Chemistry 111 **Sp 2018**

Elements of Chemistry

Instructor: Dr. Terry Office A102a tjterry@unm.edu

Lecture: M/W 9-10:15 C101
M 10:30-12:30 A128

Tutoring Hours: Wed 10:30 am – 12 pm
Tue/Thurs 9 – 10:30 am (A102a)
Thurs 1 – 3 pm (STEM Center)

Course Description: Chem111 introduces a foundation of concepts of chemistry exploring the connections between the atomic and the macroscopic world.

Required Resources

- Introduction to Chemistry, By Birks, Bauer, and Marks, 4th Ed.
- Internet access: *Blackboard Learn and UNM email address must be checked regularly*
- McGraw Hill Connect access code
- A scientific calculator (have log, anti-log, exponential functions)
- Passing grade in Math 120

Recommended Resources

- 3-ring binder and paper for worksheets and notes, and pen/pencil for note-taking
- Periodic Table for use in class
- Connect notebook: record important concepts, problems you need help with, problems you need to repeat before taking the exam

Additional Resources at UNM-VC

- **Instructor** – STEM Center Hours, Office Hours, Email, Workshops and Review Sessions
- **STEM Center –**Tutors, Molecular Modeling Kits, Laptops, Textbook

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

Grading

5 % iClicker Participation
30 % Homework (includes Connect, Classroom Activities/Worksheets, Quizzes, Exam Debriefs)
50 % Mid-Term Exams (5 exams, each count ~10% of the final grade)
15 % Cumulative Final Exam

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

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 your notes. You CANNOT make-up missed in-class activities.
- 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, iClicker problems, and working groups**
- Students are responsible for all assignments regardless of attendance. You may submit worksheets 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 within 48 hours of the originally scheduled time. In-class activities such as iClicker questions and quizzes CANNOT be made-up.
- The last day to drop the course without a grade is **Feb 2nd.** *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 and organization. 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.

McGraw Hill Connect Homework

- Completion of the first homework in Connect is **mandatory**. The **assignment is due by Jan 24th**. You may be dropped from the course without notice for not completing the assignment by **by midnight Jan 29th**.
- Computers with updated internet browsers and plug-ins are advised.
- 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 *immediately*.
- The grading policy on Connect is very generous. Attempt the problems and be comfortable making mistakes, but always continue to work the problem until you get it right.
  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 20% deduction in points for every day late.
  It is best to complete homework as soon after the related lecture as possible to reinforce learning.

In-class Clicker Problems

- iClickers will be provided and assigned to each student. Arrive early enough to get your iClicker from the instructor. Return the Clickers at the end of class.
- Participation in classroom Clicker Problems is mandatory and counts toward your grade.

Exams

Each exam is cumulative with the four mid-term exams focusing on the specified chapters.
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.
If you earn an average of 90% or higher on the mid-term exams, you are exempt from taking the final exam.
Cheating on exams is taken very seriously and results in automatic and immediate failure of the course.

How to succeed in Chem111

- **Use learning objectives as a study guide**.
- **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 relevant 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 Connect and other homework within 24 hrs of the lecture topic** while it is still fresh in your mind.
- **Use resources** including instructor office hours, tutors, SI sessions, workshops, study groups, and online help.
- **If you start to feel overwhelmed, GET HELP IMMEDIATELY!**

Global Course Objectives:

1. Increase understanding of the chemical foundations of allied health applications.
2. Increase confidence in applied math and science courses.
3. Increase student skills such as note taking, reading a textbook, and problem solving.
4. Become more effective at applying concepts and principles to problem solving in the natural world.

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.

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. 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

Learning Objectives for Students in Chem111

Atoms, Subatomic Particles, Experimental Support
Reference: Chapter 2
Students should be able to…

1. Diagram the structure of an atom in terms of its subatomic particles.
2. Justify the nuclear model of the atom with reference to Rutherford, Thompson's, Millikan's experiments, and the scientific method.
3. Identify an element or ion based on the composition of the nucleus and number of electrons.
4. Use the periodic table to classify an element as being a metal (forms cations), nonmetal (forms anions). Identify main group elements and transition elements. Also identify the following groups: alkali metals, alkaline earth metals and halogens and recall the ions commonly formed by elements in these groups.

Combining Atoms: Ionic and Covalent Compounds and Their Names
Reference: Chapter 3
Students should be able to…

1. Describe the two different forms of bonding that connect atoms - IONIC or COVALENT. Use the periodic table to determine whether a species is molecular or ionic based on chemical formula.
2. Determine formulas of ionic compounds, including the use of polyatomic ions, and molecules from their systematic names.
3. Name molecular and ionic compounds using the IUPAC system of nomenclature.

