Chem 1215-501 **Fall 2019** **Course Syllabus**

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Course Overview

This course is the second of a two-semester introduction to the chemical and physical behavior of matter designed for science and engineering majors with a strong algebra background. 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, and electrochemistry.

Course Format

This is a 16-week fully online course. Assignments (reading quizzes, problem sets, and activities) will be accessed online through BBLearn or Mastering Chemistry and will count for 40% of your grade. Exams will be proctored in person and will count for 60% of your grade.

Course Requirements

- Chemistry: A Molecular Approach, 2nd, 3rd, or 4th Ed. by Nivaldo Tro
    - You can purchase or rent the e-text, hardcover, softcover, or loose leaf versions.
    - Mastering Chemistry Access Code – online homework
- Passing grade in CHEM1215 or its equivalent.
- Calculator with log/antilog and exponential functions (available for under $15)
- Access to the Internet: Blackboard Learn, Mastering Chemistry, and UNM email must be checked regularly.
- Access to a printer and file scanner (there are phone apps that work).
- Time: Each weekly unit will require 10-15 hours of work.

Instructor Contact Information

Instructor: Dr. Terry

Use any, or all, of the following to contact me throughout the semester. The best method is the method that is most convenient for you.

- **Course Messages**: I will check **Course Messages** in BBLearn each weekday and will respond within 24-48 hours to messages.
- **Zoom office hours**: instructions are posted on the course web page
  Mon/Fri Noon-2 pm, Wed 1-2 pm, other times by appointment
- **UNM Email**: tjterry@unm.edu I check my email regularly, but student emails sometimes get buried in other campus emails. If I do not reply within 24 hours, send me a reminder email.

Course Help

- **Instructor**: The course instructor is the main source of information pertaining to the course. See the 'Instructor Contact Information' above to determine how best to contact the instructor.
- **BBLearn Discussion**: You may ask and answer student questions in the **Discussion Forum** on BBLearn.
- **On-Campus Tutoring**: The STEM Resource Center at the UNM-Valencia campus has tutors available for chemistry courses. You can drop-in, or call/email to make appointments. Phone: 505-925-8907 Email: tutor@unm.edu
- **Online Videos**: Each Unit in BBLearn contains links to various web sites that provide videos discussing many of the topics covered in this course. I will also post videos to assist in problem solving.

Time Frame

The course is divided into **16 Units**, one per week. Most units will require approximately 10-15 hours of effort by the student. Plan your schedule accordingly.

Units

Each Unit of new information will contain the following information:

- The Learning Objectives for the Unit.
- A checklist of the required work for the unit.
- A reading assignment from the textbook.
- Informational and problem solving videos.
- A reading quiz due **Monday** in Mastering Chemistry.
- A discussion board activity with a posting due by **Wednesday** in BBLearn.
- A problem set in Mastering Chemistry and/or an online activity in BBLearn that will be due by **Friday**.

You may work ahead as units are posted into BBLearn.
The units that include MidTerm Exams, Fall Break, and the Final Exam vary from the above schedule.

Sample Weekly Schedule

- Sat/Sun Read the assigned text and take bullet point notes. (2-4 hrs)
- Mon Watch videos to supplement notes from the reading. (30 min)
  Complete the reading quiz in Mastering Chemistry. (15-30 min)
- Tue Begin the problem set/activity. (2 hrs)
  Refer to samples problems in the text and videos for guidance as needed.
- Wed Complete the **Discussion Board** posting in BBLearn. (10-20 min)
  Attend Zoom office hours to get help with problems. (1 hr as needed)
- Thurs Watch videos and complete problem set/activity. (2 hrs)
- Fri Attend Zoom office hours to get help with any problems. (1 hr)
  Complete any problems and scan activities for submission. (1-2 hrs)

Assignments – Point deductions may occur for late assignments.

Reading Quizzes

Reading quizzes will consist of multiple-choice questions covering definitions, concepts, and simple calculations covered in the assigned text sections. These will be available in **Mastering Chemistry**. These quizzes will be due on **Mondays.**

Discussion Board

A Unit Discussion Board prompt will be assigned for each unit. Responses to the Discussion Board prompt will be due on **Wednesdays**.

