

GEORGETOWN UNIVERSITY
Department of Chemistry
General Chemistry II - Summer 2020 - **Updated for Online Instruction**

General Information for CHEM 002 and CHEM 010

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Office Hours: by appointment	Office Hours: by appointment

Course structure: Lecture/Recitation MTWTh 8:10 - 11:25 AM (same Zoom meeting)
Scheduled Quizzes MTWand/orTh 11:00-11:25 AM
Laboratory MTWTh 12:10 - 2:45 PM

Lab, Chem 010, is a separate course. Concurrent registration in Chem 002 and Chem 010 is required, except with permission from the instructor. The recitation portion of the lab course is used to support the lecture course and attendance to recitation is required for students in CHEM 002.

Due to the pandemic caused by Covid-19 both General Chemistry Lecture II and Lab II will be offered online. Lecture, Recitation and Lab meetings will occur synchronously in Zoom. Please obtain all required items listed below for the first day of class. There is no text lab manual required for CHEM 010 as we will use an online platform called Hands on Labs Science Delivered: [Link for information on HOL](#) which is a required purchase.

The learning environment will be in Zoom meetings and the platform for providing links lectures, labs and office hours, lecture notes, assignments and submission of quizzes and tests is Canvas.

Required Items:

1. Please download the Zoom client on a laptop or computer equipped with a camera:

<https://georgetown.zoom.us/download>

2. Chemical Principles The Quest for Insight 7th Edition by Atkins, Jones, and Laverman (e-text is fine)

3. Online homework through Sapling Learning. [Link to student registration instructions](#)

The online homework is worth points toward your grade in the course and will be used for exams. Sapling works best with the Chrome browser on a laptop or desktop computer. Students have also successfully used tablets to do Sapling assignments and tests.

4. Please obtain the HOL lab kit for the first day of class. The cost for the kit and access to the online platform is \$260.00 not including tax or S&H. While this is expensive, there is no lab manual and no \$150 lab fee for the course which is a cost normally incurred by all chemistry students. Purchasing instructions will be available at least 30 days before the start of classes July 6th.

5. Scientific calculator. A phone app should not be used as a calculator and accounting calculators do not have the functions needed for chemistry.

Suggested Item:

HGS Molecular Structure Model Kit (about \$28-30 depending upon source).

[Link to Amazon site for molecular model kit](#)

[Link to manufacturer site to purchase HGS Molecular Structure Model Kit](#)

A solution manual to the text is not required or suggested. Worked out solutions will be provided on Canvas.

What is this course all about?

The course will emphasize both assigned reading/problem solving from the textbook and lecture material. Selected handouts will be provided as supplements to the textbook or laboratory manual as required. An online homework program will be utilized to give you more practice answering questions and solving problems. It is understood that students will behave with the utmost respect for academic integrity in all aspects of this course.

Objectives: Every material thing around you, on this Earth and throughout the universe is made of atoms; atoms that combine to make molecules. Our main objectives in this course is to:

- Understand the chemical reaction through the frameworks of thermodynamics, kinetics and quantum mechanics
- Understand equilibrium processes qualitatively and quantitatively
- Understand acid base, precipitation and redox reactions
- See connections between experiments, conclusions and explanations.
- Build analytical problem solving skills.
- Develop connections between mathematical problem solving and conceptual meaning.
- Continue the process of the transformation from a container of information to a contributor to human knowledge.

There are three main areas in science that provide the framework for answering questions about our material world: Quantum Mechanics, Thermodynamics and Kinetics. Our goal is to develop your understanding and capabilities in these three frameworks.

Examinations: There will be two exams during the semester and a cumulative final exam. All students are required to take the final exam. The dates for the exams are given on the schedule. There will be **no makeup exams** in this class. If missing an exam is absolutely unavoidable the final exam grade will also count as the missed exam grade. Students who do very poorly on one of their exams, but did not miss an exam, may substitute the final exam grade for the lowest exam grade. Exams will emphasize theory, conceptual understanding and problem solving: there will be multiple choice questions, short answer and problems wherein students are required to show their work.

