Truman College
Chemistry 201 Block PQR
Spring Semester 2012

"Our Mission dedicates us to deliver high-quality, innovative, affordable and accessible educational opportunities and services that prepare students for a rapidly changing and diverse global economy."

Instructor: Mr. James Czuchra, Email: jczuchra@ccc.edu
Office hours: Immediately before class, 4:30-5:20 pm.
Class time: 5:30-9:45 pm
Place: M in room 3175, W in room 3152
Announcements and some problem sets will be posted on Blackboard, http://ccc.blackboard.com
Be sure to check it regularly.
Necessary Items: Textbook, something to write with, notebook and paper, and a scientific calculator (Cell phone calculators may not be used). Bring these to class every day. You will also need a pen and a bound notebook for lab (to be discussed on the first day of class). See http://justonly.com/chemistry/chem201/index.php for some general information.

Textbook:
General Chemistry, 10th Ed. by Petrucci, Herring, Madura, Bissonnette
Pearson ©2011, ISBN: 978-0-13-206452-1

Grading:
Your Grade will be based on laboratory reports (best 9 will be used) (30%), examinations (best two of three) (20%), quizzes (best 10 will be used) (20%), a comprehensive final exam (20%), and class participation/attendance/homework (10%). There has been talk of an exit exam for CHEM 201. Details will be provided as they become available. It's important to understand that A is earned for superior performance, B for good, C for adequate, D for minimal, and F for insufficient. Letter grades are translated to a numerical score for gradebook recording. Midterm and final grades are assigned based on the percentages earned as follows:
90-100%, A; 80-89% B; 70-79% C; 60-69%, D, below 60%, F.
Coming to class every day on time is essential to your success in this class. Quizzes are usually given at the beginning of the class session. There are **no make ups** of any missed work. One participation point will be deducted for every absence beyond the first one or every 2 tardies beyond the first two (Leaving early will be counted as a tardy). Grades are cumulative (NOT the average of midterm and second quarter grades). Students may be withdrawn from the class if it is deemed that they are not actively pursuing the course due to absences (more than 2 absences before midterm) and/or missing work.

Classroom/laboratory norms:
I want every student to be successful in learning chemistry. You came here to learn but distractions hinder the learning process for you and your classmates. Please turn off (or set to vibrate) all cell phones while in class. You may quietly leave the room to attend to whatever needs tending to. **Please do not text or listen to music while in class.** When a general question is posed to the class, please do not blurt out an answer—raise your hand. I want every student to have the chance to think about the question before the answer is revealed. Lab safety is very important. Not following safety rules will result in being asked to leave the lab and receiving a zero for the activity we are working on. The work you do must be your own. Submitting work

that is not your own may result in a grade of F being assigned as a final course grade. Class time is our collective learning time, therefore please understand if you are asked to see me outside of class to pursue questions that are do not advance learning.

The Truman College Disability Access Center (DAC) exists to meet the needs of students with disablilities. This center is responsible for verifying that students have a disability-related need for academic accommodations, and for planning the appropriate accommodations in cooperation with the students themselves and their instructors. Students who need academic accommodations should request them from the DAC. The center is located in 162-Q in the Student Services Center with phone number: (773) 907-4725. Linda Ford is the director.

The privacy of student educational records is protected by FERPA (Family Educational Rights and Privacy Act - a federal law): www.ed.gov/policy/gen/guid/fpco/ferpa/index.html. Faculty cannot reveal information about students, or discuss student records over the phone or unsecure e-mail. CCC student e-mail meets FERPA requirements. Thus, all communication between the instructor and students (beside the personal one during the class and office hours) will be done exclusively through Blackboard and ccc.edu student e-mails. Please check your ccc.edu e-mail account at least once a week.

The college, as well as your instructor, is concerned with your success. If you appear to be having difficulty with the class, you may be referred for help that the college provides via the Early Alert Program. If such a referral is made, your instructor will tell you so that you can expect someone from the college to contact you.

Detailed Student Learning Outcomes can be found at
http://justonly.com/chemistry/chem201/learning_outcomes.php

- **General Student Learning Outcomes for Chemistry 201**

At the completion of this course, the successful student will be able to:

- Solve quantitative chemistry problems and demonstrate reasoning clearly and completely. Integrate multiple ideas in the problem solving process.
- Describe, explain and model chemical and physical processes at the molecular level in order to explain macroscopic properties.
- Classify matter by its state and bonding behavior using the Periodic Table as a reference.
- Apply important theories such as the Kinetic Molecular Theory of Gases or the Quantum Mechanical Theory of the Atom to the solution of general chemistry problems.
- Perform general chemistry laboratory experiments using standard chemistry glassware and equipment and demonstrate appropriate safety procedures.
- Record, graph, chart and interpret data obtained from experimentation and use that information to correctly identify/analyze assigned unknown substances.

