**Chemistry 122 – 501** **Sp 2016**

**General Chemistry II**

**Instructor**: Dr. Terry Office A102a tjterry@unm.edu
**Lecture:** Tue/Thurs 9:00-10:15 am in C101
**Tutoring Hours:** Mon/Tue 2 pm – 3:30 pm (STEM Center)
Wed 10:30 – noon and 1 – 3 pm (Office A102a)

**Course Description:** Chem122 *continues* the General Chemistry sequence building upon the foundation of concepts established in Chem121 to explore connections between the atomic and the macroscopic world.

**Required Resources**

- Chemistry, A Molecular Approach, By Nivaldo Tro (new/used/e-book), 3rd Ed. preferred
- Internet access: Blackboard Learn and UNM email address must be checked regularly.
- Mastering Chemistry (MC) access code: may be purchased with the new text, or alone online.
- A scientific calculator to bring to each class (have log, anti-log, exponential functions).
- Passing grade in Chem 121.

**Recommended Resources**

- 3-ring binder for lecture print outs and notes, and pen/pencil for note-taking.
- Periodic Table for use in class.
- Mastering Chemistry notebook: record important concepts, problems you need to get help with, problems you need to repeat before taking the exam.

**Additional Resources at UNM-VC**

- **Instructor** – STEM Center Hours, Office Hours and Email
- **The Learning Center –** Individual Tutoring, Study Group Meeting Space, Computers
- **The STEM Center –** Individual Tutoring, Molecular Modeling Kits, Laptops
- **SI Classes**

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

If you have a documented disability, please make sure the instructor was provided with a copy of your letter from **Equal Access Services** as soon as possible to ensure that your accommodations are provided in a timely manner.

**Grading**

35 % Homework (includes MC, Worksheets, Quizzes, Exam Debriefs, and Classroom Activities)
50 % Mid-Term Exams (5 exams, each count 10% of the final grade)
15 % Cumulative Final Exam
2% Bonus possible on overall grade for *class participation* or *attending at least 10 SI Classes*

**Passing Grades: 98-100% A+; 92-97% A; 90-92% A-; 88-89% B+; 83-87% B; 80-82% B-; 78-79% C+; 73-78% C; Non-passing Grades: 69-72% C-; 60-68% D; <60% F**

## General Campus Policies – Reminder

- 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.*

## Course Expectations

- You are expected to bring a scientific calculator, pen/pencil, and paper to *each* class.
- If you miss lecture, use your textbook, watch classroom capture, use other online resources, or ask another student for help filling in the notes.
- Classroom behavior is expected to be professional and respectful of other students and the instructor:
  - Arrive on time
  - Do not distract your classmates or the instructor away from the material
  - Actively participate in discussions and working groups
- *Attendance in lecture is **mandatory**. You may be dropped from the course without notice for >2 unexcused absences. Contact the instructor if you must miss a class. (No excuses necessary.)*
- Students are responsible for all assignments regardless of attendance. You may submit an assignment during class, via email, or to the Academic Affairs Office **on the due date** for full credit.
- LATE WORK: No worksheets will be taken after the due date. Due dates for online activities may be modified with sufficient justification such as late registration for the course. Exams may be rescheduled, but must be taken **before the next class period**.
- The last day to drop the course without a grade is **Feb 5th.** *If you have **any** unexcused absences before then, you may be dropped from the course without notice.*
- The UNM Blackboard Learn system will be used for class announcements, handouts, and assignments. Keep your contact information up to date and check the course page often.
- NO CELL PHONES MAY BE USED DURING QUIZZES OR EXAMS. Phone or smart pad (ie, iPad) use, for any reason, during quizzes or exams will be considered cheating.

