General Chemistry I/Lab (CHEM 121)

Fall 2015

Turtle Mountain Community College

Instructor: Audrey LaVallie, M.S.

Prerequisite: High school chemistry recently or Chem 115; Math 102 (Intermediate Algebra) or placement into Math 111 (Algebra I) or higher.

Text and Materials of Instruction: *General Chemistry*, Sixth Edition; by Ebbing, Darrell and Steven Gammon; publisher Houghton/Mifflin Company, NY, 1999. Fry readability: College level. This textbook can be signed out at the TMCC bookstore.

Students should also have a scientific calculator; these can be signed out at the library for no charge, but must be returned or signed out again after each semester.

Instructor Office: Rm. 102
Office Phone: 477-7862 ext. 1001
Instructor email: alavallie@tm.edu

Instructor schedule:

Monday: 9:00- 10:20 General Chem 121; 11:00- 12:20 Intro to Chemistry;
2:30-3:50 Physics 251
Tuesday: 9:00- 10:20 General Chem 121; 11:00- 12:20 Intro to Chemistry;
2:30-3:50 Physics 251
Wednesday: 9:00- 10:20 General Chem 121; 11:00- 12:20 Intro to Chemistry;
2:30-3:50 Physics 251
Thursday: 9:00- 10:20 General Chem 121; 11:00- 12:20 Intro to Chemistry;
2:30-3:50 Physics 251
Friday: Office hours

Office Hours: Between classes, Fridays.

Catalog description: A four-credit course which will meet for approximately 1-1/2 hours on four days (Monday, Tuesday, Wednesday, Thursday). This course is a freshman or sophomore level course which covers fundamental chemical principles including matter, measurement, atoms, ions, molecules, reactions, chemical calculations, thermochemistry, bonding, molecular geometry, periodicity, and gases.

Rationale: This course is a required course for a number of science majors in the physical sciences as well as in many health sciences; it can also serve as an elective in other majors.

Requirements:

The final grade for the course is determined from the following criteria:

Four examinations: 100 points each.	= 400 points
Ten laboratory exercises; 10 points each	= 100 points
Quiz and homework points	= 100 pts.
	Total: 600 points

Grades on examinations and the final grade for the course are determined by the following percentages:

(90- 100%)	= A	(80- 89%)	= B
(70-79%)	= C	(60- 69%)	= D
(0- 59%)	= F		

Instructional methods: Lecture and notes review, homework and problem sessions, discussion, laboratories. Audiovisual aids used by the instructor include eraserboard and LCD projector. Word documents, instructor-drawn diagrams, web-based diagrams and informational sites are referenced via projector. Tutors may be available at Student Support Services.

Chemistry 121 is also a hybrid course in that all notes, reviews and homework documents will be available online via Jenzabar, which will change to Canvas sometime this semester.

Attendance and participation policy: Students need to attend regularly to gain full benefit of instruction and receive full credit for homework and quizzes. If students miss class, they can reference notes online. Homework and laboratories cannot be made up, although one or two of these grades are dropped in the final grade calculation. Attendance (or lack of it) can affect financial disbursement; see student services for more information.

Class Procedures: After the first week, students will be required to print out their own notes if they need them. All materials will be available on Jenzabar (and Canvas later). Notes can be printed out in computer lab rooms or the library. Many students also own smart phones and can access the notes on there as well. We are attempting to bring down the volume of paper used on campus and we thank students ahead of time for their help in this endeavor.

Homework is checked for completion prior to each problem session. Credit for homework is only given for completed work that is checked by the student at the time that the instructor presents the answers. If the problems involve calculations, all work must be shown or no credit will be given.

Quizzes are only given in class and cannot be made up. One or two laboratory, homework or quiz grades will be dropped in calculating the final grade for the course. If the student is not present on the day that the syllabus is discussed they are expected to read it on their own and be familiar with the contents.

Missed laboratory or exam policy: Laboratories usually cannot be repeated due to time constraints, so students should make an effort to complete all laboratories at the scheduled time. Laboratories scheduled for that week may occur on any day of class that week.
Absence from examinations can happen due to a number of reasons and the instructor is not in a position to check up on excuses. Students must arrange a makeup time during the next week with the instructor, or a grade of zero will be given. Makeup examinations may not be the same as the regular examination. All examinations must be taken to pass the course.

Disruptive behavior policy: There are several disruptive behaviors that are discouraged: Excessive talking, texting on the phone, and going in and out more than once during the class period. If a student talks excessively during class they will be asked to leave. If a student makes a habit of walking in and out of class (two or more times in a session), I will have a conference with the student to remedy the problem. If any problem continues, the student will be asked to attend a conference with the department head and the academic dean to correct behaviors that are infringing on the rights of others.

