Chemistry 163 – Honors General Chemistry

Course Number: 01:160:163

Semester: Fall 2021

Class Location and Time: AB 4225 (College Avenue) M/Th 11:00 AM - 12:20 PM, W 11:00 AM - 11:55 AM

Course Portal: Canvas https://tlt.rutgers.edu/canvas

Instructors: Prof. Marc N. Muñiz (marc.muniz@rutgers.edu), and Prof. Kiranjot Sethi (kjsethi@chem.rutgers.edu)

Textbook (required): "Chemistry: Structure and Properties", 2nd Edition, by Nivaldo Tro.

ISBN-13: 978-0-13-429393-6

Instructor & Facilitators' Office Hours:

Prof. Marc Muñiz (marc.muniz@rutgers.edu): via Zoom on M 1:00 – 2:00 PM and F 9:00 – 10:00 AM

Prof. Kiranjot Sethi (kjsethi@chem.rutgers.edu): TBA

Teaching Interns (TIs) will conduct weekly, virtual, STRUCTURED review and problem-solving sessions. Days and times TBA.

COVID-19 Information:

To protect the health and well-being of all members of the University community, masks must be worn by all persons on campus when in the presence of others (within six feet) and in buildings in non-private enclosed settings (e.g., common workspaces, workstations, meeting rooms, classrooms, etc.). **Masks must be worn PROPERLY during class meetings; any student not wearing a mask will be asked to leave.**

Masks should conform to CDC guidelines and should **COMPLETELY COVER the nose and mouth**:

https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/about-face-coverings.html

Each day before you arrive on campus or leave your residence hall, you must complete the brief survey on the My Campus Pass symptom checker self-screening app.

Additional Notes: This class involves a high degree of collaborative interaction. Therefore, it is IMPERATIVE that students strictly adhere to any and all COVID-19 guidelines both within and outside the classroom environment. Failure to adhere to the guidelines puts students, faculty, and their families at increased risk of illness and also jeopardizes our ability to continue with in-person learning.

In the event of illness or need to quarantine, students should immediately inform the instructors of the course (Prof. Muñiz and Prof. Sethi). Students will have access to recorded lectures and course materials online. In the event a student is ill or under quarantine during a quiz or an exam, an alternative quiz or exam will be administered electronically. Further accommodations will be made on a case-by-case basis if the student is too ill to take the assessment within the allotted timeframe.

Components of the syllabus marked with * indicate that exceptions will be made in accordance with the Rutgers Religious holiday policy: https://scheduling.rutgers.edu/scheduling/religious-holiday-policy

Description

This course will focus on the fundamentals of chemistry from a scientific research perspective. The course is intended to educate students going on to take higher-level chemistry courses such as organic or physical chemistry, or to major in chemistry or a related field in science, engineering, pharmacy or medicine. One goal of the course is for students to develop a deep understanding of chemistry concepts in order to apply them to practical problems. Another principal aim of the course is to develop students' capacities for scientific argumentation. Further, it is anticipated that students in this course will be able to transfer their chemistry knowledge and skills to completely new areas outside the scope of the course.

Pre- and Co-Requisites

Pre-requisite: One year of high school chemistry.

Co-requisite: 01:640:151 or permission from instructor.

Learning Goals

Core SAS Curriculum Learning Goals Met by this Course

- Understand and apply basic principles and concepts in the physical or biological sciences.
- Explain and be able to assess the relationship among assumptions, method, evidence, arguments, and theory in scientific analysis.