## Mastering Chemistry (MC) Homework

- *Completion of the **Chem121 Review** in Mastering Chemistry by the drop deadline is **mandatory**. You may be dropped from the course without notice for not completing the assignment.*
- Computers with updated internet browsers and plug-ins are advised. Check the system requirements.
- The Learning Center and the STEM Center have computers that will be updated throughout the semester. If you have trouble with these computers, notify your instructor and the center director *immediately*.
- The grading policy on MC is very generous. Attempt the problems and be comfortable making mistakes, but always continue to work the problem until you get it right. **There is no deduction for using hints.**
- Six attempts are allowed for fill in the blank questions with a 3% deduction per incorrect answer.
  ***This is your opportunity to make mistakes and learn how to work the problems that will be on the exams. You will not learn how to answer questions if you never practice and make mistakes.***
- Take notes on problems that you have trouble with. Get help from your instructor, tutors, or classmates.
- Due dates are posted on the MC program. There is a 30% deduction in points for every day late.
  It is best to complete homework as soon after the related lecture as possible to reinforce learning.

## Exams

Each exam is cumulative with the mid-term exams focusing on the specified chapters.
Exams may be rescheduled at the discretion of the instructor, but they MUST BE completed before the class period when the graded exams are returned, generally the next class period.
You may use a 3x5 inch index card with handwritten notes for each exam.
You are expected to bring a calculator with log/antilog/exponential functions for each exam.
**Cheating on exams is taken very seriously and results in automatic and immediate failure of the course.**

## Where to get help

- **Ask questions** in class. During lecture, ask the instructor, during activities ask your teammates, the instructor, or the tutor.
- **Attend instructor office hours, STEM Center hours, and extra study sessions** held by the instructor. The instructor is your #1 source for course information.
- **Attend SI sessions** held each week. The SI instructor is you #2 source for course information.
- **Visit tutoring centers**. Both the Learning Resource Center and the STEM Center are located down the hall from the library and have chemistry 122 tutors available. You may make appointments with specific tutors.
- **Form a study group**.
- **Read the textbook** and work through the sample problems in the chapter, then complete the end of chapter homework problems in blue, which have answers at the back of the book.
- **Email the instructor** at tjterry@unm.edu. If you do not receive a reply within 48 hours, send a reminder email. Your original email could have gotten lost.

## How to succeed in chem122

- **Use learning objectives as a study guide**. Refer to the syllabus for each section and identify the learning outcomes that tell you what you need to be able to do to show mastery of the material and hence **what will be on the exam**.
- **Read** the text before class. You don't have to understand it all, but you'll know what you need more help with before class begins and most of the terms discussed in class will be familiar.
- **Work all sample problems** in the textbook.
- **Attend class, take notes** during lecture ESPECIALLY when covering example problems.
- **Ask questions** during class, during office hours, and during SI.
- **Attempt MC and other homework within 24 hrs of the lecture topic** while it is still fresh in your mind. This will deepen your understanding of the material and save you time.
- **Use resources** (the textbook, instructor office hours, tutors, SI, study groups, online help) when you get stuck on a problem.
- **If you start to feel overwhelmed, GET HELP IMMEDIATELY!** Make an appointment with the instructor or a tutor – the earlier the better.

## Global Course Objectives:

1. Increase appreciation of the impacts of chemistry in everyday life.
2. Increase confidence in applied math and science courses.
3. Increase student skills such as note taking, reading a textbook, and
4. Become more effective at applying concepts and principles to problem solving in the natural world.
5. Become a more responsible citizen by thinking scientifically about contemporary issues.

# Topic Specific Learning Objectives

## General Chemistry I Review

1. Setup and evaluate stoichiometry problems related to mass, volume/concentration, and gasses.
2. Describe how differences in electronegativity affect bond polarity and molecular polarity.
3. Describe the characteristics of and identify the different types of bonding.
4. Draw Lewis Dot Structures for simple molecules and polyatomic ions and determine molecular/ion shape.

