

## CHEM 152L COURSE SYLLABUS

**General Chemistry II Laboratory - 1248- CHEM 152L – 09 Thursday, 8:00am – 12Noon**

*Introductory Chemistry Laboratory: Through the lens of Antimalarial Drug Design*

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**Virtual Drop In Zoom Office Hours:** Mondays, 1.00–2.00pm, Tuesdays, 4.00–5.00pm, Wednesdays, 12Noon–1.00pm, 2.30–3.30pm, Thursdays, 2.30–3.30pm. Fridays, 2.30–3.30pm., or by appointment

Zoom Link

<https://us02web.zoom.us/j/86730148606?pwd=TVlmdU44SG4yMnBtVpMwG95YTdDdz09>

Meeting ID: 867 3014 8606

Passcode: 282647

### Course Design

*Chemistry 152L is the second semester of a two-semester sequence which is designed to introduce you to the fundamental concepts, techniques, and methods of experimental chemistry. This is accomplished through a series of experiments that build upon each other. Many of the theoretical concepts and basic mathematical skills upon which the experiments depend are covered in Chemistry 152, so previous or concurrent registration in that course is required of students in 152L. Chemistry 152L builds upon the foundation we laid in Chemistry 151L, so successful completion of Chemistry 151L is a prerequisite for this course*

In this section of CHEM152L, students will gain both technical expertise & research experience through the lens of Antimalarial Drug Design. During the semester they will develop a research project using a variety of classic chemistry techniques (titration, kinetics, spectroscopy, molecular modeling) in the context of experiments to explore structure function relationships of potential antimalarial drugs targeted towards a specific enzyme. Students will develop and test research ideas related to novel approaches to target the parasite but not the human host.

During the semester students explore prior knowledge, formulate a hypothesis to be tested, design and perform a combination of computational and wetlab experiments to explore intermolecular interactions between Malate Dehydrogenase as the drug target and potential compounds that might be lead compounds for drug development. Students collect and quantitatively analyze data to test their hypothesis using molecular modeling and docking studies and wetlab techniques such as spectroscopy, kinetics, binding and titration studies, allowing them to draw evidence based conclusions. The project concludes with a formal presentation describing their project.

At the start of the semester, you will be assigned to a project group, which will conduct original research experiments. Please see the class calendar for the schedule of experiments.

*Note: the key to success in this course is to come to each lab meeting prepared.*

### Course Goals

This course will give you experience with how a chemist approaches a given chemical question, so where Chem 151L can be described as a “fundamentals and techniques” course, Chem 152L is more of an “approach” course.

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Your background in Chem 151L will come in handy because you will use techniques from that course as tools to answer complex chemical questions. In this course you will learn how to:

1. Maintain a safe work environment by following general laboratory protocol (applied to more corrosive/toxic materials than were used in Chem 151L): proper handling and disposal of hazardous chemicals; maintaining a safe work environment; what to do in case of a lab emergency
2. Assess the factors that need to be considered when designing an experiment and use them to:
  - a. Understand why we performed the experiment the way we did
  - b. Design and carry out procedures of our own
3. Perform simple tests to either characterize an unknown or to determine its identity.
4. Organize a wide array of data for a series of unknowns using a qualitative analysis scheme
5. Use observations to guide you through your experiment.
6. Link your observations to written chemical reactions taking place.
7. Propose reasonable sources of error and their likely impact on experimental results.
8. Perform new techniques
9. Further develop/refine laboratory notebook writing skills.

### Learning Outcomes for Chem 152L\*

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

- 1) *Design a simple experiment that can answer a given chemical question.*  
Determine what needs to be done and in what order, determine what types of glassware should be used in the experiment, assess the major sources of error and how to modify procedure to eliminate these errors if possible.
- 2) *Qualitatively analyze a given chemical or physical process.*  
Observe a chemical and/or the changes that take place in a chemical reaction, perform a flame test or a precipitate test, test for acidity/basicity, identify an unknown from qualitative tests.
- 3) *Quantitatively analyze a chemical or chemical process.*  
Generate and interpret a standard curve, interpret titration results, calculate percent yield for a synthesis, apply kinetics and weak acid/base equilibria concepts in calculations, write a balanced chemical equation to describe an observed chemical change.