Specific Student Learning Outcomes for Chemistry 201

The (R) designation means this is a review topic-- something from Chemistry 121. As such, we will cover these topics more rapidly. At the completion of this course, the successful student will be able to:

Scientific Method

- (R) Describe the scientific method.
- (R) Define and explain the terms: law, hypothesis, and theory.

Chemical Calculations

- (R) Use exponential notation.
- (R) Do mathematical calculations involving significant figures.
- (R) Differentiate between mass and weight.
- (R) Convert from the English system to the metric system (& vice versa) common units of length, mass, volume, and temperature.
- (R) Use the metric system in calculations.

Heat and Temperature

- (R) Differentiate between heat and temperature.
- (R) Do simple calculations of heat changes using specific heat.
- Define and use the terms standard state, standard enthalpy change, molar enthalpy of formation.

Density

- (R) Solve problems using density as the relationship between mass and volume.

Properties of Matter

- (R) Use and define (describe or explain) basic chemical concepts with respect to properties of matter: physical states of matter, physical and chemical properties of matter, physical and chemical changes, the law of conservation of mass, the law of conservation of energy, the law of definite composition, classification of elements.
- (R) Distinguish between pure substances (elements and compounds) and mixtures (homogeneous and heterogeneous).
- List the names and chemical symbols of at least 48 elements.

Atomic Theory and Structure, Molecular Theory and Structure

- (R) Distinguish between ionic and molecular compounds.
- (R) Determine the number and types of atoms represented in a chemical formula.
- Use basic chemical nomenclature for inorganic compounds.
- Write the formulas of binary ionic compounds, common binary molecular compounds, and at least 12 common acids, 4 common bases, inorganic ternary compounds using 15 common polyatomic ions.
- Use oxidation numbers to distinguish oxidation states of metals in compounds.
- (R) Balance chemical equations given the formulas of the reactants and products.

- Calculate the oxidation number of each element, given the formulas of the reactants and products.
- Balance redox equations using oxidation numbers.
- (R) List the basic principles of Dalton's atomic theory and indicate how the theory has been further developed in this century.
- (R) State the basic properties of the subatomic particles: protons, neutrons, and electrons.
- (R) Describe the Rutherford atom.
- (R) Define atomic number, mass number, and isotopes.
- (R) Define the atomic mass unit and Avogadro's number.
- (R) Use the conversion factor from grams to amu in simple calculations.
- Calculate the average atomic mass from isotopic masses and percent abundances.
- (R) Apply the terms: metals, nonmetals, alkali metals, alkaline earth metals, metalloids, transition metals, noble gases, halogens, and inner transition metals to the arrangement of elements in the periodic table.
- (R) Describe the arrangement of the elements in the periodic table.
- (R) Use the periodic table to predict formulas of compounds.
- (R) Define the terms anion, cation, and polyatomic ion.
- Describe how ionic and covalent bonds are formed.
- Calculate the oxidation number of each element in a chemical formula.

Mole-Mass Calculations

- (R) Calculate the percent composition of compounds, given the formulas.
- (R) Calculate the empirical formula, given the percent composition.
- (R)Calculate the empirical formula of compound given the mass of the sample, the mass of CO_2 and mass of H_2O produced in a combustion reaction.
- (R) Distinguish between empirical and molecular formulas.
- (R) Explain the concepts of the chemical quantity, the mole, and relate it to counting of atoms and molecules.
- (R) Convert mass in grams to moles, formula units, molecules (and/or atoms) using atomic weights, formula weights, and molecular weights.
- List the basic rules which predict whether a salt is soluble in water.

Stoichiometry

- Write the balanced equations describing several examples of combustion, acid-base, precipitation, and exchange reactions. Write the equations in the molecular, total ionic and net ionic format.
- (R) Explain the information given by the balanced chemical equations.
- Perform stoichiometric calculations from a given chemical equation.
- Use calculations determine the limiting reagent, how much excess reagent is left, and the theoretical and percentage yield of each product.

Solutions

- List the properties of solutions and distinguish true solutions from heterogeneous and colloidal mixtures.
- Define solubility, percent concentration, molarity, mole fraction, and molality.
- Explain factors affecting solubility and the rate of dissolving.
- Write molecular, total ionic and net ionic equations which show that the solution is the reaction medium.
- Use percent concentration, molarity, and molality in stoichiometric calculations.

Gases

- List the basic principles of the Kinetic Molecular Theory of gases.
- (R) Describe the measurement of pressure using a barometer.
- (R) Use four kinds of pressure units in calculations and convert from one to another.
- Calculate pressure, volumes, and temperatures of gases using Boyle's law, Charles' Law, the Combined Gas Law, and Dalton's Law of Partial Pressures.
- (R) Calculate Kelvin temperatures from Centigrade and vice versa.
- (R) Define standard conditions of temperature and pressure.
- Use the Ideal Gas Law to calculate density and molecular weight of a gas.
- Use the gas laws in chemical stoichiometric calculations.
- Define and distinguish between diffusion and effusion.

