

CHEM 1225: General Chemistry II for STEM Majors

Fall 2021 – Section 501 – CRN 64774

Instructor: Dr. Jerry Godbout

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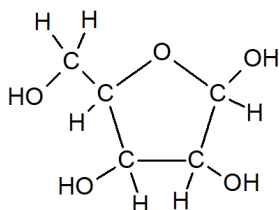
Phone: 505-925-8611

Student (office) Hours: Monday 10:30 am – 12:15 pm, Tuesday 10:30 am – 12:15 pm and other times by appointment (either in-person or remote)

Class Meeting Times: Lecture: Monday & Wednesday 9:00 – 10:15 am, VAAS 127

Course Description(s): The study of stuff, and what it does (2nd of a 2-course sequence)

This course is intended to serve as a continuation of general chemistry principles for students enrolled in science, engineering, and certain preprofessional programs. The course includes, but is not limited to a theoretical and quantitative coverage of solutions and their properties, kinetics, chemical equilibrium, acids and bases, entropy and free energy, electrochemistry, and nuclear chemistry. Additional topics may include (as time permits) organic, polymer, atmospheric, and biochemistry.



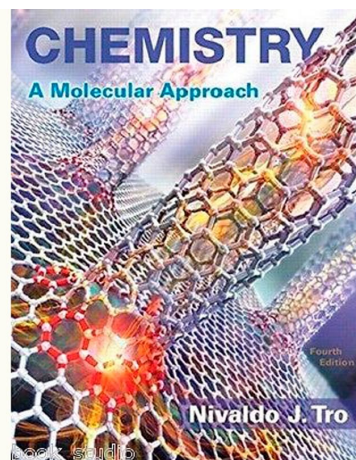
What is this molecule?
Tell me (email) for some extra credit!

(3) Continuation of CHEM 1215 (121). Lecture: 3 hours. Co-requisite: CHEM 1225L. Prerequisite: CHEM 1215 (121) and CHEM 1215L (123L) or CHEM 131 with a grade of C or higher; ACT =>25 or SAT =>590 or MATH 1220 (121) or MATH 1230 (123) or MATH 1240 (150) or MATH 1250 (153) or MATH 1430 (180) or MATH 1440 (181) or MATH 1512 (162) or MATH 1522 (163) or MATH 2530 (264). Meets UNMCC – Area 3: Physical and Natural Sciences; meets NMCC– Area III: Laboratory Science.

Guess which one is the instructor's, and guess which one has gone through various committees and perhaps a lawyer or two?

Periodic Table of the Elements

1 H Hydrogen 1.008																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.990	12 Mg Magnesium 24.305											13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.06	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 83.798
37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.906	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.905	46 Pd Palladium 106.367	47 Ag Silver 107.868	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.757	52 Te Tellurium 127.6	53 I Iodine 126.905	54 Xe Xenon 131.29
55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71 La-Lu Lanthanides	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.222	78 Pt Platinum 195.085	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [209]	85 At Astatine [210]	86 Rn Radon 222.018
87 Fr Francium 223.018	88 Ra Radium 226.025	89-103 Ac-Lr Actinides	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [263]	107 Bh Bohrium [264]	108 Hs Hassium [265]	109 Mt Meitnerium [266]	110 Ds Darmstadtium [267]	111 Rg Roentgenium [268]	112 Cn Copernicium [269]	113 Nh Nihonium [270]	114 Fl Flerovium [271]	115 Uu Ununpentium [272]	116 Lv Livermorium [273]	117 Ts Tennessine [274]	118 Og Oganesson [275]
89 La Lanthanum 138.905	90 Ce Cerium 140.12	91 Pr Praseodymium 140.908	92 Nd Neodymium 144.24	93 Pm Promethium [145]	94 Sm Samarium 150.36	95 Eu Europium 151.964	96 Gd Gadolinium 157.25	97 Tb Terbium 158.925	98 Dy Dysprosium 162.50	99 Ho Holmium 164.930	100 Er Erbium 167.259	101 Tm Thulium 168.934	102 Yb Ytterbium 173.054	103 Lu Lutetium 174.967			
104 Ac Actinium 227.033	105 Th Thorium 232.038	106 Pa Protactinium 231.036	107 U Uranium 238.029	108 Np Neptunium 237.048	109 Pu Plutonium 244.064	110 Am Americium [243]	111 Cm Curium [247]	112 Bk Berkelium [247]	113 Cf Californium [251]	114 Es Einsteinium [252]	115 Fm Fermium [257]	116 Md Mendelevium [258]	117 No Nobelium [259]	118 Lr Lawrencium [260]			