### Equipment List

1. Lab Manual and lab notebook – The lab manual will be hosted on an electronic lab notebook (ELN), <https://www.labarchives.com/>. Information is posted on Blackboard for registration. The cost is \$15/semester.
2. Calculator
3. Access to a computer, Chromebook, laptop, Surface or tablet
4. Molecular Model Set – If you do not own one from Chem 151/15L, or information will be distributed during the first week of lab on how to purchase or you may order a similar kit at the following link: [https://www.darlingmodels.com/Individual-Orders-Molecular-Model-Kits/KIT-1-ISBN-978-09648837-1-0-Plastic-Box-Organic-Inorg/prod\\_2.html](https://www.darlingmodels.com/Individual-Orders-Molecular-Model-Kits/KIT-1-ISBN-978-09648837-1-0-Plastic-Box-Organic-Inorg/prod_2.html)
5. Lab Coat – USD Bookstore
6. Safety Spectacles – From Chem 151L, or information will be distributed during the first week of lab on how to purchase
7. **Masks are always mandated in lab and while in the Shiley Center for Science and Technology and should be worn correctly, covering nose and mouth.**

### Breakage

You will be financially responsible for any cumulative glassware breakages/losses totaling over \$10.

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### Attendance Policy

Attendance at your regularly scheduled lab section is **mandatory**. For section 09, labs will begin promptly at 8.00am (Thursdays). Because of the nature of this section, there is no option to attend another section. Do not schedule another class, work or personal vacations during this time. It is unexcused and cannot be made up. You must let your instructor know in advance otherwise it is an unexcused absence. Keep the lines of communications open.

Reasons for an excused absence:

- 1) Serious illness with proper documentation (i.e. doctor's note) or
- 2) Required attendance at an official University event.
- 3) Please work with you instructor if you are experience symptoms of COVID-19 or have been exposed and must quarantine or isolate. This may affect your attendance to any of the in-person labs and you will need to work with me to make arrangements for an excused absence.

If you have an excused absence, please read the make-up protocol section. Unexcused absences cannot be made up.

### Make-up Protocol

If you have an excused absence, you will be required to complete an equivalent remote lab in its place. Work with me to obtain the "remote lab" assignment.

## Spring 2022 Chem 152L Calendar

Week of	Pre-Lab	Activity	CURE Element
W0 Thursday Jan 27 <sup>th</sup>		No Lab <b>Safety Training &amp; Quiz: must be completed before Lab in W2, February 10<sup>th</sup>.</b>	
W1 Thursday February 3 <sup>rd</sup>	<b>Remote:</b> <b>Zoom Link:</b> <a href="https://us02web.zoom.us/j/87056213586?pwd=M0U2Q3FLV3ozbDZ3ejdlRHFiLzJRZz09">https://us02web.zoom.us/j/87056213586?pwd=M0U2Q3FLV3ozbDZ3ejdlRHFiLzJRZz09</a>	L1: Introduction to the Project: PyMol and Molecular Visualization Relevance: Reading a scientific paper & background. The importance of record keeping: using your eLN Intro: Computational Analysis of Substrate Analogs and Potential Inhibitors Designing screening assays	Relevance Scientific Background
W2 Thursday February 10 <sup>th</sup>	Beer's Law PreLab	L2: Micropipetting, Beer's Law: NADH Computational Analysis of Substrate Analogs and Potential Inhibitors Designing screening assays	Background & Hypothesis Development
W3 Thursday February 17 <sup>th</sup>	Qualitative Analysis PreLab	L3: UV/Vis spectroscopy of Bradford Dye, standard curve and quantitation of the Plasmodium falciparum and Human Malate Dehydrogenases Computational Analysis of Substrate Analogs and Potential Inhibitors	Hypothesis Development