Department Learning Goals Met by this Course

By the end of this course, students will be able to draw upon:

- *relevant scientific models*
- *representations at the macroscopic, submicroscopic (small particle), and symbolic levels—including mathematical formulae*
- *qualitative and quantitative reasoning skills*

…to demonstrate their understanding (at honors level) that:

1. "**Atoms:** Matter consists of atoms that have internal structures that dictate their chemical and physical behavior."
2. "**Bonding**: Atoms interact via electrostatic forces to form chemical bonds."
3. "**Structure and Function:** Chemical compounds have geometric structures that influence their chemical and physical behaviors."
4. "**Intermolecular Interactions:** Intermolecular forces—electrostatic forces between molecules—dictate the physical behavior of matter."
5. "**Chemical Reactions:** Matter changes, forming products that have new chemical and physical properties."
6. "**Thermodynamics**: Energy is the key currency of chemical reactions in molecular-scale systems as well as macroscopic systems."
7. "**Measurement and Data**: Chemistry is generally advanced via experimental observations."
8. "**Visualization**: Chemistry constructs meaning interchangeably at the particulate and macroscopic levels."

General Format

Interactive Lectures

The class periods on Monday (AB 4225 11:00 AM – 12:20 PM) will be in an interactive lecture style. This style involves occasional think-pair-share "clicker" questions in which students are expected to reflect on the question (think) and provide an initial response individually, discuss with their fellow group members (pair), and then provide a new response to the question. At this point, the Prof. Muñiz will explain the correct answer (as well as why the distractors are incorrect) and move on to the next segment of the lecture.

Recitations

The class periods on Wednesdays (AB 4225 11:00 AM – 11:55 AM) will be recitations: sessions that emphasize the development of problem-solving skills related to course content that has been recently discussed in lecture. Prof. Sethi will facilitate recitations and will administer brief quizzes during every recitation period.

Active Learning Sessions

The class periods on Thursdays (AB 4225 11:00 AM – 12:20 PM) will consist of time dedicated to active learning activities (see below). These active learning activities are carefully designed to 1). Allow students time to **collaboratively** build their understanding of core chemical principles and problem-solving strategies, and 2). Allow students to refine their skills in scientific argumentation. The activities are facilitated by Prof. Muñiz, Prof. Sethi, and undergraduate teaching interns (TIs): students who have achieved success in Chem 163 in the past and, thus, serve as near-peer instructors. Each activity consists of a brief post-activity assignment that will be scanned and uploaded to Canvas by 11:59 PM on Thursday.

On most weeks, mastery-based e-Learning homework will be assigned online and due on Sunday evenings at 11:59 PM. In addition, there will be two brief video-based assignments each week. These assignments are described in more detail in the "Grades and Grading" segment of this Syllabus. There are three midterm exams, and final exam, <u>each of which is cumulative</u>. Additionally, there is a peer-reviewed capstone project presentation due toward the end of the semester.

Announcements and Reminders

Course-related announcements will be made frequently on Canvas. These announcements will include reminders about upcoming due dates for various assignments. It is each student's responsibility to check announcements every day and take advantage of the reminders to promptly meet deadlines. The reminders are provided as a courtesy, since there are many due dates in the course.

Grades and Grading

Mastery Based Grading (Adapted from Prof. Michael Weingart)

In lieu of a traditional points-based system, we have adapted a mastery-based grading scheme. The purpose of this grading scheme is to 1). Ensure transparency in grading criteria, 2). Signal to students the most important topics and concepts to master in the course, and 3). Promote fairness in grading. There are no grade curves in the course, therefore students are <u>not</u> in competition with each other for grades. Instead, each assessable item is scored on the following mastery-based scale:

Ungradable	**Needs Improvement**	**Progressing**	**Mastered**
The answer or product is completely incorrect and/or missing and/or there isn't enough written to accurately assess.	The answer or product is started in a reasonable way, but contains serious conceptual inaccuracies, numerical errors, is unclear and/or incomplete.	The answer or product demonstrates a moderately high level of conceptual and quantitative understanding, but contains enough errors or omissions that the skill or concept isn't fully mastered.	The answer or product demonstrates full/comprehensive level of conceptual and quantitative understanding. A minor quantitative (e.g. simple computation error) that is non-conceptual is allowed.
0 points	1 – 2 points	3 - 4 points	5 points

Note that point-equivalents are for reference **within** each problem. Each problem will have 5 points worth of grading criteria. For example:

How many atoms are in a 23.0 g sample of Na? *Report your answer to three significant figures.*

2 points – convert grams Na into moles Na using the molar mass of Na.

