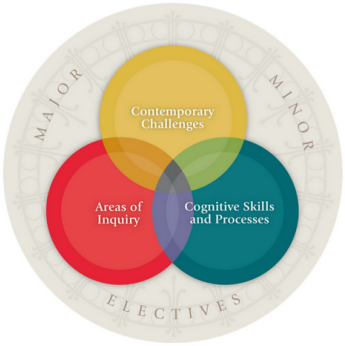
GENERAL CHEMISTRY II SUMMER 2022

Course Number: 01:160:162
Section: HA-HF
Course Portal: Canvas: https://canvas.rutgers.edu/
This course covers the second semester of the general chemistry curriculum. A goal of the course is to develop a deep understanding of underpinning chemistry concepts in order to apply them to practical problems.

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.

MATERIALS REQUIRED

- **Textbook: "Chemistry: Structure and Properties",** 2nd Edition, by Nivaldo Tro. ISBN-13: 978-0-13-429393-6
- Scientific calculator (logarithms, exponential, powers, roots, etc.)

COURSE COORDINATOR AND LECTURER

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INSTRUCTORS

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CLASSROOM MANAGEMENT

We will be using Canvas (https://canvas.rutgers.edu) as a classroom management. You should check this site regularly. If you check it now, you will find a number of documents posted. If you are registered and a Rutgers Student, you will automatically be a "member" of the online class. You will need your NetID to login. During the course many additional documents will be posted on the web site including lecture notes, practice exams, and useful information or explanations about important topics.
We will routinely use Canvas to post announcements. You must adjust Canvas settings to make sure that these announcements will automatically be sent to you by Rutgers email. Click on **account** tab (upper left) then click on **notifications**. Look at the "announcement" line in the Course Activity chart and in the "email address" click on the left side to be sure there's a green checkmark. This green checkmark on the left side means that all announcements will be immediately sent to you by Rutgers email.

COURSE SCHEDULE

The "General Course Information" module on Canvas contains the course schedule, listing the planned topics covered in each lecture, along with the corresponding section of the textbook and the suggested textbook problems associated with those topics.

LECTURES

There are five 90-minute lectures per week. The course schedule lists the topics to be covered during each lecture. We highly recommend that you do the relevant reading in the text before lecture; this practice will greatly enhance your ability to absorb the concepts introduced and follow the problems being solved. You are responsible for all material discussed in lecture whether or not it is also covered in the book. You are also responsible for announcements made in lecture. If you must miss class due to illness or personal emergency, please contact a fellow student for handouts, notes, and assignments.

HOMEWORK

Please keep up with the material by studying the text, the lecture notes and by doing the homework problems listed in the course schedule. When doing problems, use the study guide only as a last resort. If you had to

use the study guide to solve a problem, go back to that problem in a couple of days and try to solve it on your own. Use the recitation section to enhance your level of understanding. There will be homework review problems posted on the course website that you are highly encouraged to work on. The answers for these problems will be discussed in recitation section. The homework is not collected.

ONLINE HOMEWORK

Online graded homework will be assigned through Canvas every week. You will have one attempt to complete the homework within 60 minutes once started. Homework will be released on Friday at 8:00 am and due every Sunday at 6:00 pm. Individual extensions and make-ups cannot be granted.

RECITATIONS

Recitation sessions are 55 minutes long and will be held in person. The schedule of the recitations sections is listed below:

Section	Day	Time	Location	Instructor	Email
HA	MWF	12:30 - 1:25 pm	BE 221	Robert Young	ryoung.2011@rutgers.edu
HB	MWF	12:30 - 1:25 pm	BE 250	Robert Porcja	Porcja@chem.rutgers.edu
HC	MWF	12:30 - 1:25 pm	BE 121	Bryan Langowki	loki@chem.rutgers.edu
HD	MWF	12:30 - 1:25 pm	BE 111	Harpal Sangari	hsangari@chem.rutgers.edu
HE	MWF	3:15 - 4:10 pm	TIL 209	Robert Young	ryoung.2011@rutgers.edu
HF	MWF	3:15 - 4:10 pm	TIL 230	Robert Porcja	Porcja@chem.rutgers.edu

Recitations are designed for smaller groups in which students can ask questions, and more easily converse with the instructor than would be possible in a large lecture. Recitations are used to go over homework problems and explain material that is covered during the lectures. Be prepared, and do not hesitate, to ask questions in order to use recitation time effectively. Any material that is not clear in the textbook or the lectures should be discussed during recitations. Homework problems will be discussed in detail during recitation class. Recitation is an integral part of the course and must be attended.