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		Designing screening assays	
W4 Thursday February 24 <sup>th</sup>		L4: Measuring Rates of Reactions: Rate Laws & Enzyme Assay Hypothesis Development Quiz 1	Proposal
W5 Thursday March 3 <sup>rd</sup>	Initial Rate Kinetics PreLab	L5: Characterizing wild type kinetics	Experiments
Thursday March 10 <sup>th</sup> .	Spring Break	– No Lab	
W6 Thursday March 17 <sup>th</sup> .	Integrated Rate Law Assignment	L5: Characterizing wildtype kinetics	Experiments Data Analysis
W7 Thursday March 24 <sup>th</sup> .	Experimental Design PreLab	L6: Inhibition Kinetics: Experimental Development Lab (two weeks)	Experiments
W8 Thursday March 31 <sup>st</sup> .		L6: Inhibition Kinetics Experimental Development Lab (two weeks) Quiz 2	Experiments Data Analysis Presentation
W9 Thursday April 7 <sup>th</sup> .	Titration Curve PreLab	L7 – pH Titrations of weak acid inhibitors	Experiments Data Analysis
Thursday April 14 <sup>th</sup>	Easter Break:	No Lab.	
W10 Thursday April 21 <sup>st</sup> .	Equilibrium PreLab	L8 –pH Dependence of Equilibrium Constant and Le Chatelier’s principle Assignment	Experiments Data Analysis Presentation
W11 Thursday April 28 <sup>th</sup>		L9 – Data Analysis Prepare for Poster Presentations: Displaying Data	Data Analysis Conclusions
W12 Thursday May 5 <sup>th</sup>	Experimental Design PreLab	L10 – Repeat Key Experiment Prepare for Poster Presentations Quiz 3	Data Analysis Conclusions Future Plans
W13 Thursday May 12 <sup>th</sup>		L11 – Final project presentations and discussion	Presentation

**Points Distribution**

<i>Week</i>	<i>Prelab (PL)</i>	<i>Lab Notebook (LN)</i>	<i>Assignment (AS)</i>	<i>Quizzes 60 pts</i>
<i>Total points = 320</i>	<i>60 pts</i>	<i>90 pts</i>	<i>110 pts</i>	
<i>1: L0</i>				
<i>2: L1</i>	<i>10 pts</i>	<i>10 pts</i>	<i>5 pts Relevance</i>	
<i>3: L2</i>	<i>10 pts</i>	<i>10 pts</i>	<i>10 pts</i>	

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			<i>Science Background</i>	
<i>4: L3</i>		<i>10 pts</i>	<i>10 pts Hypothesis</i>	<i>20 pts (Project Background)</i>
<i>5:L4</i>			<i>15 pts Proposal</i>	
<i>6-7: L5</i>	<i>10 pts</i>	<i>15 pts</i>	<i>5 pts Experiments</i>	
<i>8-9: L6</i>	<i>10 pts</i>	<i>15 pts</i>	<i>5 pts Experiments</i>	<i>20 pts (Experimental Techniques)</i>
<i>10: L7</i>	<i>10 pts</i>	<i>10 pts</i>	<i>5 pts Experiments</i>	
<i>11: L8</i>	<i>10 pts</i>	<i>10 pts</i>	<i>5 pts Experiments</i>	
<i>12: L9</i>			<i>15 pts Data Analysis etc</i>	
<i>13: L10</i>		<i>10 pts</i>		<i>20 pts (Data Analysis)</i>
<i>14: L11</i>			<i>35pts Presentation</i>	

**Grade Details Overview**

Course grades will be assigned based on this scale, and plus and minus grades will be assigned within each category.

A = 90 – 100%

B = 78 – 89%

C = 65 – 77%

D = 52 – 64%

This course contains a total of 320 possible points. The point breakdown in the course is:

Category	Points (out of 320)	Percentage of the grade
8 Prelab	60	~19%
9 Experiments & Lab Notebook	90	~28%
5 Assignments	110	~34%
5 Quizzes	60	~19%

**Notes**

- ❖ Please note that it is a violation of the Academic Integrity Policy to possess and otherwise use course materials (i.e. lab reports, problem sets, exams) from previous semesters of Chem 152L. <https://www.sandiego.edu/conduct/documents/HonorCode.pdf>
- ❖ Arrive to class on time – no make-up quizzes.
- ❖ A maximum of 50% credit will be given to any pre-lab assignment or notebook work submitted after the deadline, but before the class' graded work is distributed. After that, the late work cannot be accepted.
- ❖ No assignments, including "remote lab" make-ups will be accepted seven days past the due date.

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### Safety Training

All students must review the safety rules from Chem 151L prior to beginning work in the lab. The safety rules will be posted on Blackboard and the ELN. The knowledge will be demonstrated by passing a Safety Quiz on Blackboard.

### Safety Policy

Your safety and that of your classmates is of paramount importance during laboratory. Safety regulations must always be observed as it only takes one accident to cause a serious permanent injury. Be sure to thoroughly review the department's safety regulations.

The #1 safety concern in any lab is eye protection. For this reason, **safety spectacles must be worn at all times in the laboratory when anyone is doing lab work.** If you need to remove your spectacles during an experiment you will need to stop your lab work, notify your instructor, and excuse yourself from the room before removing the spectacles. Most lab-related eye injuries result from a spill that was generated **not** by the injured person, but by someone else in the nearby vicinity, so it is imperative that you keep your eyes covered when in the lab. Bring spectacles with you to the first lab experiment and store them in your locker for the semester. You will be asked to leave the lab and will receive a grade of zero for the experiment if you repeatedly violate the eye-protection policy.