Because of online instruction exams will be administered in a live Zoom meeting during regular class time as indicated on the syllabus. Students will scan written work and upload it to Canvas. The Sapling homework platform may be used for exams as well. Genius scan is an example of a free app that students can use on their phones to get pdfs of written work that can be uploaded to Canvas (also an app on the phone). We will practice this together in class so everyone is comfortable with the process.

Quizzes: Quizzes will be given as indicated on the schedule. Quizzes are very important in helping you gauge your success with the material, learn to work quickly and efficiently on problems, as well as encouraging good study habits. No quizzes will be given outside of scheduled class times, but the lowest quiz grade will be dropped so one missed quiz is not a problem. Quizzes will be challenging in order to properly prepare you for exams.

Because of online instruction quizzes will be administered in a live Zoom meeting at 11AM as indicated on the syllabus. Quizzes will be given in two possible ways: a Canvas quiz or a document shown to students in Zoom, students write answers, convert to pdf and upload to Canvas.

Problem Sets (ungraded): *"It is much easier to find something if you seek it"*

Assigned problems from the text are selected to assist your learning and focus in your reading. Please attempt the problems before lecture on that topic so you are exposed to what it is you need to know. My lectures are only meaningful to you if there is something in them you wish to know. If you have tried the problems in advance then you have some ideas about what to expect in class: this is what we mean by **"come to class prepared to learn"**. Do not arrive blank, ready to be written upon; arrive actively curious and hopefully lecture will be enlightening.

A word of caution: Do not be upset if you cannot immediately make sense of a problem, or you do not understand the answer to the problem in the back of the book. If you are struggling to solve a problem, your mind is working and you are learning ways to piece the information together. This is the actual value to you in taking this course; not the facts you assemble, but your method of learning new, complex ideas. If you rely too heavily on looking up answers before you finish trying it yourself, you will gain a false sense of confidence with the material. It is important to struggle a bit with problem solving, to

force yourself to find your own way. This doesn't happen immediately, in fact, we will be working on developing this skill all summer long!

Online Homework with Sapling Learning: These assignments will be worth credit toward your grade in the course. This work is meant to be a learning experience with immediate feedback. Your independent work is graded and recorded by the online program. Online homework is each student's independent work and collaboration is not acceptable. Sign up instructions are here: [Link to student registration instructions](#)

Homework due dates are listed in the Sapling site.

Attendance: It is most highly recommended that students attend all class meetings. Students are responsible for making up any missed work in either lecture or recitation on their own. Attendance in Zoom for Lab is mandatory. If a student is sick and must miss a lab, please contact Prof. Shahu to make an alternative arrangement.

All lectures, recitations and lab meetings will occur synchronously on Zoom. All meetings will be recorded and posted on Canvas (labs on the 010 Canvas site, lecture & recitation on the 002 Canvas site). Please do not allow yourself to get off track with our live meeting times. It is very important that you diligently keep to a rigorous schedule just as you would if we were meeting in person. The purpose of providing recordings is to give students yet another resource for review and learning and to also cover them in times of illness or family emergency. Please note that because we are completing a 15-week semester in just 5 weeks there is very little room to adjust for falling behind.

Laboratory: Students are expected to be prepared for each experiment and obey all safety rules consistently. This is especially important during this summer's online lab instruction wherein students will be doing lab experiments in their homes. Thorough safety training is required and provided the first day of class. All students must sign a waiver on the first day. See the lab guidelines and lab general information handouts for details. Technically the lab is a separate course, CHEM 010. The lab grade is therefore reported to the registrar separately from the lecture grade. All students registered for CHEM 002 must also be registered in CHEM 010 unless they are excused with permission from the instructor.

Grading: Chemistry can be a very difficult body of material to master and the last thing you need is the added pressure of competing with each other for grades. My goal is to enable each student to learn as much of the subject matter as they can master. Therefore, the grades will be determined by how the scores fit into a fixed grading system, not how they compare with other scores in the class. There will be no scaling of grades. Note that an A will represent significant achievement, a very difficult, but certainly not impossible accomplishment.

Assessments

Exam I	20 %
Exam II	20 %
Final exam	30 %
Quizzes	20 %
Online Homework	10 %

Given below are the expected ranges for final grades in the course. If your final average is in this range, you are guaranteed at least the grade indicated.

