Course Requirements  
This course requires the first semester of General Chemistry Lab 125 as a pre-requisite. Generally, this is a lab course, although this semester we will be doing a few labs, but mostly the course will be online activities centered around computation using several pieces of software.

Each of you will need to download or access the following software. It must be installed on your system and can be downloaded using the links below. Install them on your system. Learn how to use each of them. Particularly focus on ChemDraw because of its extensive use in chemistry. We will be using them the entire semester of General Chemistry Lab 126. Some software can be installed, while some cannot and must be used from online. Before classes begin please download: Gnuplot, ChemDraw, Logger Pro, Word and Excel. Another office suite may be used, such as Pages, but you will need to convert the document to Excel format before submitting it for grading. This will include writing mathematical expressions and creating data sets within Excel for the different equations we use in lab. Spartan is the only piece of software you can purchase, but it is also available online through the NYU VCL portal. Excel is also available through this portal.

We will not be using a laboratory manual for this semester. Instead, I will be providing written lab experiments, and both pre and post lab exercise assignments.

Although Dr. BG is using McGraw Hill Connect, I am may not use it for the lab, except for the Final Exam.

If you are expecting to work in the general chemistry lab, you will need to see the image at the end of the syllabus. This is the list of mandatory PPE’s for this semester Fall 2020.

Gloves
Disposable Laboratory Jacket
Face mask
Goggles
Full face shield

Course Description
The lab portion of the course is a companion to the lecture and recitations. In particular, it should provide laboratory exercises at the chemical bench. Because of covid-19 requirements, I have reorganized the general chemistry 126 course, and it will not be following the same format as in the previous semester. It will now be organized into three different projects, and each project will be three or four weeks long according to the syllabus schedule. Each project will contain chemical exercises based on the topic Dr. Burt Goldberg is focusing on during his lecture.

I have done this by involving more physical chemical objectives into the proper learning paradigm group, and making the exercises more inclusive in nature. So molecular geometry and chemical bonding are in the first group. This group will extend into rates of molecular reactions and Chemical Kinetics. This will lead into concepts of chemical equilibrium, and so kinetic laboratory elements will be part of two projects. Finally, we will end with thermodynamics and electrochemistry.

During the lab, conceptual discussions and computational modeling, as well as, real time data collection for each on-campus experiment will be done. The software will be used to understand the chemical principles and testing the data through Excel calculations and using one of the plotting programs. For this reason,
recommend you download the software at the end of the syllabus, and begin familiarizing yourself with each of the programs.

Gnuplot is a wonderful program used for plotting and is very powerful. One caveat, it is a command line program on both the Mac, and on the PC. We will be using Gnuplot for inputting data sets from Excel in tabulated form. We will not be using the graphics that come with excel. The laboratory will involve measurements and analysis using real data sets, as well as using excel to calculate certain quantities. This semester, the laboratory component will have a strong computational analytical chemistry structure.

The last group of exercises and the third project will involve equilibrium thermodynamics, free energy, entropy, and electrochemistry. Because the course is on chemistry, we will focus the entire semester on chemical properties of a variety of molecular reaction systems.

Course Organization, Lab and Distance Learning Structure

The course will be held each Friday morning, beginning at 9:30am. There will be an in-lab quiz given each week immediately following my talk, and it will be given to you by your laboratory teaching faculty.

Lab Organization
The lab is organized so the students working on-campus will be collecting data for the entire class. Each student will then process the data on their own and submit a "typed" laboratory report, and will include data tables, graphs, calculations, as well as applying the correct number of significant digits. You will also write excel functions to do calculations, using the function you write and should be included in your report. No lab reports may be submitted using preformatted excel functions. You will generate your own excel analytical functions for each calculation that will need to be done. You will also be setting up your work using Excel, then provide a written report to be submitted. This will include your excel sheet, and any graphs from Gnuplot, Spartan, ChemDraw, or Logger Pro.

We will initially meet for lab at 9:30am using the Zoom link through NYU Classes. I will then dismiss the group and you will meet with your lab faculty at 10:00am using your assigned section Zoom link. A quiz will be given and begin at 10:10am, and must be submitted by 10:30am. I will give you 15 minutes for the quiz and 5 minutes to upload it using Adobe scan. Submissions will be considered late at 10:31am. You will not be allowed to submit your quiz after 10:30am. No quizzes will be accepted after this deadline.