Another important safety concern is proper laboratory attire. You will need to wear a lab coat and closed-toed shoes during each experiment, and be sure to secure long hair back.

**No food or drink are allowed in lab or in the hall outside of lab at any time.**

### **Lab Notebook Policy**

Since the lab notebook is an integral part of the experiment, you should be focused on maintaining a clear and concise notebook. While discussion and exchange of ideas is encouraged, your lab write-up must be done in your own words. All experimental procedures must be written into the lab notebook prior to actually performing the experiments. We will discuss upcoming experiments in our "Lab Meeting" at the end of each lab to help you with the next week's lab preparation. *Note: you will not have time during the experiment to write out your procedure – all procedure information MUST be in your notebook prior to the start of class.*

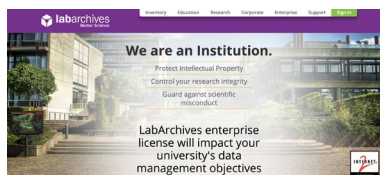
***For my section, I use a template (that you download from Blackboard for each experiment) to assist you in preparing for lab, this is due by Noon the day before lab for parts 1 & 2 of the template, and by Tuesday of the following week for the remainder of the template.***

This template also allows you to organize any changes to the procedure that occur in the actual lab and is used to document your data and data analysis and appropriate conclusions. There are two additional sections in the template that let you document your thinking about what might come next in the project and any published literature you might find. **The template once completed can be saved and uploaded to your eLN.**

For a number of the experiments that we will perform during the semester there is a pre-lab that will help you put the context of your experiments in this course in the broader context of chemistry- we will discuss these, the week before they are due, in class.

Please see the [Laboratory Notebook Orientation](#) in the Electronic Lab Notebook (ELN) for detailed guidelines on keeping a laboratory notebook. The expectations and guidelines will be discussed on the first day of lab.

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Background & Instructions for these prelab assignments will be in the ELN folder for assignments that contain a prelab.

152L Spring 2021 Master Notebook

- Course Information: Getting Started
- Course Material
  - W1: Orientation
  - W2: Heat
    - Introduction
    - Pre-Lab Assignment
    - Experiment
    - New...
  - W3: Copper Cycle
  - W4: Beer's Law
  - W5-W6: Solutions & Titration
  - W7: Qualitative Analysis
  - W8-W9: Kinetics
  - W10: Acid-Base Review
  - W11: Applications of Equilibria
  - W12: Titration Curve
  - W13: Simulation of a Titration Curve
  - New...
- Reference: Lab Techniques and Tutorials

### CHECKLIST OF THINGS TO DO TO PREPARE FOR THIS EXPERIMENT

Julia Schafer - Jan 11, 2021, 4:18 PM PST

Be sure you understand pertinent concepts from Chem 151L/151:

Concept/task	Skill Builder/other to Review
	<b>*Skill Builders have been included in the ELN under Reference if you need to review.</b>
Significant figures	SB - Sig Figs
Download and Install Vernier Graphical Analysis App	<a href="https://www.vernier.com/product/graphical-analysis-4/">https://www.vernier.com/product/graphical-analysis-4/</a>

- Read over the entire experiment so you will understand what we'll be doing in lab.
- Write out the procedure for the experiment in your lab notebook prior to coming to lab.
- Submit the prelab assignment by the due date assigned by your instructor.

# Student Safety Information

## General Chemistry Labs

### EMERGENCY INFORMATION

1. In case of injury, fire or other emergency, notify your lab instructor and call USD Public Safety at extension 2222.
2. Public Safety will take any injured person for medical help.
3. If the alarm sounds, walk calmly to evacuate the facility. Use the designated evacuation route. The assembly area for the Science Center is in front of La Paloma. Do not stand in the street.
4. There are fire extinguishers in each lab and in the corridors. Use the fire extinguisher only if the fire is small, and does not put anyone in danger. Always be aware of the location of the exits. There are fire alarm pulls at the ends of each floor. If the fire is larger than a small trash can, pull the alarm, and evacuate the building immediately. To use the fire extinguisher, PASS: Pull the pin, Aim at the base of the fire, Squeeze the handle, Sweep back and forth.
5. If there is a spill of any hazardous chemical notify your instructor immediately. If the spill is large or presents an imminent danger, leave the room and call Public Safety at x2222.
6. In the event of an earthquake, take shelter under a sturdy table. Keep away from falling hazards such as bookcases, file cabinets, and overhead fixtures. Once the shaking has stopped, calmly leave the building and go to the evacuation area.
7. Do not use the elevators when evacuating the building.
8. If you encounter disabled individuals who need assistance during an evacuation, ask them to wait in the landing of a stairwell, and inform Public Safety or other trained emergency personnel of their location.