REVIEWS

There will be five review sessions. These will be on Thursdays immediately after lecture. We will concentrate on working exam problems relevant to the material we covered that week. There will also be some time for questions and answers about the week's material, quizzes, homework problems, etc. These sessions are optional and no new material will be presented.

QUIZZES AND EXAMINATIONS

- QUIZZES

The schedule of the quizzes is listed below: Quizzes will be 20 minutes long and will be given at the end of recitation. Missed quizzes will count as zero.

Date	Quiz
18 July	Quiz 1
1st Aug	Quiz 2
15 Aug	Quiz 3

Periodically we will have **unannounced** lecture quizzes in lecture that will count toward your cumulative grade.

- EXAMINATIONS

There will be two 90 – minute examinations. Exam I is on Tuesday 7/26, and Exam II Tuesday 8/9. Each examination will be given during the lecture time (1:40–3:10 pm). Each 90-min examination will account for 100 points. A three-hour final exam covering the entire course material will be given on Wednesday 8/17 from 1:40 –4:40 pm. The final exam is worth 200 points. If you miss an exam on medical grounds, please provide a written explanation and supporting documents - a note from your doctor.

Date	Exam
26 July	Exam I
9 Aug	Exam II
17 Aug	Final Exam

GRADING AND LETTER GRADE

There are a total of 520 points which can be accumulated in this course, distributed as follows:

	Point	%
Homework	40	8
Lecture Quizzes	20	4
Quizzes	60	12
Exam 1	100	19
Exam 2	100	19
Final	200	38
Total	520	100

There are no grade curves in the class – grades are assigned based on the overall percentage score according to a final scale to be decided at the end of the course. An approximate idea of the grading scale would be:

A: > 90 %. B: 80-89 % C: 60-79 % D: 50-59 % F: < 50 %

Missing more than one exam for any reason (excused or unexcused), missing the final exam, a grade of < 35% on the final exam, or breach of academic integrity will result in an automatic F for a final grade.

DISABILITIES SERVICES

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability should contact the office of Disability Services at https://ods.rutgers.edu or tel: 848-445-6800.
Once you receive a Letter of Accommodations, please submit it to the course administrator as soon as possible.
Additional information can be found here: https://ods.rutgers.edu/students/receiving-accommodations-online

ACADEMIC INTEGRITY

Students are expected to 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/
Use of external sources to obtain solutions to homework assignments or exams is cheating and a violation of the University Academic Integrity policy.
Cheating in the course may result in penalties ranging from a zero on an assignment to an F for the course, or expulsion from the University. Posting of homework assignments, exams, recorded lectures, or other lecture materials to external sites without the permission of the instructor is a violation of copyright and constitutes a facilitation of dishonesty, which may result in the same penalties as explicit cheating.

INTELLECTUAL PROPERTY

Lectures and materials utilized in this course, including but not limited to videocasts, podcasts, visual presentations, assessments, and assignments, are protected by United States copyright laws as well as Rutgers University policy.
The instructors of this course possess sole copyright ownership. Students are permitted to take notes for personal use or to provide to a classmate also currently enrolled in this course. Under no other circumstances is distribution of recorded or written materials associated with this course permitted to any internet site or similar information-sharing platform without my express written consent. Doing so is a violation of the university's Academic Integrity Policy.