92.5 % and above	A
89.5-92.4	A-
87.5-89.4	B+
82.5-87.4	B
79.5-82.4	B-
77.5-79.4	C+
72.5-77.4	C
69.5-72.4	C-
67.5-69.4	D+
59.0-67.4	D
below 59 %	F

Feedback: Please feel free to call me at my office, or send me e-mail, any time if you have questions or if you need anything clarified. Obtaining a coherent knowledge of chemistry is one of the first steps toward your goal and I am here to help you in every way possible. So, please let me know how I may serve you best. Work hard and take advantage of all the resources available to you.

YOU ARE REMINDED OF THE PLEDGE YOU HAVE MADE:

In the pursuit of the high ideals and rigorous standards of academic life, I commit myself to respect and uphold the Georgetown University Honor System: To be honest in any academic endeavor, and to conduct myself honorably, as a responsible member of the Georgetown community, as we live and work together.

GOOD LUCK !!! and **ENJOY !!!**

CHEM 010 General Chemistry Laboratory II
LABORATORY GUIDELINES – Updated for Online Instruction

Due to the pandemic caused by Covid-19 both General Chemistry Lecture II and Lab II will be offered online. Lab meetings will occur synchronously in Zoom according to the schedule in the syllabus. There is no lab manual required for CHEM 010 as we will use an online platform called Hands on Labs Science Delivered: [Link for information on HOL](#)

Please obtain the HOL lab kit for the first day of class. The cost for the kit and access to the online platform is \$260.00 not including tax or S&H. While this is expensive, there is no lab manual and no \$150 lab fee for the course which is a cost normally incurred by chemistry students. Purchasing instructions will be available at least 30 days before the start of classes July 6th.

The learning environment will be in Zoom meetings and the platform for providing links to lab meetings, office hours and HOL activities is Canvas.

9 Labs will be completed using the HOL kit and cloud interactive website. We will follow all instructions and safety guidelines provided by this platform. There is extensive safety training for using the kits at home. The first lab will be dedicated to safety in a 3-hour exercise. The second lab day has no scheduled lab to provide an opportunity for students to acquire the items needed for lab that are not in the kit. A list will be provided and it includes items like paper towel, distilled water, white vinegar, table salt, matches/lighter, aluminum pie pan, toothpicks, measuring spoon, rubber bands, etc. Items like a thermometer, balance, burner, science glassware and chemicals as well as goggles and nitrile gloves are included in the kit.

Important: We will ask you to sign a safety contract and a waiver that places the full responsibility for the correct use of the HOL kit with the student. We will discuss this and ask for the signed forms after the first lab day. Students will have the option to opt out of doing the experimental part a lab in their homes if they do not have a safe place to carry out the lab work. **Each student is free to choose to participate or to opt out.** If a student chooses to opt out: they will still have a kit with access to the HOL resources and complete the lab on the HOL platform which provides excellent instruction, videos, quiz questions, data tables and a final lab assessment, but they will do the experimental part with a TA. Please contact Prof. Shahu and Prof. Glick to make arrangements.

Summary: There is no pre-lab, lab report or post lab questions to submit for HOL experiments. All of these labs are self-contained projects in the HOL format which includes prelab readings and questions, exploration and data collection, followed by an assessment. We will meet in Zoom while students do their work so students have access to teaching assistants and the lab professors during lab time.

1. The Zoom meeting link can be found on the Canvas site under “Zoom Conferencing”. Meetings will be synchronous, but also recorded. Please arrive on time, at 12:10PM for each day there is a scheduled lab.
2. All 010 students (both sections) will be divided into 3 groups of 10-12 students that will meet with a TA in Zoom for lab.

3. The HOL experiences are designed such that students can do them independently, therefore if a student must miss a day of lab the experiment can still be completed by the student. Any request for an alternative lab time must be approved by Prof. Shahu.
4. All work must be completed on each lab no later than 11:59PM on the date indicated on the syllabus.

There are 3 labs that will be executed in the same manner as carried out in CHEM 009 during the first summer session. The instructions below describe how labs 9, 11 and 12, which have separate prelab and post lab submissions to Canvas, are to be completed.