COURSE/INSTRUCTOR COMMUNICATIONS

- Please use the messaging feature in UNM Learn for course correspondence.
- When requesting an appointment (which I am always happy to schedule), please propose three (3) times that work for you in your initial request. This will simplify and quicken the process
- It is the responsibility of the student to keep up with course announcements. ***Check Blackboard Learn and your UNM email and daily!***

WHAT I'LL NEED (Required Resources)

- Chemistry: A Molecular Approach (3rd, 4th or 5th edition)
- Mastering Chemistry Access Code (link on UNM Learn, course ID is godbout90046)
- Calculator (non-graphing) with log/antilog and exponential functions
- Internet Access: *Blackboard Learn* and *UNM*

WHAT I'LL FIND USEFUL (Recommended Resources)

- 3-ring binder for lecture notes, handouts, group activities
- Periodic table (on paper)
- Mastering Chemistry notebook: keep track of problem solving, identify patterns, record areas of difficulty

WHAT IF I NEED HELP? (UNM-Valencia Resources)

- **Instructor:** Office hours, STEM Center Hours, email
- **STEM Center:** Tutors*, molecular modelling kits, Laptops, textbooks

* Reminder: when using tutors, it is the **students'** responsibility to make sure they understand well enough to complete the problems on **their own**.

HOW IS MY GRADE DETERMINED?

(Exams, Quizzes, Homework, and the Like)

	How Many	Weight
Class Points	1	10 %
Quizzes	15*	10 %
Homework	10*	15 %
Exams	4**	50 %
Final Exam	1	15 %
Total		100 %

* Approximate values

** Each equally weighted, 12.5 % each

WHAT DO I NEED FOR AN A?

(What's the grading scale?)

Earn This %	Get This Grade
98	A+
92	A
90	A-
88	B+
83	B
80	B-
78	C+
73	C
69	C-
67	D+
62	D
60	D-
55	F+
0	F

WHAT WILL MY ROUTINE BE LIKE?

- **Before Class:** complete any preparatory assignment (quiz, reading, video, etc.)
- **During Class:** work with your group to master concepts. The more you put in, the more you'll get out
- **After Class:** work on homework assignment relevant to that day's topic (review notes, **WORK ON PROBLEMS**, think of questions for office hour visits, **WORK ON PROBLEMS**, etc.)
- **Repeat 30 times!**

WHAT WILL EACH CLASS BE LIKE?

- **Quiz:** (before class) covering material recently covered and any assigned preparation (reading, video, etc.)
- **Course Business**
- **Group Activity:** collaborative activities to help master that day's topic
- **Reflection:** an opportunity to put the day's lesson into larger perspective, and formulate/ask questions

Other Things That Aren't Chemistry, But Are Still Important (Class Policies and Important Dates)