Discussion Board etiquette:

- Stay on topic.
- Be polite.
  I will delete posts if they stray too far off topic or are not polite.
- Posts and responses should be thorough and thoughtful. (Go beyond "I agree". Use logic and course information to explain why or why not.)
- Use complete sentences.
- Include references. If you are discussing a particular part of the text, please reference the chapter, section, and page number.

Grading note: for most Discussions, you are required to post before you can read other posts. **If your initial post is blank, you will receive no credit for that Discussion.** If you submit an additional post revising your answer after reading other posts, you may earn additional credit.

Problem Sets

Problem sets will be posted in Mastering Chemistry. The problem sets must be completed by **Friday** of each week. Late assignments will be given partial credit automatically through the Mastering Chemistry online system.

Activities/Worksheets

Other activities may be assigned for a unit. These activities may include quizzes given through BBLearn or worksheets completed by hand and submitted as a .pdf file. **Only .pdf file formats will not be graded.** These will be due on **Fridays**.

There are apps that allow you to scan documents with the camera on your phone. Scanner Pro is the one I use and costs $4.

Exams

Exams must be taken at a pre-determined participating proctoring facility. You may choose a Student Testing Center at any UNM campus or another exam proctoring facility of your choice. Contact your instructor with your preferred testing facility by the end of week 2 of the semester. (This is a Unit 2 assignment.)

The instructor will also proctor exams in a Zimmerman Library study room.

Bonus Points

Participation/Communication
Asking questions during Zoom office hours will count towards bonus points on your final grade of up to 2%.

General Campus Policies

Academic Honesty

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, including dismissal, against any student who is found responsible for academic dishonesty. Any student who has been 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 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; and misrepresenting academic or professional qualifications within or outside the University.

Equal Access

If you have a documented disability, please make sure Equal Access Services has contacted me as soon as possible to ensure that your accommodations are provided in a timely manner. It is up to you to obtain documentation of a disability. I will not guarantee accommodation without the appropriate documentation.

Title IX

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 (see pg 15 - http://www2.ed.gov/about/offices/list/ocr/docs/qa-201404-title-ix.pdf). This designation requires that any report of gender discrimination which includes sexual harassment, sexual misconduct and sexual violence made to a faculty member, TA, or GA must be reported to the Title IX Coordinator at the Office of Equal Opportunity (oeo.unm.edu). For more information on the campus policy regarding sexual misconduct, see: https://policy.unm.edu/university-policies/2000/2740.html

Equal Opportunity

Harassment is a form of discrimination. When University faculty, administrators, and supervisors witness or receive a written or oral report or complaint of discrimination or harassment, they are required to engage in appropriate measures to prevent violations of this policy and promptly notify OEO, including notification of any actions taken to achieve informal resolution of the complaint. The University relies on its employees to notify the University's OEO office of all disclosures of discrimination and harassment as defined in this policy. https://policy.unm.edu/university-policies/2000/2720.html

Netiquette

One of the overriding principles in online conversations is to "craft your responses effectively." It is sometimes difficult to remember that there are real people reading posted messages. This is especially true of online communication where others do not have the opportunity to see body language or hear tone of voice; therefore, misunderstandings are more likely.

Please, follow these guidelines in all of your online responses and discussion postings.

- Honor everyone's right to an opinion.
- Respect the right of each person to disagree with others.
- Respond honestly but thoughtfully and respectfully; use language which others will not consider foul or abusive. You may also use emoticons to convey a lighter tone.
- Respect your own privacy and the privacy of others by not revealing information which you deem private and which you feel might embarrass you or others
- Be prepared to clarify statements which might be misunderstood or misinterpreted by others.

A Special Note about Anger

- Do not send messages that you have written when you are angry, even anonymous ones. In the online world, angry messages are known as "flaming" and are considered bad behavior. Venting and flaming are two different things. It is possible to vent without becoming "ugly." Stick to the facts, without name calling, of what is causing you frustration.
- Do not send messages that are written all in upper case; this is the visual equivalent of SHOUTING. It is considered aggressive and is considered bad behavior. If you ever feel like shouting a message, take a deep breath and wait until you have calmed down before responding. Then, respond in a calm and factual manner. Sometimes I type it all out in a Word Document to get it out of my system and then immediately delete it and start over.