## Intermolecular Forces

1. Identify the IMFs experienced by a molecule or between molecules
2. Describe how intermolecular forces affect phase changes
3. Describe how intermolecular forces affect solubility
4. Calculate the energy required/removed to raise/lower the temperature of a substance through phase changes
5. Label and interpret phase diagrams

## Solutions

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 solubilities 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, mass percent, or ppm 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
7. Calculate the molar mass of an unknown substance if given the freezing point of a solution, freezing point of the solvent, and $K_f$ of the solvent

## Kinetics

1. Tell the effects of variables (temperature, concentration, collision factors, catalysts) on rate of reaction
2. Write rate expressions
3. Determine reaction order/rate law/rate constant using the isolation method
4. Relate rate laws to mechanisms
5. Discuss qualitative aspects of activation energy
6. Explain the effect that catalysts have on a reaction and its rate law/mechanism
7. Determine order of reaction graphically via correlation with the linearity of integrated rate laws
8. Use the integrated rate law to calculate the concentration of a reactant at a given time, or how long it will take for a reactant or product to reach a given concentration
9. Determine activation energy of a reaction given rate data at different temperatures.

## Equilibrium

1. Explain what is meant by dynamic equilibrium
2. Describe the numerical meaning of K
2. Write an equilibrium constant expression for any given chemical reaction
3. Qualitatively and quantitatively relate the numerical value of the equilibrium constant to the equilibrium position and reactant/product concentrations
4. 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)

## Acid Base Equilibrium and pH

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. Describe auto ionization of water
4. Calculate pH, given a molar concentration for strong acids or bases
5. Calculate the $K_a$ of a weak acid given pH of its solution
6. Calculate the pH of a weak acid solution given the $K_a$ of the acid
7. Calculate the pH of a weak base solution given the $K_b$ of the base
8. Determine if an anion or cation is acidic, basic or neutral
9. Correlate molecular structure and acid strength
10. Identify the Lewis acid and Lewis base in a reaction

**Equilibrium in Buffers**

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. Select an indicator (given its pH range) for a given titration

**Thermodynamics**

1. Demonstrate an understanding of entropy by making qualitative predictions of the sign of $\Delta S$ for various processes and chemical reactions
2. Calculate numerical values for $\Delta S$
3. State the first, second, and third law of thermodynamics
4. Demonstrate an understanding of Gibbs free energy by making qualitative predictions of the sign of $\Delta G$ for various processes and chemical reactions
5. Calculate numerical values for $\Delta G$
6. Assess the temperature dependence of a reaction's spontaneity by considering the signs of $\Delta S$ and $\Delta H$, and their effect on the sign of $\Delta G$
7. Estimate values for equilibrium constants based on thermodynamic data
8. Correlate values of $\Delta G$ with reaction spontaneity and position of equilibrium

**Electrochemistry**

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. Predict relative strengths of oxidizing and reducing agents
6. Calculate cell voltages
7. Distinguish between galvanic and electrolytic cells in terms of sign of $E_{cell}$, $\Delta G$, $K_{eq}$, and position of equilibrium
8. Predict how various changes in concentration affect cell voltage
9. Relate cell current and time to quantities of products formed in electrolytic cells

**Nuclear**

1. Explain radioactivity, rate of decay and half-life
2. Describe the different forms of radioactive decay and radioactive particles
3. Correlate penetrating power and ionizing ability with hazard levels for the different types of radiation under different conditions (time permitting)