### LABORATORY SAFETY

#### *LAB ATTIRE:*

1. Closed toe, protective shoes are required in all USD science labs. No sandals, flip flops, high heels etc. are allowed in the labs.
2. Tie back long hair. Remove neckties, scarves and dangly necklaces.
3. Safety glasses and lab coats must be worn at all times when working in chemistry labs. Gloves are also required if the work involves hazardous chemical such as acids, bases, organic solvents, or liquid nitrogen.
4. When using a flammable chemical, wear a flame retardant lab coat, and make sure no open flames or sparks are nearby.
5. Safety glasses and lab coats must be worn when working with vacuum flasks or other apparatus that could shatter or explode.

#### *CONDUCT IN THE LAB:*

6. Do not eat or drink or chew gum in any laboratory.
7. No smoking or smokeless tobacco is allowed in the building.
8. Do not smell, taste or touch any chemical.
9. Do not work in the laboratory alone.
10. Know the location of the eyewash and safety shower.
11. Each lab has a set of MSDS's and a binder containing a glove compatibility chart, a chemical incompatibility list, and SOP's for hazard classes.
12. Volatile chemicals must be used in a proper functioning fume hood. If a fume hood alarm is sounding, do not use it. Contact your instructor or lab manager.
13. Do not pipet any liquid by mouth.



## Student Safety Information

# General Chemistry Labs

14. Do not leave hotplates or Bunsen burners unattended while heating something. Use low or medium heat, if possible. Never heat a flammable substance over a Bunsen burner. Closely monitor any flammable substance that is on a hotplate. Use only heat-tolerant glassware & porcelain on hotplates or with Bunsen burners. Be sure that the container being heated is uncapped so pressure does not build up.
15. Wash your hands after working in the lab.
16. Be aware of the chemical hazards for each particular chemical that you need to use. Double check the labels to make sure you have the correct container.
17. Maintain a serious attitude. Horseplay or other careless acts are prohibited.
18. Unauthorized experiments are absolutely forbidden.

### *IN CASE OF PERSONAL INJURY OR EXPOSURE:*

19. If you have skin or eye contact with a chemical, flush the area for 15 minutes. If the chemical is in the eye, use your thumb and index finger to hold open the eye while using the eyewash station. Notify Public Safety for any injury.
20. If a chemical spill contaminates your clothing, remove the contaminated fabric and gently wash the skin at the nearest sink. If the spill was large you will need to use the safety shower.
21. If clothing catches fire: "Stop, Drop & Roll".
22. Notify the instructor or teaching assistant regarding any mishap or spill that takes place in the lab, even if it seems minor.
23. If a spill of any hazardous chemical occurs, notify your instructor or lab manager immediately. Do not attempt to clean up a large spill on your own, ask for assistance.

### *CHEMICAL STORAGE AND DISPOSAL:*

24. All chemical containers must be properly labelled with the contents. This includes labels on beakers, flasks and other temporary storage. No abbreviations are allowed.
25. Remove spilled chemicals off of balances using the brushes provided. Put the excess chemical into the appropriate waste container.
26. Store chemicals in proper storage areas. Flammable chemicals must be stored in a flammable storage cabinet. Acids and bases must be stored in corrosive cabinets. Follow the instructor's directions regarding chemical storage.
27. Never put any hazardous chemical, solid or liquid, down the drain.
28. Follow the instructions given by the teacher for proper disposal of hazardous waste. Make sure to put hazardous waste into the appropriate waste bottle, located in hood A.
29. Do not put needles into regular trash. Needles must go into a special sharps disposal container.
30. Broken glass must go into a designated broken glass waste box. Do not put broken glass into the regular trash.

### *MEDICAL CONDITION:*

31. If you have a medical condition that may be affected by the activities in this lab, it is your responsibility to notify the instructor. Examples include pregnancy, seizures, asthma, and severe allergies. A physician release may be requested.

Updated January 2013