Laboratory safety: Students are given a safety sheet at the beginning of the semester- if they are not present for the discussion on it the first day they are expected to get a copy and to read it on their own. Talking and texting on a phone in laboratory is NOT allowed nor are students allowed to leave the room to take a call; this is due to safety considerations. Students are responsible for their own experimental apparatus and for contributing to the group. Points for the group can be taken off if the group has not cleaned its lab space accordingly.

Academic honesty is also expected to be adhered to; correcting someone else's homework will not benefit the student. If cheating is observed on exams, a zero will be assigned and the matter will be reported to the Academic Dean. Also, phones will not be allowed to be used during exams. A regular calculator needs to be brought to the exam.

Disability policies: If you have emergency medical information to share with me, if you need special arrangements in case the building must be evacuated, or if you need accommodations in this course because of a disability, please make an appointment with me. My office is room 102 and office hours are generally in the morning before 11:00 and on Fridays). If you plan to request disability accommodations, you are expected to register with the college counselor.

Cultural content: Chemical processes, research or issues that impinge on Native Americans in general or are of local concern will be mentioned, discussed or investigated when possible. Grant studies of local interest, conducted by the instructor as principal investigator, in particular, will be highlighted within the course at opportune times.

References available in the TMCC library:

The American Biology Teacher
American Health
Discover
E
Earth
National Geographic
National Wildlife
North Dakota Outdoors
Science
Science News
The Sciences
Scientific American
Smithsonian

General goals:

Students will know in general:

1. Basis of atomic theory; properties of subatomic particles; identification of elements and atomic number, mass number, atomic mass, type of isotope.
2. Types of substances and types of bonding; metal, nonmetal and metalloid properties and how these relate to bonding, and physical/chemical properties.
3. Nomenclature of elements and compounds; types of bonding involved in compounds and types of reactions which produce compounds.
4. How to interpret reactions in terms of molar amounts, mass units, type of reaction, thermodynamic tendencies, equilibrium tendencies.
5. Ionic theory of solutions, solubility rules, how concentration units relate to each other; acid/base identification.
6. Phases and phase change processes; laws that dictate gas, liquid and solid behavior.
7. Electromagnetic energy divisions; basics of wave behavior; quantum theory and definition of four quantum numbers;.
8. Electron configuration notation; Pauli exclusion principle; Aufbau principle; Hund's rule.
9. Periodic table trends in terms of electronegativity, atomic size, ion size, electron affinity.
10. Definition of bond length, bond order and formal charge; how these relate to bonding behavior.
11. Laboratory procedures, effectively utilizing equipment and technology.
12. Laboratory reporting procedures, using problem solving skills to manipulate data in order to reach conclusions and then to effectively communicate conclusions.

Students will demonstrate the following skills:

1. Calculate metric conversions; specify and use significant figures in operations, use scientific notation, use factor labeling, analyze data for percentage error and percentage deviation.
2. Measure chemical and physical properties of substances with laboratory equipment, including glassware, heating devices, electrical meters and sensors.
3. Convert moles to mass, calculate molecular mass and percent compositions of compounds and find empirical and molecular formulas.
4. Write reaction equations including reduction/oxidation and acid/base, and balance them; find limiting reagents and percent yield.
5. Calculate solution molarity and mass percentage; carry out titration and dilution calculations.
6. Calculate reaction enthalpy (by standard formation enthalpies or Hess' law), entropy and Gibbs' free energy; use thermodynamic data stoichiometrically, determine endothermic vs exothermic reactions, spontaneity vs. nonspontaneity;
7. Determine electron configuration and quantum numbers for any atom or ion; draw Lewis dot diagrams for elements or compounds.
8. Calculate formal charge for molecules; estimate percentage ionic character.
9. Use laboratory equipment effectively, and use problem-solving to arrive at experimental conclusions which are effectively presented in written form.

Student attitude: Consideration for the huge volume of contemporary chemical knowledge and the many branches of chemistry available for study, as well as chemistry interdependence on mathematics and physics, will be developed. Students will also develop a multistep approach to complex problems and be able to classify and analyze data for a specific outcome. Various lecture opportunities on the part of the instructor will enable students to appreciate how chemistry enters into everyday events and is also the driving force behind many current scientific endeavors. Information about local chemical phenomena and studies will also be gained.