- **Be There** Attendance in lecture and lab/recitation is mandatory. Students are expected to attend all meetings of the classes in which they are enrolled.
 - A student with 4 total absences may be dropped from a course by the instructor with a grade of WP or WF or the student may receive a grade of F at the end of the semester.
 - I will exercise my discretion without notice to drop any student who:
 - misses the first two meetings;
 - has not completed any assignments in BB Learn and/or Mastering Chemistry by the end of the 2nd week;
 - after 2 consecutive unexcused absences; or after 4 total absences.
 - Excused absences must be authorized.
- **Be on time.** Lectures and labs/recitations will begin promptly. After 10 minutes, a student will be counted absent. Late arrival or early departure is unacceptable. Absences and late assignments due to illness or any mitigating circumstance are unavoidable but must be documented or approved in advance. If you must miss a lecture or lab, email me ASAP in order to get your absence excused and discuss when you will turn in or make up any allowable assignments. Students are responsible for all assignments regardless of attendance.
- **Your job begins when class ends:** Electronic homework will be assigned regularly. Your answers are to be submitted and scored on Mastering Chemistry. Late homework will not be accepted.

Selected Important Dates & Holidays¹

Fri, 03 Sep 2021	Last day to register, ADD sections, change grade mode, and change credit hours Enrollment cancellation for non-payment
Mon, 06 Sep 2021	University Holiday – Labor Day
Fri, 10 Sep 2021	Last Day to DROP without “W” grade and 100% tuition refund
Thu, 14 Oct 2021	University Holiday – Fall Break (through Fri, 15 Oct, 2021)
Fri, 12 Nov 2021	Last Day to DROP WITHOUT Dean's Permission
Thu, 25 Nov 2021	University Holiday – Thanksgiving (through Sun, 28 Nov 2021)
Fri, 10 Dec 2021	Last day to withdraw WITH Dean's Permission and change grading options
Wed 15 Dec 2021	Final Exam (for this section)

¹ For a complete and up-to-date calendar, please see <https://registrar.unm.edu/semester-deadline-dates/fall-2021.html>

WHEN WILL WE LEARN THIS STUFF?

(Schedule is approximate and subject to change by the instructor)

Meeting	Date	Topics/Events
1	Mon 23 Aug	Syllabus, Review: Lewis Structures, VSEPR, Polarity
2	Wed 25 Aug	Intermolecular Forces, Phase Changes, Relative BP (11.4 - 11.8)
3	Mon 30 Aug	Solutions and Solubility (13.1 - 13.5)
4	Wed 01 Sep	Colligative Properties (13.6 - 13.7)
	Mon 06 Sep	Labor Day - No Meeting
5	Wed 08 Sep	Exam 1: CHEM 121 Review, Chapters 11, 13
6	Mon 13 Sep	Kinetics: Introduction (14.1 - 14.3)
7	Wed 15 Sep	Kinetics: Integrated Rate Laws (14.4)
8	Mon 20 Sep	Kinetics: Temp Dependence and Mechanisms (14.5 - 14.7)
9	Wed 22 Sep	Kinetics: Review
10	Mon 27 Sep	Equilibrium: Intro (15.1 - 15.5)
11	Wed 29 Sep	Equilibrium: ICE Tables (15.1 - 15.8)
12	Mon 04 Oct	Equilibrium: Q and LeChâtelier's Principle (15.7 - 15.9)
13	Wed 06 Oct	Equilibrium: Review
14	Mon 11 Oct	Exam 2: Kinetics and Equilibrium (Chapters 14, 15)
15	Wed 13 Oct	Acids/Bases: Definitions, K_a , K_w , pH scale (16.1 -16.5)
16	Mon 18 Oct	Acids/Bases: Weak acid/base equilibria (16.6 - 16.7)
17	Wed 20 Oct	Acids/Bases: Weak acid/base equilibria (cont) (16.6 - 16.7)
18	Mon 25 Oct	Acids/Bases: Salts, Polyprotic Acids, Lewis Definition
19	Wed 27 Oct	Equilibrium: Buffers (17.1 - 17.3)
20	Mon 01 Nov	Equilibrium: Weak A/B titrations (17.4)
21	Wed 03 Nov	Equilibrium: Solubility
22	Mon 08 Nov	Exam 3: AB Equilibria, Solubility (Chapters 16, 17)
23	Wed 10 Nov	Thermodynamics: Entropy (18.1 -18.5)
24	Mon 15 Nov	Thermodynamics: Gibbs Free Energy (18.6 - 18.9)
25	Wed 17 Nov	Thermodynamics: GFE and Equilibrium and Review (18.10)
26	Mon 22 Nov	Electrochemistry: Intro and Balancing (19.1 - 19.2)
27	Wed 24 Nov	Electrochemistry: Galvanic and Electrolytic Cells (19.3 - 19.6)
28	Mon 29 Nov	Electrochemistry: Batteries and Corrosion
29	Wed 01 Dec	Thermodynamics and Electrochemistry Review/Catch Up
30	Mon 06 Dec	Exam 4: Thermodynamics and E-Chem (Chapters 18, 19)
31	Wed 08 Dec	Review of CHEM 1225 Topics and Learning Objectives
	Wed 15 Dec	Final Exam (9:00 - 11:00 a.m.)