3 points – convert moles into atoms of Na using Avogadro's number.

Note that a student can still achieve mastery even if the answer is not reported to the correct number of significant figures. This would be a simple computation error that is non-conceptual.

A separate document titled "Learning Objectives from Anchoring Concept Map (Chem 163) course learning objectives" lists all the learning objectives associated with the course. ***These learning objectives are grounded in the ACS General Chemistry Anchoring Concepts Content map***. This is a set of concepts and skills identified by a wide array of General Chemistry instructors to be important in a first-year undergraduate General Chemistry course sequence.

There are two tiers of learning objectives:

- **Critical Objectives**: These 65 objectives are absolutely necessary for success in subsequent chemistry courses. Therefore, a high level of mastery of these objectives is required to earn a passing grade in Chem 163.
- **Foundational Objectives**: These 90 objectives form the basis of a comprehensive general chemistry education.

Each assessment item (individual questions on homework, quizzes, exams, etc.) targets one or more learning objectives. Therefore, the level of mastery can be tracked for each student across assessments.

Single-point mastery is defined as:

> **Earning an "M" on all HW items that target the learning objective (Keep in mind that adaptive HW assignments can be re-taken to help establish mastery)**
>
> **OR**
>
> **Earning an "M" on a summative assessment item that targets the learning objective.**

Since it is not possible to assess every single learning objective in the course on both lower-stakes (e.g. HW) and higher-stakes (e.g. quizzes, exams) summative assessments, the concept of single-point mastery will be important as each student works toward mastering course content. Please note that single-point mastery will be most relevant in the context of Foundational Objectives, since ALL critical objectives will be assessed on both HW and quizzes/exams.

One overarching goal for students in this course is to achieve **sustained mastery**. That is, build their mastery of each skill and concept (which are nested within learning objectives) and **maintain** a high level of mastery. **For our purposes, the definition of sustained mastery is:**

1. **Earning an "M" on all HW items that target the learning objective (Keep in mind that adaptive HW assignments can be re-taken to help establish mastery),**

   AND

2. **Earning an "M" on at least two summative (quiz or midterm exam) assessment items that target the learning objective. Note: Earning an "M" on a final exam item that targets the learning objective replaces this requirement.**

As a result, grading will prioritize the sustained mastery of learning objectives across different tiers. **Below is the grading scheme for the course**:

- To earn a grade of **C** in the course, each learner must:
  - Demonstrate **complete sustained mastery** in **all Critical** learning objectives
- To earn a grade of **B** in the course, each learner must:
  - Achieve **all** of the criteria outlined above (i.e. all criteria to earn a "C" in the course)
  - Demonstrate **single-point mastery** in at least **half (45)** of the Foundational learning objectives
- To earn a grade of **A** in the course, each learner must:
  - Achieve **all** of the criteria outlined above
  - Demonstrate **single-point mastery** in **at least two thirds (60)** of the Foundational learning objectives

The capstone project (described in more detail below) will replace up to 10 Foundational learning objective mastery units. For example, if a student has achieved sustained mastery in all Critical learning objectives and in 50 foundational learning objectives, they would normally be on track to earn a B in the class. If, however, they earn full credit for their capstone project, they would earn 10 Core learning objective mastery units – thus bumping their total Foundational objective mastery to 60. They would earn an "A" in the class.

Plus (+) grading is possible within the C and B range (i.e. C+ is a possible grade and B+ is a possible grade). Students must meet the criteria for the base "C" or "B" AND have successfully completed every video assignment AND have zero (0) unexcused absences from class.

It is important to note that the above grading criteria are **fixed** and **non-negotiable**. Since the grading structure is organized around discrete units (mastery of learning objectives), there is no "rounding" possible. There is also no extra credit in the course.

Uploading Content to Canvas:

In many cases, you will be required during and/or outside of class sessions to upload completed activities in PDF format to Canvas. If you printed out the materials: The most convenient way of scanning the file(s) will be to use the free Genius Scan App (or similar app) that allows conversion of images taken the camera on your mobile device (phone, tablet, laptop) to PDF, that then can be uploaded to Canvas.