For the students making the laboratory measurements, you will be graded on the preparation, organization and results. Once you collect the data, you will provide the data to the rest of the students in the course to be used in calculations and writing the laboratory report. The laboratory portion of the lab will be used to collect data for the entire lab. The data will then be "pooled", and the measurements made available to everyone. This means we will be working with sets of data, and not individual measurements. Assuming there will be on campus students, the data will be grouped so there are several sets available.

To make it fair, the on-line students will also have some extra work in the way of organizing the project due at the end of the project period.

Students
Each student will do their own work and submit their own laboratory report with a printout of the files needed in the lab from the software used to complete the lab work. Each student will develop an Excel sheet with the experiment title as the excel sheet name and tab name. Your Excel sheet will become a collection you are responsible for keeping as part of your electronic lab book. You will need to password protect your book.

You must retain the Excel Book as a record of your laboratory data and calculations. This includes any formulas you program as required and must be included in your laboratory report. You will need to keep a back-up copy of your work. Please make the proper folders on your desktop to keep all the information on your computer, and then back up this folder.
If you use the VCL version of any of the software listed, then you will need to keep a copy of the work on your own computer. Again, you are responsible for the back-up copy.

This semester, the general chemistry lab will strongly incorporate an analytical computational component as the core of your chemical technology learning experience. This will include data acquisition, numerical calculations, and graphing. The functions represent the analytical organization and will require you to use Excel to calculate several quantities throughout the semester. You will be writing your own Excel math functions to be used for your calculations. These will be submitted along with your datasheets written in a laboratory report.

**Laboratory Projects**

There will be three (3) laboratory projects, each containing three to four laboratory exercises each. The project organization is used to group similar information, allowing conceptually similar exercise components to be within the project structure. I want you to learn chemistry. But in addition to chemistry, there is also data analysis as a very important and involved research process.

Each project represents some major component of the lessons you will learn in the course lectures you study this semester. The learning objective is to build a comprehensive understanding of the important chemical concepts, such as molecular geometry and the relationship to the physical and chemical properties of material substances. By adding a strong analytical computational approach to our studies, we will gain the insight of how the mathematical equations and the experimental data are related. This is best presented as a collection of scientific measurements, along with analytical reasoning approaches. In this approach, the on-campus students will be collecting the data experimentally and generating a table for the data. This will be only part of your grade for the project, but not the experiment within the project organization. The online students will be responsible for organizing and reporting a group summary of all the data for the entire project. You each will be working in the same group throughout the semester, remaining within your laboratory sections.

This means each project will take several weeks to complete. You must complete each of the week's assignments, in addition to completing the project by the last day assigned. Once the next project begins the previous project will have already been submitted. This is the projects complete date, and penalties begin to accrue thereafter. No work will be accepted after a deadline period of two days. Day 1 is a 30% points deduction for the project, and does not include any incorrect responses. Day 2 is a 70% points deduction and again, does not include deductions for any incorrect responses on the laboratory assignment. Day 3 is zero points for the exercise. There will be No Exceptions to this organization. It should be clear late work after the day 2 will not be graded.

**On-Campus**

There will be no quizzes inside the laboratory space. The laboratory space will be used only to collect data. While in the lab, each student must wear a face mask, goggles, face shield, gloves and laboratory jacket (see the last page of the syllabus).

The key to success is the workflow within the lab and it must remain within the working allowances of the social distancing requirement's (6 ft). This requires being patient and polite to your peers. You should not be in a hurry to finish the measurements, and must focus on accuracy, precision and recording the correct data values with units. This group will collect the data for the experiment and work with the online students organizing the data. It will then be used by the entire group. Not only will calculations be done, but analysis and statistical analysis will also be done for each experiment. The on-line group will be responsible for writing the statistical functions and reporting the final project work for the group. I recommend the ones doing the experiment work with the online students writing the project summary. The summary must be a typed written scientific paper with the following structure:
Title
Names of everyone in the group
Abstract
Background Information
Experimental conditions and observations
Conclusion

Throughout the semester, you will **NOT** be allowed to use any Excel built in math functions. The only exceptions will be the need to use certain mathematical expressions as necessary functions. Such as a $\log x$, and $e^{-x}$ expression.