Course-Level Student Learning Outcomes

1. Explain the intermolecular attractive forces that determine physical properties and phase transitions, and apply this knowledge to qualitatively evaluate these forces from structure and to predict the physical properties that result.
2. Calculate solution concentrations in various units, explain the effects of temperature, pressure and structure on solubility, and describe the colligative properties of solutions, and determine solution concentrations using colligative property values and vice versa.
3. Explain rates of reaction, rate laws, and half-life, determine the rate, rate law and rate constant of a reaction and calculate concentration as a function of time and vice versa, as well as explain the collision model of reaction dynamics and derive a rate law from a reaction mechanism, evaluating the consistency of a mechanism of a given rate law.
4. Describe the dynamic nature of chemical equilibrium and its relation to reaction rates, and apply Le Chatelier's Principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures as well as describe the equilibrium constant and use it to determine whether equilibrium has been established, and calculate equilibrium constants from equilibrium concentrations and vice versa.
5. Describe the different models of acids and base behavior and the molecular basis for acid strength, as well as apply equilibrium principles to aqueous solutions, including acid base and solubility reactions, and calculate pH and species concentrations in buffered and unbuffered solutions.
6. Explain titration curves and speciation diagrams, as well as calculate concentrations of reactants from the former and determine dominant species as a function of pH from the latter.
7. Explain and calculate the thermodynamic functions, enthalpy, entropy and Gibbs free energy, for a chemical system, and relate these functions to equilibrium constants and reaction spontaneity; balance redox equations, express them as two half reactions and evaluate the potential, free energy and equilibrium K for the reaction, as well as predict the spontaneous direction.
8. Construct a model of a galvanic or electrolytic cell; or describe organic reactions.
9. Describe bonding theories, such as valence and molecular orbital theory.

Respect the UNM Community by Preserving Health

UNM Administrative Mandate on Required Vaccinations

All students, staff, and instructors are required by [UNM Administrative Mandate on Required Vaccinations](#) to be fully vaccinated for COVID-19 as soon as possible, but no later than September 30, 2021, and must provide proof of vaccination or of a UNM validated limited exemption or exemption no later than September 30, 2021 to the [UNM vaccination verification site](#). Students seeking medical exemption from the vaccination policy must submit a request to the [UNM verification site](#) for review by the [UNM Accessibility Resource Center](#). Students seeking religious exemption from the vaccination policy must submit a request for reasonable accommodation to the [UNM verification site](#) for review by the [Compliance, Ethics, and Equal Opportunity Office](#). For further information on the requirement and on limited exemptions and exemptions, see the [UNM Administrative Mandate on Required Vaccinations](#).

UNM Requirement on Masking in Indoor Spaces

All students, staff, and instructors are required to wear face masks in indoor classes, labs, studios and meetings on UNM campuses, see [masking requirement](#). Vaccinated and unvaccinated instructors teaching in classrooms must wear a mask when entering and leaving the classroom and when moving around the room. When vaccinated instructors are able to maintain at least six feet of distance, they may choose to remove their mask for the purpose of increased communication during instruction. Instructors who are not vaccinated (because of an approved medical or religious exemption), or who are not vaccinated yet, must wear their masks at all times. Students who do not wear a mask indoors on UNM campuses can expect to be asked to leave the classroom and to be dropped from a class if failure to wear a mask occurs more than once in that class. With the

exception of the limited cases described above, students and employees who do not wear a mask in classrooms and other indoor public spaces on UNM campuses are subject to disciplinary actions.