BEFORE LAB - Pre Lab Assignment: Due no later than 11:59 PM the night before the Lab

1. Read the experiment.
2. Complete *all* of the pre-lab questions and write an outline of the lab procedure.
3. Submit your answers to all the pre-lab questions and your outline of the lab procedure to Canvas by 11:59 PM the night before the lab as pdf files. Outlines and pre-lab must be done before lab therefore no credit will be given if the assignment is done during or after lab. They can also be done well in advance of the lab, so completing them early is not a problem.

DURING LAB

1. The Zoom meeting link can be found on the Canvas site under “Zoom Conferencing”. Meetings will be synchronous, but also recorded. Please arrive on time, at 12:10PM for each day there is a scheduled lab.
2. All 010 students (both sections) will be divided into 3 groups of 10-12 students that will meet with a TA in Zoom for lab.
3. The lab will begin with a PowerPoint presentation describing the theory, experiment and calculations. Since students will have already submitted the prelab questions and outlines, this will be a good opportunity for asking questions about the details. Students can also get feedback on prelab questions.
4. A video depicting the lab experiment will be shown.
5. Experimental data will be given to each pair of students. Each pair will go to a Zoom break out room to discuss and analyze their data. Lab partners will be rotated every week. This is an opportunity to get to know your colleagues as well as building teamwork skills.
6. Everyone will reconvene to discuss results, calculations and ask questions. We anticipate that most people will finish before the lab period ends at 2:45, but the TA will stay in the Zoom meeting room to meet with any student that returns with questions.
7. We highly encourage students to complete the lab in this setting, but students may

leave and finish later.

8. Reports are to be written in ink. All data must be entered into the data sheet for the experiment. Do not obliterate errors, draw a single line through your error and continue on the same report sheet. (i.e. do not erase or scribble out mistakes, do not re-write report sheets, and do not write data on separate sheets of paper)

AFTER LAB

1. Certain questions at the end of each lab are to be completed and turned in with the lab report. See the lab schedule for these assignments. (Do not confuse this with completing all the pre-lab questions for your pre-lab assignment.)
2. Submitted reports must have all data and calculations. Answers to the questions, graphs, etc., are to be submitted with the corresponding lab report. Reports must consist of one file with all the required pages. **Each student submits their own lab report even though they worked in pairs.**
3. A formal lab report is required for one of the experiments, #11. The formal report has the format of an American Chemical Society (ACS) journal article consisting of the following sections: Abstract, Introduction, Experimental Method, Results, Discussion, Conclusion and References. Details about the formal lab report format will be posted on Canvas and one lab period will be dedicated to discussion of this topic.
4. Each student will submit a reflection/concluding paragraph summarizing certain aspects of the lab with each lab report. These key topics are to be included in the reflection/conclusion paragraph.
 - a) Re-state the purpose of the lab.
 - b) Comment on what you learned from the lab experience.
 - c) What specific tasks helped you learn a specific skill/concept?
 - d) What specific lab techniques were learned?
 - e) Comment on systematic and random experimental errors.
(Do not confuse this part with experimenter error.)
 - f) If you repeated this lab what would you do differently?

Lab reports will be submitted on Canvas as a single pdf file. Scan Genius is a useful app for this purpose. Your phone can be used as a scanner to include all handwritten pages with the lab report.

Lab reports are due no later than 11:59 PM according to the due dates on the syllabus. A 5-point deduction will be assessed for each report submitted after 12am. A 10-point deduction will be assessed if the report is a day late. Each subsequent day will cost the lab score 15 points. Lab reports will not be accepted more than 3 days late.

The lab report grade will depend upon the accurate presentation of data graphically. All graphs must be done in Excel. You must, title every graph and all axes must be properly labeled and

scaled. If you are unsure how to correctly present your graphical data, please ask! It is all part of your learning process.

And finally:

Experimental technique during lab is very important and this is something we cannot have you do yourself in labs 9, 11 and 12. Techniques will be demonstrated via video. To make up for this shortcoming in teaching lab online there will be a strong emphasis on error analysis, data analysis and graphing, experimental design and technical writing for experiment 9, 11 and 12. We are very excited to have the opportunity for you to collect your own data and set up your own experiments with the HOL kits. We hope you find this an intriguing and genuinely fun way to explore chemistry.