Class Components:

- **Active Learning Activities:** A series of active learning activities will be administered each Thursday and will be facilitated by course instructors and teaching interns (TIs). This learning environment is structured to provide a co-operative incentive among group members to increase their mastery of the topics being covered in class. The pedagogical structure will focus on building scientific argumentation: an essential skill in which claims are supported or refuted by evidence. There will be a post-activity assignment due to Canvas by 11:59 PM on every Thursday for which there is an active learning activity. No un-excused absences are allowed.*
- **e-Learning Adaptive Homework:** Adaptive, Mastery-based homework will be assigned weekly online (on the eLearning webpage) and is due on Sundays at 11:59 PM. The e-Learning HW platform uses dynamic problems to assess specific learning objectives in the course. *Uploading activities to Canvas speed grader*.
- **Capstone Project:** Each student will develop a capstone project/presentation as part of a collaborative team. Students will begin work on the capstone projects during the semester, choosing topics (from a set list to be released by the beginning of October), developing outlines and collecting information, data and references. There are three phases associated with the Capstone project: In phase I, students choose from an array of capstone project ideas. In phase II, students develop story boards and make draft presentations that are posted online and peer-reviewed. In phase III, students revise their presentations based on the peer reviews, and create full project productions. These final productions are posted online and discussed collectively by the class in a formal webinar (virtual network symposium).
- **Weekly Quizzes:** There will be a total of twelve (12) brief (~10 min.) quizzes administered in-person (in class), starting on Wednesday September 15th. These quizzes will generally consist of three questions, and will be cumulative in nature. There are no make-up quizzes for unexcused absences.*
- **Video Assignments**: On most weeks, there will be two (2) video assignments: one due 11:59 PM on Monday and one due at 11:59 PM on Wednesday. These assignments will be short (~30 min.) and require students to watch a brief problem-solving related video or mini-lecture and answer questions associated with the content via PlayPosit (embedded within Canvas). The aim of the assignments is to ensure students are keeping up with course content as well as revisiting prior course content (i.e. *interleaving*). Successful completion of ALL Video assignments is one of the requirements necessary to receive "+" grading.
- **Midterm Exams:** There will be three 3, synchronous (held during class time) written midterm exams given in class during the semester, each lasting 75 minutes. All Midterms will take place in-class unless otherwise specified. These three midterm exams will cover the entire range of material taught over the semester, and in that sense, together, are cumulative. The exams will consist of a combination of multiple choice and free-response questions that are carefully linked to course learning objectives. The exam dates and times can be found on the course planning calendar. Students are responsible for making it to exams prepared and on time - there are no make-up exams.*
- **Final Exam:** There will be a 3-hour, in-person cumulative final exam. The final exam will be split into two portions: a multiple choice standardized American Chemical Society (ACS) exam, and a separate open-ended section. The exam date and time can be

found on the course schedule. Students are responsible for attending the exam session prepared and on time - there is no make-up final exam.*

Other Grade-related Matters

Make up exams or quizzes. There are no make up exams or quizzes. Instead, student performance on pertinent course learning objectives on the Final exam will be used in lieu of the missed content on the exams or quizzes.

Final Exam. The final exam is scheduled on **Monday, December 20th from 12 PM (noon) to 3 PM** – MARK YOUR CALENDARS! This is an immovable date and you must be available to take the final – travel, weddings or family events are not valid excuses and make-ups cannot be given, so potential conflicts need to be scheduled around the final exam.*

Grade Inquiries. If a student has questions or concerns about a graded assignment or assessment, they can bring this to the instructor within 1 week of receiving the grade. This encourages students to promptly review their graded assignments and assessments and understand their mistakes. However, request for re-grading *will not be allowed after a week.*

Absences. Attendance is mandatory. If a student is absent for a class or one of the midterm exams, the student must fill out a self-reported absence form *within 48 hours of the beginning of the missed class session*, available at http://sims.rutgers.edu/ssra (Links to an external site.). These will be reviewed and deemed either "excused" or "un-excused" in accord with Rutgers policies (https://sasundergrad.rutgers.edu/degree-requirements/policies/attendance-and-cancellation-of-classes (Links to an external site.)). Submission of a self-reported absence form within this time is required in order to possibly be considered an "excused" absence, but does not guarantee the absence will be considered excused. In some cases, but not all, missed graded work may be made up in accord with the course and university policies where such policies exist. Under **unusual or extenuating circumstances** the instructors might make special arrangements on a case by case basis.