Chemical Reactions: Classify, Balance, and Describe
Reference: OpenStax Supplement
Students should be able to…

1. Identify and balance acid base, precipitation, and oxidation-reduction reactions.
2. Predict products of precipitation reactions using solubility rules and represent the process as a balanced chemical equation.
3. Predict the products of acid base reactions and represent the process as a balanced chemical equation.
4. Identify oxidizing and reducing agents in oxidation-reduction reactions.
5. Use the IUPAC system of nomenclature to describe chemical changes: convert from a descriptive sentence to a balanced chemical equation or from a balanced chemical equation to a descriptive sentence.

SI System, Calculations, Significant Figures
Reference: Math Toolbox 1.1, 1.2, 1.3
Students should be able to…

1. Use the appropriate SI units and metric prefixes to express numbers in scientific notation.
2. Express the result of any set of simple mathematical operations on measurements to the appropriate number of significant figures.
3. Convert between units and prefixed units using dimensional analysis and develop a systematic approach to solving problems involving unit conversions and equations.

Chemical Quantities: Moles, Molar Mass, Molarity, Reaction Stoichiometry
Reference: Chapter 4.2, Ch 4.4, Ch 6.1-6.3
Students should be able to…

1. Determine and use molar mass to convert between mass, moles, and numbers of molecules.
2. Perform stoichiometric calculations for solids (relate the mass of reagents and products in a chemical reaction).
3. Define molarity and perform calculations involving the composition of solutions, including dilution calculations.
4. Perform stoichiometric calculations for solutions (relate volumes of reagents to quantities of products).

Gas Laws and Reactions of Gases
Reference: Chapter 9
Students should be able to…

1. Recall and use the gas laws (Boyle, Charles and Avogadro) to calculate properties of an ideal gas under changing conditions.
2. Relate atomic level behavior to macroscopic properties of gases.
3. Recall and use the ideal gas law, PV = nRT to calculate P, V, n or T given three of the four parameters.
4. Apply the ideal gas law to find number of moles from P, V and T conditions, and use this information in stoichiometric calculations.

Electronic Structure of the Atom
Reference: Chapter 7
Students should be able to…

1. Describe the Bohr model of the hydrogen atom in terms of quantized circular orbits.
2. Sketch the shapes of orbitals designated by s, p, and d.
3. Write electron configurations and orbital diagrams for ground state atoms and ions by applying the Pauli exclusion principle, Hund's rule, the Aufbau principle, and the position of the atom in the Periodic Table.
4. Identify atoms based on electron configurations and orbital diagrams.
5. Use the positions of atoms in the Periodic Table to predict the relative values of periodic properties: atomic size, chemical reactivity, ion size, electronegativity.

Chemical Bonding
Reference: Chapter 8
Students should be able to…

1. Define and describe how atoms form ionic and covalent molecules.
2. Use Lewis structures to represent the valence electrons of molecules and determine bond order and placement of non-bonding electrons.
3. Predict the shape of any given molecule by writing the Lewis structure and applying VSEPR to assign the positions of the bonding and non-bonding electrons pairs.
4. Use trends in electronegativity to determine bond polarity. Predict the relative polarity of covalent bonds.
5. Predict the relative polarity of covalent molecules using the bond polarity and VSEPR predicted shape of the molecule.

Intermolecular Forces and Related Molecular Properties
Reference: Chapter 10.2, Chapter 11.3
Students should be able to…

1. Use structure to classify molecules by their strongest intermolecular force: London Dispersion, Dipole-Dipole, or Hydrogen Bonding.
2. Use structure and intermolecular attractive forces to qualitatively predict the relative physical properties of molecules: solubility in water, solubility in nonpolar solvents, and boiling point.

Chemical Kinetics
Reference: Chapter 12.1-12.3, OpenStax Supplement
Students should be able to…

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. Explain rates and rate laws.
3. Determine reaction order/rate law/rate constant using the isolation method
4. Derive a rate law from a reaction mechanism; evaluate the consistency of a mechanism with a give rate law
5. Use the integrated rate law to calculate the concentration of a reactant at a given time, or calculate reaction time from a given concentration for a first order reaction.

Chemical Equilibrium
Reference: Chapter 12.4-12.6
Students should be able to…

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, predict the direction of the reaction.
5. Predict how changes in reaction conditions (heat/pressure/addition or removal of a reactant or product) will affect the equilibrium position (Le Châtelier).

Acid-Base Reactions
Reference: Chapter 13.1-13.6
Students should be able to…

1. Describe the different models of acid-base behavior (Arrhenius, Brønstead-Lowry, and Lewis).
2. Recognize common acids and bases as strong or weak.
3. Calculate the pH and species concentrations for strong acid and base solutions.
4. Use ICE tables to calculate the pH and species concentrations in buffered solutions.

Nuclear Reactions
Reference: Chapter 15
Students should be able to…

1. Recognize the basic radioactive decay modes (α, β, and γ).
2. Compare the penetrating and ionizing power of α, β, and γ radiation.
3. Fill in missing species in a balanced nuclear equation.
4. Use first order kinetics equations for half-life calculations for radioactive isotopes.