The laboratory equipment will be assigned to each student and you will need to use the equipment for the entire semester. Particularly is the use of either the analytical or top loading balances that must be shared. So, you will use the same balance each time you are in the lab to allow Covid-19 traceability. **I have the expectation and will request the laboratory space be set up for each experiment before we enter the lab.**

If there are enough students on-campus, the lab weeks may need to be divided. No more than 45 students will be allowed in the lab space at any time. There will be a sign in sheet.

**NYU Classes**
We will be using classes for many aspects of our course grading management organization. We will use the assignments tab in classes to upload all assignments as PDF files, as they should also be stored on your computer in the experiments folder. We will also be using Classes to upload the laboratory quizzes as PDF documents into a dedicated assignments tab. There will be an assignment for each lab quiz, and lab report.

**Zoom**
In addition, we will be launching Zoom from both the general course tab genchem001 (Dr. BG and I share this course tab), and also from the laboratory section tabs you are enrolled. This is the same as last semester. The lab quiz will be given in your section tab. Please be very clear about how we will be utilizing NYU Classes.

**Connect** by McGraw Hill
We will only use Connect for the Final Exam, unless I decide to make the quizzes available using this website. Please see Dr. GB’s syllabus for the website link to McGraw Hill.

**Course Policies**

**Academic Integrity**
In this course we will follow all university policies - no exceptions. Poor academic integrity will be dealt with through the proper channel. If you are involved in academic misconduct, it will be forwarded to the Dean of the College of Arts and Science.

**No Makeups**
There will be no allowed laboratory makeups. There are three projects and different labs within each project, and so no exercises will be dropped. This means no labs will be dropped from the total, and only one quiz will be dropped. (**See lab university policy for acceptable missed reasons**).

**No makeup quizzes.** A missed quiz is a zero, unless excused. Excuses are defined by the University - Religious observations, scheduled University events, and illness.

There will be 12 experiment Quizzes and will always include the information of the project. Each is worth 20 points. A single (10) point safety quiz will be given during the semester.
Pre-Lab, Post Lab and Project
Each project is worth 500 points, but the pre and post lab questions are separate scores. The project will have experiment points (100), and a project score (100). The project material only covers the material inside each project. The pre-lab points will effectively be 16 points each, but may vary by one or two points to give the total points allocated. This applies to the post lab questions as well.

Final Exam - A missed final exam will need to be taken in the spring semester and will give you an incomplete for the semester.

Course Points
The laboratory section is 25% of your total composite score earned toward your semester grade. The lecture, recitation, and LG's are the remaining 75% from Dr. BG. The total laboratory points for the semester is 2300. This includes three projects, each worth 500 points, Pre-Lab, and Post Lab Assignments each worth 200 points, Lab Quizzes 250 points (weekly), and the Final Laboratory Exam 150 points.

<table>
<thead>
<tr>
<th>Project 1</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 2</td>
<td>500</td>
</tr>
<tr>
<td>Project 3</td>
<td>500</td>
</tr>
<tr>
<td>Prelab Assignments</td>
<td>200</td>
</tr>
<tr>
<td>Post Lab Assignments</td>
<td>200</td>
</tr>
<tr>
<td>Lab Quizzes</td>
<td>250</td>
</tr>
<tr>
<td>Final Exam</td>
<td>150</td>
</tr>
</tbody>
</table>

Total Point's 2300

Course Lab Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Project</th>
<th>Experiments</th>
<th>Notes</th>
<th>Zoom, Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/4</td>
<td>1</td>
<td>Molecular Geometry (Lewis Structure)</td>
<td>Excel, ChemDraw, Logger Pro</td>
<td>Z</td>
</tr>
<tr>
<td>9/11</td>
<td>1</td>
<td>Molecular Geometry (Molecular Orbital)</td>
<td>Excel, ChemDraw, Gnuplot, Spartan</td>
<td>Z, C</td>
</tr>
<tr>
<td>9/18</td>
<td>1</td>
<td>Molecular Geometry</td>
<td>Excel, ChemDraw Gnuplot, Spartan</td>
<td>Z, C*</td>
</tr>
<tr>
<td>9/25</td>
<td>1</td>
<td>Kinetics Rates</td>
<td>Excel, Logger Pro, ChemDraw, Gnuplot</td>
<td>Z, C</td>
</tr>
</tbody>
</table>