HAVE FUN! We hope it is possible for you to enjoy the online lab environment. We hope to make it collaborative, conversational and illustrative of techniques. Think about what the experiment is designed to prove and observe closely how the data was collected in the video. Ask questions!

Academic Honesty: ALL STUDENTS ARE EXPECTED TO EXERCISE HONESTY IN THEIR WORK. YOU ARE REMINDED OF THE PLEDGE YOU HAVE MADE:
In the pursuit of the high ideals and rigorous standards of academic life, I commit myself to respect and uphold the Georgetown University Honor System: To be honest in any academic endeavor, and to conduct myself honorably, as a responsible member of the Georgetown community, as we live and work together.

Summary of Grading Criteria in General Chemistry Laboratory II – Updated for Online Instruction

The goal for the assessment of students in General Chemistry Lab is to maintain an environment that is both fair and academically challenging. As the second lab course taken by science majors, Chem 010 plays an important role in exposing students to the experimental nature of chemistry. Because of the pandemic caused by Covid-19 we find ourselves in a new situation: online lab courses. Because of the importance of the experimental nature of chemistry the Hands-on-Labs Science Delivered lab kits have been adopted as a way to give students direct experience with experimental technique and data collections. There are three labs which will not involve data collection, and while you do not get to collect data yourself we will create an environment designed to teach you the experimental nature of chemistry wherein you can learn about how experiments are done and as well as their limitations.

75% of the lab grade will be the score obtained from completing the HOL experiments.
25% of the lab grade will be based on the results from experiments 9, 11 and 12.

Labs are due no later than 11:59 PM according to the due dates on the syllabus (HOL and reports for 9, 11, 12). A 5-point deduction will be assessed for each report submitted after 12AM. A 10-point deduction will be assessed if the report is a day late. Each subsequent day will cost the lab score 15 points. Lab reports will not be accepted more than 3 days late.

The lab work for the experiments 9, 11 and 12 is assessed based on:

1. Student preparedness for experiments.....10%
2. Engagement and participation in lab lessons.....10%
3. Complete experiments and lab reports.....65%
4. Reflection/Conclusion paragraphs.....15%

1. Preparedness is evaluated based on the submission of an outline of the lab procedure and completed pre-lab questions. There is a deduction on your lab report of 10 points if the outline of the lab is not done. Sometimes, certain pre-lab questions are graded.

2. Engagement and participation means that students actively work to analyze the data. Arriving on time and not missing swaths of the lab are also important. An accommodation can be made for this component if a student must make up the lab at a different time.

3. The criteria for grading each lab report will be determined after you have done the lab. Each lab is different, so points are assigned to emphasize different aspects of the lab. Each lab emphasizes different skills, e.g. problem solving, graphing, unknown determination, etc. Some labs have extensive calculations and problems to solve, so most of the credit is associated with doing these problems correctly.

All original lab data will be provided. Data must be written into the report sheet in ink and then treated as if it was data collected by the student. Original data must be submitted with every report. Do not rewrite lab data. Do not erase your work as you proceed with the lab.

The lab report grade also depends upon the accurate presentation of data graphically. **All graphs must be presented in Excel.** You must **title every graph and all axes must be properly labeled** and scaled. An Excel tutorial is posted on Canvas for additional assistance.

Students working as a pair in the lab share data because they acquire the data together. This is perfectly reasonable. All other data sharing is dishonest. The data you receive will be genuine experimental data and therefore different results are expected from one group to another. While we would always expect students to get good data, there is not a penalty for poor results. If you believe your results are in error, you are encouraged to write an explanatory note to show your understanding of the situation and possible sources of error.

4. Along with each lab report each student will submit a reflection/concluding paragraph summarizing certain aspects of the lab:

- a) Re-state the purpose of the lab.
- b) Comment on what you learned from the lab experience.
- c) What specific tasks helped you learn a specific skill/concept?
- d) What specific lab techniques were learned?
- e) Comment on systematic and random experimental errors.
(Do not confuse this part with experimenter error.)
- f) If you repeated this lab what would you do differently?