Course units and educational objectives:

Chem. 121 (30):

Students will develop subjective knowledge and/or skill in calculation of the following (1- 9 reflect chapter numbers in the textbook):

1.Measurement skills:

a. Determine significant figures in numerals and perform operations with significant figures

b. Convert metric units and use factor labeling for metric and nonmetric conversions
c. Assign percentage error and percentage deviation to a set of data
d. Use scientific notation and instrument measurement

2. Atoms, Molecules and ions:
   a. Identify isotopes, ions, atomic number, mass number; do simple calculations
   b. Name compounds, types of bonds, polyatomics
   c. Write and balance reactions
   d. Identify chemical vs physical properties; mixtures, types of atoms
3. Calculations with chemical formulas and reactions:
   a. Calculate molecular mass, percent mass, moles to mass
   b. Determine empirical and molecular formulas
   c. Find limiting reactant, theoretical and percent yield
4. Chemical reactions introduction:
   a. Describe types of reactions and identify components such as oxidation states, redox status
   b. Solve molarity and dilution problems
   c. Predict solubility and activity
   d. Predict acid-base strength range, find variables in titration problems
5. Gases: pressure measurement;
   a. Predict gas behavior using gas laws
   b. Use gas laws to find temp, pressure, volume and density of gases
   c. Calculate partial pressures
6. Thermochemistry: balancing heats of reaction expressions;
   a. Describe types of energy and measurement of it
   b. ID exo- and endo- reactions; balance enthalpy in equations
   c. Use Hess' Law or standard enthalpies of formation to find reaction enthalpy
7. Quantum theory:
   a. Describe properties of electromagnetic spectrum, waves and emission/absorption spectra;
   b. Use wave and Planck's equation to predict wavelength, frequency
   c. Describe quantum numbers relative to electron behavior, Aufbau

8. Electron configurations:
   a. Give electron configuration, Hund diagram, and Lewis diagram for any atom or ion
   b. Predict periodicity of main elements (ionization energy, electron affinity, electronegativity)

9. Ionic and covalent bonding:
   a. Draw or identify Lewis diagrams of bonding using octet rule
   b. Define ionic character using Pauling's electronegativity
   c. Calculate formal charge,
   d. Describe bond length and order, bond energy, resonance;

ID order and resonance in diagrams

10. Laboratory procedures, including equipment and technology use;
manipulation of data to reach conclusions based on acquired knowledge;
presentation of experimental findings in written form.

Assessment: As a general education class, Chemistry 121 will be assessed by the instructor and TMCC personnel in terms of student acquisition of the aforementioned instructional objectives, by means of comparison of a pre-assessment instrument and post-assessment documentation of objective acquisition as revealed by embedded examination questions within the regular course examinations

Approximate timetable: In the following timetable, the total number of assignments is listed for each chapter. Each assignment is typically two pages (front and back) of problems, usually selected from the book but also from other sources. Some assignments are more difficult than others, but plan on at least one hour of homework a night, sometimes more for each assignment.

August 24- 27: Text assignment: Read chap. 1 (Chemistry and Measurement)
Subjects covered in lecture: Metric conversion, factor labeling, rounding off,significant figures, scientific notation, percents and decimals, precision and accuracy, mass/volume/density, measurement with instruments.

Laboratories: Metric measurement
Measuring Techniques
Class assignment/homework (chap 1: six assignments)
Other assignments: Review sheets chap 1

Aug. 31- Sept. 3: Text assignment: Read chap. 1 and 2 (Atoms, Molecules and Ions)
Subjects covered in lecture: Substances and mixtures, phases, chemical and physical properties and reactions, Periodic table review of families, element vs. compound, chemical symbols, metals vs nonmetals, conservation of mass, energy in chemical change, conservation of energy.

Laboratories: Basic techniques in chemistry.
Class assignment/homework (chap 2: five assignments week one)
Other assignments: Review sheet chap 2

Sept. 7- 10: Text assignment: Read chapter 2

Subjects covered in lecture: Electrical charge, ions, isotopes, subatomic particles and behavior, atomic number and mass number calculations, common and systematic names of chemicals, writing formulas from compound names, binary compounds, polyatomic ions, ionic trends by chemical family, types of bonding.

Laboratories: Identification by physical properties; separation of mixtures.
Class assignment/homework (chap 2: five assignments week two)
Other assignments: Review sheet chap 2

Sept. 14 - 17: Text assignment: Read chapter 3 (Calculations with Chemical Formulas and Equations)

Subjects covered in lecture: Atomic mass units, formal weight and mole measurements, percent composition of compounds by mass, calculating empirical formulas, calculating mole ratios and applying quantitatively.

Laboratories: Chemical Reactions
Class assignment/homework (chap 3: five assignments week one)
Other assignments: Review sheets chap. 3
Exam I: Chap. 1 and 2.

Sept. 21- 24: Text assignment: Read chap. 3.

Subjects covered: Empirical formulas vs actual molecular formula, writing more chemical formulas and balancing, types of reactions, mole to mole calculations, mole to mass calculations, mass to mass calculations; limiting reagents.