Teamwork Incentives. There is strong evidence that cooperative and team-based learning are effective ways to improve student learning outcomes in chemistry. This class is all about collectively raising the bar, and helping one another achieve success. To this end, students will be assigned to teams, typically consisting of 3 members, to work on active learning scientific argumentation activities in Thursday course sessions. Teams will periodically change in order to have students working with a diverse group of peers and optimize positive group interdependence. Incentives may be introduced as the course progresses to encourage students to learn from one another and work effectively in teams. Remember – part of the skill set of becoming a STEM professional is developing the ability to work in an interdisciplinary team to solve high-impact problems. This requires communication and thoughtful discourse to analyze, evaluate and create ideas.

Adaptive eLearning Homework

Part of your grade will be determined by completion of online homework that will be assigned on a weekly basis. To access the homework assignments:

1. Go to: https://my.elearning.rutgers.edu/#/account/login (Links to an external site.)
2. Login with your NetID and password

Online assignments will be released every Monday by 8 AM and due every Sunday evening by 11:59 PM

Homework needs to be turned in online before the scheduled deadline - late assignments will not be permitted and not receive a grade.*

*If you have any questions or technical issues **for the e-Learning homework system**, you may contact technical support at*: **https://techsupport.elearning.rutgers.edu/open.php**

Active Learning (AL).

In this class you will engage in active, collaborative learning in chemistry. You will become part of a peer working group – your learning team – that will work together on these activities. All team members are responsible for participating in all activities related to active learning - including discussions and solutions to all questions and problems. Each team member is required to complete and submit their own post-activity worksheets to Canvas by 11:59 PM on Thursdays.

File Upload Format: Activities will require electronic submission. You may complete the activities by downloading the PDF of the activity and using an electronic writing tool to record your responses **or** by printing the activities and using a pen or pencil. In the latter case, use your phone/tablet/electronic device and upload it to this Canvas site. It is recommended that you download both the free Genius Scan app and Canvas-student app in order to easily submit your post-activities from your smart phone or tablet. Completed post-activities are always due by 11:59 PM on Thursdays, unless otherwise indicated.

Attendance Policy: Attendance in all course sessions (lectures and active learning) is mandatory as each student is an integral part of a learning team. See policy on *Absences*.*

What will you need for class?

- A **properly-worn** mask (in accordance with public health guidelines)
- Pen/pencil and a notebook
- Calculator
- Textbook "*Chemistry: Structure and Properties*" by Nivaldo Tro (2nd edition)
- Laptop, tablet or other mobile device

Resources

In addition to the textbook, lecture slides, active learning material, there are also other useful resources provided to you to maximize your chance of success in this subject.

- **Technical support for Canvas:** https://canvas.rutgers.edu/canvas-help/
- **LibreTexts**- an open access / free online textbook: https://chem.libretexts.org/Courses/Rutgers_University/Chemistry_163%3A_Honors_General_Chemistry (Links to an external site.)
- **Discussion boards**: In addition to office hours the instructor and facilitators hold, you should ask questions on the discussion boards. These discussion boards will be moderated by instructors and/or TIs and should serve as a useful resource.
- We provide a formula sheet that will be used for all exams for Chem 163, and we recommend that you use this formula sheet for all your homework, quizzes, and activities throughout the semester.

Academic Integrity

Students must adhere to the university policies on academic integrity and student conduct in all assignments, assessments and other matters regarding this course. These policies can be found online: http://studentconduct.rutgers.edu/academic-integrity/