Student Learning Objectives

Course Level Learning Objectives

By the end of the course, students will be able to…

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.

Unit level learning objectives (minor rearrangements of topics are possible)

By the end of the course, students will be able to…

Unit 1 - Review of Prerequisite Topics – MasteringChemistry Tutorial Problems
1. Setup and evaluate stoichiometry problems related to mass, volume/concentration, and energy. (Background for CLO 2, CLO 3, CLO 4)
2. Complete Enthalpy calculations using Hess's Law. (Background for CLO 7)
3. Describe the characteristics of and identify the different types of bonding. (Background for CLO 1)
4. Describe how differences in electronegativity affect bond polarity and molecular polarity. (Background for CLO 1)

Unit 1 - Intermolecular Forces (CLO 1)
1. Identify the IMFs experienced by a molecule or between molecules.
2. Describe how intermolecular forces affect phase changes and solubility.
3. Predict relative solubility and boiling points of molecules based on structures.
4. Label and interpret phase diagrams.

Unit 2 – Solutions (CLO 2)
1. Define the terms solute, solvent, miscible, solubility.
2. Describe the intermolecular forces present in various types of solutions.
3. Use "like dissolves like" to determine relative solubility of molecules based on chemical formula or skeletal structure.
4. Relate solubility of solids and gasses in terms of temperature and pressure.
5. Calculate molarity, molality, mole fraction, and mass percent of a solution given sufficient information and interconvert between these units.
6. Calculate the freezing point or boiling point of a solution, given sufficient information on solution concentrations.
7. Calculate the solution concentration given the freezing point or boiling point of a solution.

Unit 3 – Kinetics of initial rates (CLO 3)
1. Tell the effects of variables (temperature, concentration, collision factors, catalysts, activation energy) on rate of reaction based on the Collision Model of reaction dynamics.
2. Determine reaction order/rate law/rate constant using the isolation method.

Unit 4 – Time dependent kinetics (CLO3)
3. Determine reaction order/rate law/rate constant graphically.
4. Use the integrated rate law to calculate the concentration of a reactant at a given time, or calculate reaction time from a given concentration.
5. Derive a rate law from a reaction mechanism; evaluate the consistency of a mechanism with a give rate law.

Unit 5 – Exam 1

Unit 6 – Equilibrium with ICE Tables (CLO 4)

1. Explain dynamic chemical equilibrium and its relation to reaction rates.
2. Describe the numerical meaning of the equilibrium constant K.
3. Write an equilibrium constant expression for a given chemical reaction.
4. Qualitatively and quantitatively relate the numerical value of the equilibrium constant to the equilibrium position and reactant/product concentrations.
5. Use ICE tables to calculate the equilibrium constant given equilibrium concentrations, or calculate equilibrium concentrations given the equilibrium constant.

Unit 7 – Equilibrium with La Chatelier (CLO 4)
5. Continue to use ICE tables to calculate the equilibrium constant given equilibrium concentrations, or calculate equilibrium concentrations given the equilibrium constant.
6. Judge how changes in reaction conditions (heat/pressure/addition or removal of a reactant or product, coupling of the reaction to a secondary reaction system), will affect the equilibrium position (Le Châtelier.)

Unit 8 – Acid Base Equilibrium and pH (CLO 5)
1. Compare and contrast the three major acid/base definitions (Arrhenius, Brønstead-Lowry, and Lewis).
2. Describe the difference between weak and strong acids and the relation to K_a.
3. Calculate pH and species concentrations given a molar concentration for strong acids or bases.
4. Calculate the K_a of a weak acid given pH of its solution.
5. Calculate the pH and species concentrations of a weak acid solution given the K_a of the acid.

Unit 9 – Spring Break

Unit 10 – Acid Base Equilibrium and pH (CLO 5)
6. Calculate the pH and species concentrations of a weak base solution given the K_b of the base.
7. Correlate molecular structure and acid strength.
8. Identify the Lewis acid and Lewis base in a reaction.