10/2 Deadline Project 1: Submission by end of lab period (Lecture Exam 1 this week) Project 2 - Discuss and Organize Z

<table>
<thead>
<tr>
<th>Date</th>
<th>Project</th>
<th>Experiments</th>
<th>Notes</th>
<th>Zoom, Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/16</td>
<td>2</td>
<td>Equilibrium: Acid Base</td>
<td>Excel, ChemDraw, Logger Pro</td>
<td>Z, C</td>
</tr>
<tr>
<td>10/23</td>
<td>2</td>
<td>Equilibrium: Buffers</td>
<td>Excel, ChemDraw, Logger Pro</td>
<td>Z, C</td>
</tr>
<tr>
<td>10/30</td>
<td>2</td>
<td>Equilibrium: KSP</td>
<td>Excel, ChemDraw, Logger Pro</td>
<td>Z, C</td>
</tr>
</tbody>
</table>

11/6 Deadline Project 2: Submission by end of lab period (Lecture Exam 2 this week) Project 3 - Discuss and Organize Z

<table>
<thead>
<tr>
<th>Date</th>
<th>Project</th>
<th>Experiments</th>
<th>Notes</th>
<th>Zoom, Campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/13</td>
<td>3</td>
<td>Thermodynamics</td>
<td>Excel, ChemDraw, Gnuplot</td>
<td>Z, C</td>
</tr>
<tr>
<td>11/20</td>
<td>3</td>
<td>Thermodynamics: Colligative properties</td>
<td>Excel, ChemDraw, Gnuplot</td>
<td>Z, C</td>
</tr>
<tr>
<td>11/27</td>
<td>3</td>
<td>Thermodynamics: Electrochemistry</td>
<td>Excel, ChemDraw, Gnuplot</td>
<td>Z, C</td>
</tr>
<tr>
<td>12/4</td>
<td>3</td>
<td>Thermodynamics</td>
<td>Excel, ChemDraw, Gnuplot</td>
<td>Z, C</td>
</tr>
<tr>
<td>12/11</td>
<td>Check Out of Lab</td>
<td>Students taking the On-Campus lab</td>
<td>(Lecture Exam 3 this week)</td>
<td></td>
</tr>
</tbody>
</table>

12/15 Begin Final Exams
12/21 End Final Exams

* Check-In
Course Numerical Computational Structure
All numerical calculations for the lab will be done using excel and will include reporting the mathematical functions you develop for your calculations as part of your lab report. An excel templet sheet will be made available to you, but you will need to write the mathematical expressions in excel to complete your calculations. This includes using constants in the calculations, such as Avogadro's number \( h \) = I will show you what you need for writing functions in Excel.

Videos
Some short video tutorials will be provided for each piece of software you will be using this semester. These videos will be made available to you a week before the experiment is done. I may or may not use experiment videos as a YouTube ancillary source. If a video is used for the experiment, then I will provide you the link to it, when it is needed.

Each lab will have several files from using the different software applications. This means your general chemistry lab folder, will need multiple folders for each experiment and should be labeled clearly. You will be submitting a lab report each, with datasheets, printouts of graphs, tables, chemical structures and numerical calculation leading to experimental results.

Excel Lab Sheets and other files
These are the core to your numerical calculations and will be submitted as an excel book with your name, section and title. You will be using the following file format. Anything else from this organization will cost a 5% deduction in points from your experiment, and possibly the project if not properly labeled for its. Please use the following file descriptor organization for each experiment when uploading your work:

- Name  Section# . Project# . Experiment#

Albert Einstein  201.1.3 (physical chemist)
Josiah W. Gibbs 202.2.1 (physical chemist)
Michael Faraday 204.3.4 (physical chemist)
Ludwig Boltzmann 206.2.2 (physical chemist)

Significant Figures
We will follow significant rules used by Dr. BG. All numerical calculations need to be reported to the proper number of significant figures with units on your Excel sheets and formatted properly as a reported value. All final reported values need to be highlighted in red.