STUDY HINTS

General Chemistry is considered by many students to be a moderately difficult course. In order to be successful, you must be conscientious and devote considerable time to the course material. Your success will depend primarily on your being able to analyze logically the wording in the chemical problems assigned for homework and given on quizzes and exams. You must learn to relate the basic concepts to the mathematical expressions that describe them. For most students, the best way to learn the material is to work on the homework problems independently (with the solutions manual closed). Good analytical skills and problem-solving techniques must be acquired in order to pass the exams, which consist solely of word problems. Rote memorization of the book will not allow you to pass the course. Chemistry is a cumulative subject where one principle builds upon another. This course in general chemistry moves along at a fast pace—even more so over the summer—and you need to always stay on top of the material. Experience shows us that students who fall far behind encounter difficulties and rarely catch up again.
Don't worry about the exact values, formula, constants, etc. Worry about the concepts BEHIND the equations. Once you understand the equation itself, plugging in and solving the problem becomes almost trivial. Look for connections between concepts. The topics are all related one way or another.
Two rules will solve most chemistry problems: follow the units and estimate. Do a unitary or dimensional analysis. If the answer comes out to be in the correct units, then 99 times out of 100, your answer will be correct. You should know the approximate magnitude of your answer (or even a more accurate estimate). If your calculated answer isn't close to your estimated one, then you've plugged in wrong. For example, if we

asked the number of grains of sand on a one acre stretch of beach and you end up with a small number, recheck your calculations. The number should be very, very large.
Make lists of questions. When you attempt the homework, divide the problems into three categories: problems you can solve with no or little difficulty, problems that you needed a little hint from the solutions manual or study guide, and problems that you don't even know where to start. The last category of problems should be the first ones you ask about in recitation.
Don't have the solution's manual open and near you when you try the homework. Refer to it after you have attempted all the problems. If you didn't understand the problem at all, don't even look it up. Ask lots of questions. If you are confused, then so are your classmates. If you don't ask, we can't help.
Don't stay up late the night before a test. Research shows that being well-rested for a test improves you score much more than last-minute studying. If you don't know the material by the night before the test, you aren't going to learn it overnight. Studying in the last hour before a test lowers many students' scores for subjects that don't depend on rote memorization like the sciences. They get nervous. Relax. Don't over-think the questions. Read them carefully.

ADDITIONAL HELP

If, despite attending all lectures and recitation classes and working out all homework problems, you realize that some difficulties remain with understanding the course material, then seek help early! Office hours are posted. We will be glad to assist you as long as you take the initiative.

CHAIN OF COMMAND

In general, routine questions regarding course material, homework problems, quizzes, exam scores, absences, etc. should be directed first to your recitation instructor. Only for further information, or if the above procedure fails to resolve a particular problem, should you contact Dr. Rabeony, the course coordinator. The coordinator will not, for the most part, consider complaints in grading that are less than a few points. Questions regarding lecture material can be directed either to your recitation instructor (this is a very good use of recitation time) or directly to the lecturer, as time permits. Specific comments or requests are always valued.

CHEM 162 HA–HF Syllabus Summer 2022

All readings and assignments are in "*Chemistry: Structure and Properties*" by Nivaldo J. Tro,

Exact pace of topics and associated problems subject to change, as determined in lecture

