10-figure/table and a 10-page limit on all reports. Students will be expected to turn in a single electronic file (pdf file) of each lab report. An additional supplemental section is allowed for additional figures and showing detailed calculations for statistical and error analysis (e.g., propagation of error). Lab reports should be in the style and format of a scientific publication (e.g., American Chemical Society (ACS) - *Journal of Physical Chemistry*, *Journal of Chemical Education*).

### Lab Report Format (Rubric, 100 pts ea.):

Student lab reports will be modeled after a standard scientific manuscript or journal article. Lab reports should be submitted in an ACS approved scientific journal format. Representative manuscripts will be provided to students. All reports must be typed and should follow the standard double column format with embedded figures and tables, as found in a typical ACS scientific journal article. Reports should contain the following parts:

- **Title** – The title should be informative and should contain keywords that will allow others to search in databases for your manuscript. For this class, you should also include the experiment number. (2 pts)
- **Authorship** – Your full name, email address and name of lab partner(s). (2 pts)
- **Abstract** – This should briefly and clearly describe the purpose of the experiment, the principle results and the major conclusions. The principle results are typically numerical values with the associated errors. (6 pts)
- **Introduction** – The introductions should state the purpose of the investigation. It should also include appropriate citations and should provide concise background and/or theory relevant to the experiment/lab. (10 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 and/or experimental components performed by the student'? (10 pts)
- **Results & Discussion** – Present the results of the experiments, computation and/or simulations using tables and figures to illustrate all critical components of the project (40 pts). Include detailed figure captions for all tables and figures used in your report (10 pts). Discuss the results and compare with your expectations and other known literature results (5 pts). An analysis and discussion of error for the experiment should be included in this section (5 pts), however, often detailed examples of the error analysis statistics and calculations are provided as a supplemental section. Any detailed calculations for the data analysis can be put into a supplemental section. (60 pts Total)
- **Conclusion** – Briefly summarize your results and interpretation. (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. (5 pts)

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### General ASU Policies

#### 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 Disability Resource Center (DRC) 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 DRC. 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 the DRC by going to <https://eoss.asu.edu/drc>, calling (480) 965-1234 or emailing DRC@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

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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 discuss any concerns confidentially and privately.

### **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 and <https://eoss.asu.edu/dos/safety/ThreateningBehavior>.

### **Disability Resources**

Students who feel they will need disability accommodations in this class but have not registered with the Disability Resource Center (DRC) should contact DRC immediately. The DRC Tempe office is located on the first floor of the Matthews Center Building. DRC staff can also be reached at: (480) 965- 1234 (V) or (480) 965- 9000 (TTY). For additional information, visit: [www.asu.edu/studentaffairs/ed/drc](http://www.asu.edu/studentaffairs/ed/drc).

### **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.

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### **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.