WEEK	CHEM 111 TOPICS	Notes
1 Jan 17	**Wednesday –** Class Introduction, Atomic Theory, Structure of the Atom, Identify Elements & Ions by Subatomic Particles, **Element/Ion WS**	Wed – Ch 2.1, 2.2, 2.3,
2 Jan 22/24	**Monday** – Scientific Method: Thompson, Rutherford, and Millikan Experiments, Periodic Table and Element Classification, Ionic/Covalent **Monday Lab –** IUPAC naming of Ionic and Covalent Molecules, **Nomenclature WS** **Wednesday** – Polyatomic Ions and Nomenclature, **Element Quiz**	Mon – Ch 2.2, 2.5 Lab/Wed – 3.1-3.5
3 Jan 29/31	**Monday –** Precipitation, Acid Base, and Redox Reactions **Monday Lab – Chemical Reactions Lab Demo & WS** **Wednesday –** Predict Reaction Products, Identify Oxidizing and Reducing Agents, **Polyatomic Ion Quiz** **Friday, Feb 2nd – Last day to drop with full refund**	Mon/Wed – Supplement (BBL)
4 Feb 5/7	**Monday –** Exam I (Atoms, Ions, Compounds, Reactions) **Monday Lab –** Unit Conversions using SI System and Significant Figures **Wednesday –** Moles, Mass, Molar Mass and Conversions	Lab – Math Toolbox Wed – Ch 4.2
5 Feb 12/14	**Monday –** Stoichiometric calculations for solids in reactions using Molar Mass **Monday Lab –** Molarity, Solution Concentration Calculations, Dilution Calculations **Wednesday –**Stoichiometry calculations for solutions in reactions using Molarity	Mon – 6.2-6.3 Lab - 4.4 **Wed – Stioch I WS due**
6 Feb 19/21	**Monday –** Boyle's, Charles' and Avagadro's Laws and Before/After gas calculations **Monday Lab –** Ideal Gas Law and Stoichiometry Calculations **Wednesday – Exam II Review**	**Mon – Stoich II WS due** Ch 9
7 Feb 26/28	**Monday –** Exam II (Unit Conversions, Sig Figs, Molar Mass, Molarity, Gas Stoichiometry) **Monday Lab –** Bohr Model of the Atom and Orbitals, Electron Config. **Wednesday –** Electron Configurations WS (Hund's Rule, Aufbau, and Pauli Exclusion Principles)	Lab – Ch 7.2-7.6
8 Mar 5/7	**Monday –** Periodic Trends **Monday Lab –** Lewis Structures & VSEPR Shapes WS **Wednesday –** Bond and Molecular Polarity	Mon – 7.7 Lab – 8.1-8.3, 8.5 Wed – 8.5
9 Mar 12/14	**Spring Break**	Complete LDS/VSEPR WS
10 Mar 19/21	**Monday –** Intermolecular Forces **Monday Lab –** IMF Lab Demo **Wednesday –** Exam III (Electron Configurations, Molecular Structure and Polarity, Intermolecular Forces and Physical Properties)	**Mon – LDS/VSEPR WS due** Mon – 10.2
11 Mar 26/28	**Monday –** Collision Model of Kinetics, Rates, Rate Laws **Monday Lab –** Isolation Method of Determining Rate Laws **Wednesday –** Time Dependence of First Order Reactions and Calculations	Mon – 12.1-12.3 Lab/Wed – Supplement (BBL)
12 Apr 2/4	**Monday –** Mechanism and Rate Laws **Monday Lab –** Equilibrium Constant K, Calculate Concentrations Using K, Predict the Direction of Reactions **Wednesday –** Le Chatelier Principle	Mon – Supplement (BBL) Lab – 12.4-12.5 Wed – 12.6
13 Apr 9/11	**Monday –** Review Kinetics **Monday Lab -** Le Chatelier Demos and WS **Wednesday —** Exam IV (Kinetics and Equilibrium)	

14 Apr 16/18	**Monday –** Acid Base Definitions (Arrhenius, Bronsted Lowry, Lewis) and Examples, Strong Acids and Bases to KNOW, pH Scale **Monday Lab –** pH of Household Solutions and Concentrations **Wednesday –** Weak Acids and Ka Values	13.1-13.5
15 Apr 23/25	**Monday –** Buffered Solution Calculations **Monday Lab –** Penetrating Power of α, β, and γ Emitters Lab **Wednesday –** Radioactive Decay (α, β, and γ) and Balanced Nuclear Equations	Mon – 13.6 Lab – 15.1 Wed - 15.2
16 Apr 30 May 2	**Monday –** First Order Kinetics of Nuclear Decay **Monday Lab – Review for Exam V** **Wednesday –** Exam V (Acid Base and Nuclear Chemistry)	Mon 15.3
Finals Week	**Review (TBD)** **Final Exam (Monday, May 7th)**	

Dates are subject to change. Any changes will be discussed in class and posted onto Blackboard Learn with a revised schedule.