Graphs
Graphical data will be generated by Gnuplot, Logger Pro, and/or Spartan. You will also be drawing chemical structures using ChemDraw. You will submit printouts of your graphs and for Gnuplot, the text file holding your set commands. This will allow you to include the plotting information in the lab submission. The set commands can be found in the Gnuplot user manual you can download. Gnuplot is free. The submission may also include energy values, AO's or MO's structures from Spartan, or Chemical Structures from ChemDraw. These will be cut and pasted into your written (typed) lab report.

Tables
Any data tables generated with Excel will be submitted as part of the lab. The files themselves will only be submitted as verification of your work, if I ask. I will ask! But the functions you use in your code must be pasted into your lab report and organized.

Computer File Folders
You will all need to create a folder with subfolders on your desktop for storage of your experimental information. See the lab schedule for the subfolders you will need.
Name of main desktop folder → General Chemistry Lab

Three subfolders → Project 1, Project 2, Project 3

One subfolder for each experiment within each project → Exp #

Course Lab Books
We will not be using a laboratory book this semester. Instead we will be using the Excel spreadsheet and I will be providing written lab exercises available to you through NYU classes. The exercises will be provided as a set of PDF documents and will be made available to you, two weeks before the experiment begins.

Course Software Links

Gnuplot and Reference Manual
Download the application program and the reference manual from this site (http://www.gnuplot.info). This is a command line program. This means you will need to write the command line arguments into a simple text file and then load it into Gnuplot to plot your data. You can use word, but you must save the file as a plain text file with the extension *.txt

A simple text file has an extension filename.txt

ChemDraw
This link takes you to the NYU library site where ChemDraw information can be found. Please follow the instructions on this page to download ChemDraw. You will need to register for the software. It is free for students to use during the semester. The second link is the form you will need to fill out at Perkin Elmer. Use the account ID provided (Account ID = 3088SL).
https://guides.nyu.edu/c.php?g=276594&p=1844910
https://gallery.cambridgesoft.com/register.html?FlexeraAccountId=3088SL

Excel
If you do not have Excel on your computer, you may use the one found at NYU VCL

Logger Pro
Located within NYU Classes under the laboratory tab for General Chemistry I26, although most of you should have this already on your computer from the first semester. If you need to install logger pro, please use the latest version for your system. There are only two versions available. For the Mac and Windows OS. There is no version for the Chrome OS. So, you cannot use the Chrome OS with Logger Pro.

Spartan Software
We will be using Spartan software to calculate the Molecular Orbital Energy levels for a variety of different chemical substances to determine their energies. You do not need to purchase the Spartan Software.

The first link below is available for you as an online IT service from NYU VCL (Virtual Computer Lab). You must be continuously connected to the internet to use the software. Notice this link forces you to log into the system. You will need to use your NYU Net ID login information.

Use the following links for Spartan, and other software offered through the Virtual Computing Lab (VCL).

Follow this link for the NYU VCL Login Portal for Spartan Software (Use your NYU login information)
https://nyu.apporto.com/
Follow this link, and click on previous VCL link within the document paragraph. It will take you to the login portal.


Use this link if you need help from IT with VCL
https://nyu.service-now.com/servicelink/kb_search.do?id=041213019263437

This link takes you to the IT software page "location web page" for VCL.
https://www.nyu.edu/life/information-technology/getting-started/software/software-by-nyu-it-location.html

If you want a Spartan desktop version of your own, you can purchase the software at the following link:
https://store.wavefun.com/product_p/spstudent.htm

Adobe Acrobat Software for Students (Download)
https://nyu.service-now.com/servicelink/kb_search.do?id=KB0018090

Adobe Scan for iPhone or Android (Download)
Required to upload files in PDF format from your phone

Personal Protection Equipment (PPE)
This is the proper dress code, but the face shield may be omitted.

NO EXCEPTIONS! You will not be allowed in the lab, if any of these items are not with you. These items may (will) be available for purchase through NYU?(. This decision is being made by the Dean of Science. Please do not purchase them until after our first lab meeting over zoom, when they need to be purchased.

Professor Acknowledgements
I reserve all rights to change any of the contents within the syllabus. I will be providing an appropriate amount of time, if I feel any changes become necessary during the semester.

I wish you all the best, and stay focused.

We are now ready to focus on chemistry!

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