Laboratories: Chemical formulas.
Class assignment/homework (chap 3: five assignments week two)
Other assignments: Review sheets chap. 3

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Sept. 28- Oct.1: Text assignment: Read chap. 4 (Chemical Reactions)

Subjects covered: Solutions and their properties, solubility rules for compounds, molar concentration and dilution of solutions, review of concentration calculations with molarity, molality, percent by mass, percent by volume; types of reactions.

Laboratories: Identification of Household chemicals.
Class assignment/homework (chap 4: six assignments week one)
Other assignments: Review sheets chap. 4.

Oct. 5- 8: Text assignment: Read chap. 4.

Subjects covered: Definitions of acids and bases, reactions of acids/bases, dissociation and ionization of electrolytes, ionization of water and calculation of pH, simple kinetics of reactions.

Laboratories: Copper reactions and percent yield.
Class assignment/homework (chap 4: five assignments week two)
Other assignments: Review sheets chap. 4.

Oct. 12- 15: Text assignment: Read chap. 5 (The Gaseous State)

Subjects covered in lecture: Kinetic theory, calculations involving pressure, Boyle's Law, Charles' Law, combined gas equation, calculating moles and density of gases, Dalton's partial pressures, effusion and diffusion. Stoichiometry of gases.
Avogadro's Law. Intro to energy and SI units, concepts of enthalpy and entropy

Laboratories: Molecular Weight of a vapor; vapor-pressure math.
Class assignment/homework (chap 5: four assignments)
Other assignments: Review sheets chap. 5
Midterm exam: Chap. 3 and 4.

Oct. 19- 22: Text assignment: Read chap. 6 (Thermochemistry)

Subjects covered in lecture: Avogadro's Law. Intro to energy and SI units, concepts of enthalpy and entropy. Potential and kinetic energy and specific heat; exothermic and endothermic reactions.

Laboratories: Colligative Properties; hot and cold packs.
Class assignment/homework (chap 6: three assignments week one)
Other assignments: Review sheets chap. 6
Exam III: Chapters 9 – 13.

Oct. 26- 29: Text assignment: Read chap. 6.

Subjects covered in lecture: Using thermodynamic equations with heat of reaction and changing molar concentrations or reversing equations. Hess's Law and finding heat of reaction from table of standard enthalpies of formation.

Laboratories: Calorimeter and thermodynamics.
Class assignment/homework (chap 6: two assignments week two)
Other assignments: Review sheets chap. 6

Nov. 2- 5: Text assignment: Read chap. 7 (Quantum Theory of the Atom)
Subjects covered in lecture: Electromagnetic energy spectrum, modern atomic theory, the Bohr model, energy level theory of electrons, photoelectric effect; Planck's equation; emission and absorption spectra, quantum theory and quantum number assignments for each element, description of orbitals.

Laboratories: Emission spectra/Photoelectric effect; potential and kinetic energy
Class assignment/homework (chap 7: two assignments)
Other assignments: Review sheets chap. 7
Exam III: Chap. 5 and 6.

Nov. 9- 12: Text assignment: Read chap. 8 (Electron Configurations and Periodicity)
Subjects covered in lecture: Planck's number and calculating energy change corresponding to orbitals. Pauli exclusion principle and shorthand electron configurations, Aufbau building-up principle and exceptions; Hund's rule; relation of electron configuration to periodic table and magnetism.

Laboratory: Absorbance and colorimetry; reflectivity and emissivity
Class assignments (chap 8: two assignments week one)
Other assignments: Review sheets chap.8.

Nov. 16- 19: Text assignment: Read chap 8.
Subjects covered in lecture: Lewis electron dot diagrams; atomic and ionic radii trends; ionization energy and electron affinity trends; properties and trends for group I-VIII elements.

Laboratory: Titration I.
Class assignment/homework (chap 8: two assignments week two)
Other assignments: Review sheets chap. 8.

Nov. 23- 26: Text assignment: Read chap 9 (Ionic and Covalent Bonding)
Subjects covered in lecture: Lattice description of ionic compounds; molecular description of covalent compounds. Electron configuration and prediction of ionic forms of atoms and molecules. Polar and nonpolar covalent bonding; description and quantification of electronegativity.

Laboratory: Gravimetric analysis of chloride salt.
Class assignment/homework (chap 9: three assignments week one)
Other assignments: Review sheets chap.9.

Nov. 30- Dec. 3: Text assignment: Read chap 9.

Subjects covered in lecture: The octet rule (and exceptions) and sharing of electrons in covalent bonds including sigma (single) sigma and pi (double and triple bonds); electronegativity using Pauling formula; describing resonance with bonding theory; calculating formal charge; sample bond energies, lengths and orders.

Laboratory: Redox reactions.
Class assignment/homework (chap 9: three assignments week two)
Other assignments: Review sheets chap 9.

Dec. 7- 10: Final examination: Chap. 7, 8 and 9.

Syllabus prepared August 2015.