Communication on change in modality

The university may direct that classes move to remote delivery at any time to preserve the health and safety of the students, instructor and community. Please check your email and your UNM Learn site regularly for updates about our class, and please check <https://bringbackthepack.unm.edu> regularly for general UNM updates about COVID-19 and the health of our community.

Acceptable masks and mask wearing in class

A two-layer mask that covers the nose and mouth and that is cleaned regularly is acceptable, as are disposable medical masks, KN95, KF94, FFP1 and FFP2 masks. A face shield is not sufficient protection. It is vital that you wear your mask correctly, covering your nose and mouth. Removing your mask for an extended period to eat or drink in class violates the university mask requirement and endangers others.

Consequences of not wearing a mask properly

If you don't wear a mask, or if you do not wear a mask properly by covering your nose and mouth, you will be asked to leave class. If you fail to wear a mask properly on more than one occasion, you can expect to be dropped from the class. If you insist on remaining in the classroom while not wearing a mask, class will be dismissed for the day to protect others and you will be dropped from the class immediately.

The instructor will try to have a few disposable masks available in the classroom on a first-come, first-served basis.

Academic Integrity

Having academic integrity is paramount to your success in any class. Plagiarism or cheating is not tolerated. Any instance of this will result in a grade of zero for that assignment. Here is the link to the UNM Academic Dishonesty Policy:



Academic Integrity Policy

<https://policy.unm.edu/regents-policies/section-4/4-8.html>, or scan the QR code above:

The policy states: *Each student is expected “to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or who otherwise fails to meet the expected standards. Any student judged to have engaged in academic dishonesty in course work may receive a reduced or failing grade for the work in question and/or for the course.*

Academic Dishonesty is defined as: "Academic dishonesty" includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.

Equal Access Services (Valencia Campus)

If you have a documented condition that may affect your performance in this class, please register with Equal Access Services as soon as possible so accommodations can be arranged in a timely manner. EAS can provide a quiet place to take exams, additional time, and additional services if there is a documented need. For more information, please see their website at <https://valencia.unm.edu/students/advisement/equal-access-services.html>, or scan the QR code above:



Equal Access Services

Sexual Misconduct and Gender Discrimination

In an effort to meet obligations under Title IX, UNM faculty, teaching assistants, and graduate assistants are considered “responsible employees.” by the Department of Education <http://www2.ed.gov/about/offices/list/ocr/docs/qa-201404-title-ix.pdf>). This designation requires that any report made to a faculty member, TA, or GA regarding sexual misconduct or gender discrimination must be reported to the Office of Equal Opportunity and the Title IX Coordinator. For more information on this policy, <https://policy.unm.edu/university-policies/2000/2740.html> or scan the QR Code above:



Title IX Policy

Land Acknowledgement

Founded in 1889, the University of New Mexico sits on the traditional homelands of the Pueblo of Sandia. The original peoples of New Mexico Pueblo, Navajo, and Apache since time immemorial, have deep connections to the land and have made significant contributions to the broader community statewide. We honor the land itself and those who remain stewards of this land throughout the generations and also acknowledge our committed relationship to Indigenous peoples. We gratefully recognize our history.

Citizenship and/or Immigration Status

All students are welcome in this class regardless of citizenship, residency, or immigration status. Your professor will respect your privacy if you choose to disclose your status. As for all students in the class, family emergency-related absences are normally excused with reasonable notice to the professor, as noted in the attendance guidelines above. UNM as an institution has made a core commitment to the success of all our students, including members of our undocumented community. The Administration’s welcome is found on our website: <http://undocumented.unm.edu/>



Citizenship/Immigration status