Lec #	**Date**	**Reading**	**Topics**	**Recitations**	**Homework Problems** to be covered in recitation
1	7/11/M	13.1–5	Solutions: types, solubility, energetics, factors affecting solubility, expressing solution concentration	Math Sheet	**13:** 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 53, 55, 57, 59, 61, 63, 95
2	7/12/T	13.5–6	Colligative properties: vapor pressure lowering; freezing point depression, boiling point elevation, osmotic pressure		**13**: 67, 69, 71, 73, 75, 77, 79, 81, 101, 105, 109, 117
3	7/13/W	13.6–7	Colligative properties of strong electrolyte solutions	13.1–6	**13:** 83, 85, 87, 89, 91, 93, 109
4	7/14/Th	14.1–4	Kinetics intro, rates of reaction, instantaneous vs average rates, rate law: method of initial rates	Review	**14:** 27, 29, 33, 35, 39, 41, 43, 45
5	7/15/F	14.5– 6	Integrated rate laws, temperature dependence of rate, activation energy, collision theory	13.6–7 14.1–4	**14:** 47, 49, 51, 53, 55, 57, 59, 61, 63, 69, 85, 71, 89, 91, 109, 111
6	7/18/M	14.7–8	Reaction mechanisms, catalysis	14.5–6	**14:** 75, 76, 77, 78, 81, 82, 95, 96, 101
7	7/19/T	15.1–6	Equilibrium principles, nature of the equilibrium constant K, solving equilibrium expressions		**15:** 21, 23, 25, 27, 29, 33, 37, 39, 41, 43
8	7/20/W	15.7–9	Reaction quotient Q and K, equilibrium problems approximation methods, Le Châtelier's principle	14.7–8 15.1–6	**15:** 47, 49, 53, 55, 59, 61, 63, 65, 67, 69, 71, 73, 75, 81, 89, 93
9	7/21/Th	16.1–6	Definitions of acids and bases, acid strength related to molecular structure and K_a, strong vs weak acid	Review	**16:** 31, 33, 35, 37, 39, 41, 43, 49, 51, 53, 55, 57, 59
10	7/22/F	16.6–8	Autoionization of water, pH scales, K_a and K_b problems	15.7–9 16.1–6	**16:** 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95, 125, 133
11	7/25/M	16.9	Ions as acids and bases, pH of salt solutions	16.6–8	**16:** 97, 99, 101, 103, 105, 107, 109, 111, 143
	7/26/T		EXAM I (Lec 1–10: Chapter 13.1-16.8)		
	7/27/W	16.10–11	Polyprotic acids, Lewis acids and Lewis bases	16.9	**16:** 113, 115, 117, 119, 121,123
13	7/28/Th	17.1–3	Buffers	Review	**17:** 25, 27, 29, 31, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57
14	7/29//F	17.4	Titrations and pH curves, Indicators	16.10–11 17.1–3	**17:** 59, 61, 63, 65, 67, 69, 71, 73, 75, 79, 81, 119, 121
15	8/1//M	17.5–7	K_{sp} and solubility, common ion effect, Q test, selective precipitation, K_f and complex ions	17.4	**17**: 83, 85, 87, 89, 91, 93, 95, 97, 99, 101, 103, 105, 107, 109, 126, 127
16	8/2/T	18.1–6	Thermodynamics, spontaneity, entropy, the second law of thermodynamic, Gibbs free energy, Q and K		**18**: 27, 29, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61
17	8/3/W	18.6–9	Free energy and non-standard states, temperature dependence of K	17.5–7 18.1–6	**18**: 63, 65, 67, 69, 71, 73, 75, 89, 77, 81
18	8/4/Th	19.1–3	Balancing redox reactions, half-reactions, galvanic cells, standard electrode potential	Review	**19**: 33, 35, 37, 39, 41, 43, 45, 99, 121
19	8/5/F	19.3–5	Standard electrode potential, free energy and K	19.1–3	**19**: 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 115
20	8/8/M	19.6	Nernst equation, concentration cells	19.3–5	**19**: 69, 71, 73, 75, 77, 105
	8/9/T		EXAM II (Lec 11–19: Chapter 16.9–19.5)		
21	8/10/W	19.7–9	Batteries, electrolysis, corrosion	19.6	**19**: 85, 87, 89, 91, 93, 95, 97, 119
22	8/11/Th	20.1–6	Nature of the nucleus, types of radioactivity, valley of stability: predicting the type of radioactivity, kinetics of radioactive decay and dating	Review	**20**: 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 83, 91
23	8/12/F	20.7–12	Nuclear binding energy, fission and fusion, effects of radiation	19.7–9 20.1–6	**20**: 57, 59, 61, 63, 64, 65, 67, 69, 71, 73, 75, 85, 109
24	8/15/M		Catch-up and review	20.7–12	
25	8/16/T		Catch-up and review		
	8/17/W	FINAL EXAM (Lec 1–23: Chapter 13.1–20.12)			

Date	**Quiz**	**Material Covered**
18 July	Quiz 1	13.1–14.4
1st August	Quiz 2	16.9–17.3
15 Aug	Quiz 3	19.3–20.6

Date	**Exam**	**Material covered**
26 July	Exam I	13.1–16.8
9 Aug	Exam II	16.9–19.5
17 Aug	Final	13.1–20.12

Review sessions every Thursday after lecture (optional)