| WEEK | CHEM 122 TOPICS | Due | Ch |
|---|---|---|---|
| 1<br>**Jan 19/21** | **Tuesday –** Syllabus, Review: LDS, VSEPR, Bond Polarity, IMFs, Phases<br>**Thursday –** 11.5-11.8 – Phase Changes/Diagrams | **Tue –** Polarity Review WS<br>**Thurs –** Review WS Due | **11** |
| 2<br>**Jan 26/28** | **Tue** – 12.1-12.5 – Solutions and Solubility<br>**Thur** – 12.5-12.8 Colligative Properties | **Tue** – MC 121 Review MC Ch 11 HW<br>**Thurs** – MC Ch12a | **11, 12** |
| 3<br>**Feb 2/4** | **Tue –** Review for Exam 1 (Chem121 Review, Ch11, Ch12)<br>**Thurs – Exam1**<br>**FRIDAY Feb 5th – Last day to drop with full refund** | **Tue** – Ch 12b HW | **12** |
| 4<br>**Feb 9/11** | **Tuesday** – Ch13.1-13.4 – Kinetics Intro<br>**Thurs** – **Kinetics Activity 1** | **Tue –** MC Ch13a | **13** |
| 5<br>**Feb 16/18** | **Tue** – 13.4-13.7 - Kinetics<br>**Thurs** – **Kinetics Activity 2** – Kinetics Review | **Tue** – MC Ch13b<br>**Thurs** – MC Ch13c | **13** |
| 6<br>**Feb 23/25** | **Tue** – 14.1-14.5 – Chemical Equilibrium<br>**Thurs** – 14.1-14.8 - ICE Tables | **Tue** – MC Ch13d<br>**Thurs** – MC Ch14a | **14** |
| 7<br>**Mar 1/3** | **Tue** – **Equilibrium Activity 1**<br>**Thurs** – 14.9 Le Chatelier Principle | **Tue** – MC Ch14b<br>**Thurs –** MC Ch14c | **14** |
| 8<br>**Mar 8/10** | **Tue** – **Equilibrium Activity 2**<br>**Thurs – Exam 2** – Ch 13 & 14 | **Tue** – MC Exam 2 Review | **14** |
| 9<br>**Mar 15/17** | **Spring Break**<br>**Ch 15.1-15.5 Worksheet/Online Activity – Acids/Bases, Ka, Kw, pH scale** | **Tue** – MC Ch15a | **15** |
| 10<br>**Mar 22/24** | **Tue –** 15.5-15.6 – **ICE Activity**<br>**Thurs -** Ch 15.7-15.9 | | **15** |
| 11<br>**Mar 29/31** | **Tue** – Ch 15 Review/Activity<br>**Thurs** – 16.2-16.4 - Buffers | **Tue** – MC Ch15b<br>**Thurs** – MC Ch16a | **16** |
| 12<br>**Apr 5/7** | **Tue - Buffer Titration Activity**, Review Ch15/16<br>**Thurs** – **Exam 3** – Ch 15-16 | **Tue** – MC Exam 3 Review | **16** |
| 13<br>**Apr 12/14** | **Tue** – Ch 17.1-17.4 Thermodynamics:Entropy<br>**Thurs** – 17.5-17.8 Thermo: Gobbs Free Energy | **Tue** – MC Ch17a<br>**Thurs** – MC Ch17b | **17** |
| 14<br>**Apr 19/21** | **Tue** – **Thermo Activity** – 17.9<br>**Thurs** – 18.1-18.3 Electrochem/RedOx | **Tue** – MC Ch17c<br>**Thurs** – MC Ch17d-18a | **17**<br>**18** |
| 15<br>**Apr 26/28** | **Tue** – 18.4-18.6 Echem Calculations<br>**Thurs** – Batteries, Electrolysis, Corrossion | **Tue** – MC Ch18b<br>**Thurs** – MC Ch18c | **18** |
| 16<br>**May 3/5** | **Tue** – Ch 19 – Nuclear Chemistry<br>**Thurs** – **Exam 4 –** Ch 17-18 | **Tue** – MC Ch 19a<br>MC Exam 4 Review | **19** |
| **FINAL EXAM – Tue, May 10th 9-11 am** | | | |

**Friday, Feb 5th – Last day to drop with full refund**

Dates are subject to change. Any changes will be discussed in class and posted onto Blackboard Learn with a revised schedule. Sign in to Mastering Chemistry for online homework assignments and due dates.