Given below are the ranges for the final grades in the course. If your average is in this range, you will get at least the letter grade indicated.

92.5 % and above	A
89.5-92.4	A-
87.5-89.4	B+
82.5-87.4	B
79.5-82.4	B-
77.5-79.4	C+
72.5-77.4	C
69.5-72.4	C-
67.5-69.4	D+
59.0-67.4	D
below 59 %	F

Course Schedule for CHEM 002-20 Summer 2020

Date		Topic	Chapter
6Jul	Mon	Introduction to CHEM 002 Focus 5: Equilibria Physical Equilibria, Vapor Pressure, Phase Diagrams	5A-5C
7Jul	Tue	Solubility, Molality, Colligative Properties	5D-5F
8Jul	Wed	Chemical Equilibria Quiz 1	5G-5J
9Jul	Thu	The Nature of Acids and Bases Practice and Problem Solving Quiz 2	6A
13Jul	Mon	Review and discuss topics on Exam 1 The pH Scale Quiz 3	5A-J, 6A 6B
14Jul	Tue	Exam 1 (5A-J, 6A) Weak Acids and Bases, Polyprotic acids	6C-6F
15Jul	Wed	Buffers and Titrations	6G-6H
16Jul	Thu	Solubility Equilibria Quiz 4	6I-6J

20Jul	Mon	Balancing Redox reactions Galvanic Cells, Standard Reduction Potentials	6K-6M
21Jul	Tue	Nernst Equation and Electrolysis Quiz 5	6N-6O
22Jul	Wed	Kinetics Quiz 6	7A-7C
23Jul	Thu	Kinetics	7D-7E
27Jul	Mon	Review and discuss topics on Exam 2 Quiz 7	6B-6O & 7A-7E
28Jul	Tue	Exam 2 (6B-6O &7A-7E)	
29Jul	Wed	Periodic Trends	8A-B, 9A-B
30Jul	Thu	Coordination Chemistry	9C-9D
3Aug	Mon	Coordination Chemistry	9C-9D
4Aug	Tue	Nuclear Chemistry Quiz 8	10A-10C
5Aug	Wed	Review for Final Exam Quiz 9	
6Aug	Thu	Final Exam 8:15 am – 11:15 am	Cumulative

Course Schedule for CHEM 010 20/21 Summer 2020

Updated for Online Instruction

Date	Exp #	Topic	Post-Lab Questions
6 Jul	1	Laboratory Safety & SDS (Due 7/6) Intro to Experimental Error, Statistics and Graphing	HOL Cloud Submission
7 Jul		No Lab <u><i>Obtain/Purchase Student supplied items for HOL labs</i></u>	Item list provided
8 Jul	2	Colligative Properties and Osmotic Pressure (Due 7/12)	HOL Cloud Submission
9 Jul	3	Equilibrium and Le Châtelier's Principle (Due 7/13)	HOL Cloud Submission
13 Jul		No Lab	
14 Jul		No Lab	
15 Jul	4	Using Buffers (Due 7/19)	HOL Cloud Submission
16 Jul	5	Titration of Acetic Acid Vinegar (Due 7/20)	HOL Cloud Submission
20 Jul	6	Determination of K_a of a Weak Acid (Due 7/21)	HOL Cloud Submission
21 Jul	7	Oxidation-Reduction Activity Series (Due 7/22)	HOL Cloud Submission
22 Jul	8	Electrochemical Cells and Potentials (Due 7/26)	HOL Cloud Submission
23 Jul	9 Handout on Canvas	Electrolytic cells (Due 7/28)	1-5
27 Jul		Introducing the Annotated Lab Report Writing Guide	
28 Jul		No Lab	
29 Jul	10	Reaction Order & Rate Laws (Due 8/02)	HOL Cloud Submission
30 Jul	11 Handout on Canvas	Kinetics of Fading Phenolphthalein (Due 8/04)	Formal Report
3 Aug	12 Handout on Canvas	Coordination Chemistry (Due 8/05)	Worksheet
4 Aug		No Lab	
5 Aug		No Lab	
6 Aug		No Lab	