Unit 11 – Equilibrium in Buffers (CLO 6)
1. Explain what constitutes a buffer solution.
2. Select an appropriate buffer system based on the desired pH of the solution.
3. Calculate the concentrations needed to reach a specific pH in a buffer system.
4. Calculate the pH of a buffer using the Henderson-Hasselbalch equation.
5. Calculate the pH of a buffer following the addition of a given amount of acid or base.
6. Explain titration curves and calculate concentrations of reactants from a titration curve.
7. Explain speciation diagrams and determine dominant species as a function of pH.

Unit 12 – Exam 2

Unit 13 –Thermodynamics – Entropy and Gibbs Free Energy (CLO 7)
1. Demonstrate an understanding of entropy by making qualitative predictions of the sign of ΔS for various processes and chemical reactions.
2. Calculate numerical values for ΔS and ΔG.
3. State the first, second, and third law of thermodynamics.

Unit 14 –Thermodynamics (CLO 7)

4. Demonstrate an understanding of Gibbs free energy by making qualitative predictions of the sign of ΔG for various processes and chemical reactions.
5. Assess the temperature dependence of a reaction's spontaneity by considering the signs of ΔS and ΔH, and their effect on the sign of ΔG.
6. Correlate values of ΔG, ΔS, and ΔH with reaction spontaneity and the position of reaction equilibrium.

Unit 15 – Electrochemistry (CLO 8)

1. Describe redox reactions in terms of gain/loss of electrons, changes in oxidation state, oxidizing vs reducing agents, and individual half reactions being coupled together.
2. Be able to balance electrochemical (redox) reactions using half reactions.
3. Employ standard cell notation to describe the operation of electrochemical cells.
4. Differentiate between anodes and cathodes.
5. Calculate cell potentials and determine spontaneous direction of the cell.
6. Distinguish between galvanic and electrolytic cells (spontaneity) in terms of sign of E_{cell}, ΔG, K_{eq}, and position of equilibrium.

Unit 16 – Exam 3

Course Schedule

Unit # Date	Topics	Chapter
Unit 1 Jan 20-24	START HERE – Intro to online learning MasteringChemistry – Chem1215 Review InterMolecularForces (IMFs), Phase Changes/Diagrams, Predict relative boiling points	11.1-11.9
Unit 2 Jan 27 - 31	Solutions, Concentration Units, Solubility Colligative Properties	13.2, 13.5-13.7
Unit 3 Feb 3-7	Kinetics – Collision Theory and Rate Expressions and Isolation Method	14.1-14.3
Unit 4 Feb 10-14	Kinetics – Time dependent integrated rate laws, Mechanisms	14.4-14.7
Unit 5 Feb 17-21	Exam 1 Practice (due M-W) Exam 1 (due W-Fri)	
Unit 6 Feb 24-28	Equilibrium – eq constant K, ICE tables	15.1-15.6
Unit 7 Mar 2-6	Equilibrium – ICE tables, Q/K relationship, Le Chatelier Principle	15.6-15.9
Unit 8 Mar 9-13	Acid/Base –Arrhenius, Bronsted Lowry, Ka/Kb, pH equations, weak acid ICE tables	16.1-16.6
Unit 9 Mar 16-20	**Spring Break**	
Unit 10 Mar 23-27	Acid/Base – weak base ICE tables, structure vs acid strength, Lewis A/B	16.7-16.12
Unit 11 Mar 30 – Apr 3	Equilibrium in Buffers, Titrations, Henderson-Hasselbalch Equation	17.1-17.4
Unit 12 Apr 6-10	Exam 2 Practice (M-W) Exam 2 (W-F)	
Unit 13 Apr 13-17	Thermodynamics – Enthalpy, Entropy, Gibbs Free Energy - Spontaneity	18.1-18.6
Unit 14 Apr 20-24	Thermodynamics – Calculations and Equilibrium	18.7-18.10
Unit 15 Apr 27 - May 1	Electrochemistry – Balance Redox Reactions, Cell Potential, Equilibrium, Galvanic vs Electrolytic Cells	19.1-19.6
Unit 16 May 4-8	Exam 3 Practice (M-W) Exam 3 (W-F)	
May 11-15	**Cumulative Final Exam**	