Energy and Light

- Define and explain the terms electromagnetic radiation, wavelength, frequency, wave amplitude, spectrum, and nodes.
- Describe the Bohr hydrogen atom; describe the hydrogen atom in terms of simple quantum mechanics.
- Perform calculations using the equation $\lambda v = c$.
- Explain the source of the atomic line spectra.
- Describe the properties of light.

Molecular Orbital Theory

- Write electronic configurations of the first 50 elements; show the diagrams of their electronic structure, and indicate the spin of each electron.
- Sketch the shape of the s, p and d orbitals.
- Identify the 4 quantum numbers for any electron in an atom.
- Predict which atoms or ions are paramagnetic and which are diamagnetic using the electronic configurations.
- State the Pauli Exclusion Principle, Hund's rule, and the Aufbau principle.
- (R) Define ionization energy and be able to rank using the periodic table.
- Use ionization energy trends to predict the stability of electronic configurations and the tendency for outer shell electrons to undergo changes in order to form compounds.
- (R) Define electronegativity: show how it varies with respect to the periodic table.
- (R) Use electronegativity to estimate the polarity of bonds.
- Show the trends of atomic and ionic sizes on the periodic table.
- State the octet rule, including exclusions.
- Write Lewis electron dot structures for simple covalent compounds and polyatomic ions.
- Use double and triple bonds to show structures of molecules and ions; use resonance to describe equivalent bonds.

- Use the Valence Shell Electron Pair Repulsion theory to describe electron pairs geometry, molecular geometry, hybridization, and bond angles.
- Predict the polarity of bonds and molecules.
- Define bond order and bond dissociation energy; use bond energies to estimate reaction enthalpies.
- Calculate the formal change of an atom in a molecule or ion, and use it to predict the most reasonable resonance structures.
- Explain the difference between oxidation number and formal change.
- Explain simple valence bond theory.
- Use the concepts of orbital overlap, sigma and pi bonds, hybrid orbitals to explain the strength and orientation of covalent bonds.

Properties of Solutions

- Use molarity in calculations concerning the dilution of solutions.
- Explain at least two examples of colligative properties.
- Calculate the freezing point depression and the boiling point elevation due to the addition of a nonvolatile molecular solute to a pure solvent.

Acids and Bases

- List at least four properties each for acids and bases.
- Explain the behavior of acids and bases in terms of the Arrhenius and Brønsted/Lowry theories.
- Write equations for acids and bases showing conjugated acid/base pairs.
- List at least five common strong acids and five common strong bases.
- Given an acid, write the formula of the conjugate base, and vice versa.
- Write complete equations for at least two examples of each of the following reactions: acid + base, acid + metal, acid + metal oxide, acid + carbonate.
- Given the formula of a salt, write the formulas of the acid and the base which would react to form the salt.
- Distinguish between electrolytes and non-electrolytes, strong and weak electrolytes. List at least three examples of each.
- Define pH. Given a pH value, state whether the solution is acidic, basic, or neutral.
- Given a pH value calculate the H^+ concentration, and vice versa.
- Estimate pH and pOH values without the use of a calculator given H^+ concentration and/or OH^- concentration.
- Given a pOH value calculate the OH^- concentration, and vice versa.
- Convert from H_3O^+ concentration to pH then to pOH then to OH^- concentration.

Laboratory and Evaluations

- Perform simple tasks in the laboratory. Perform ten laboratory experiments.
- Carry out laboratory measurements and calculations using the correct significant figures.
- Perform the necessary calculations, prepare any required graphs and answer the questions for each experiment.
- Achieve a grade of at least 50% for the final comprehensive examination.
- Record all data in ink directly onto the data sheet or in the laboratory notebook.
- Prepare a lab report including a summary.
- On any quizzes and exams answer short essay questions.

Chem 201 PQR **M 5:30 – 9:40 Room 3175**
W 5:30 – 9:40 Room 3152

Mr. James Czuchra

January/February 2012

Monday	Tuesday	Wednesday	Thursday
Jan. 30 Class Intro Topic A Lab Check-in	31	Feb. 1 Topic A, B	2
6 **Lab 1** Topic B, C	7	8 Topic C, D	9
13 **Lab 2** Topic D	14	15 **Exam 1** Topic E	16
20 **President's Day Holiday**	21	22 Topic E	23
27 **Lab 3** Topic F	28	29 Topic F	Mar. 1

A – Scientific Method, Matter, Properties, and Measurement (Ch. 1)
B – Atomic Theory, Periodic Table, the Mole Concept (Ch. 2)
C – Compounds: Composition, Oxidation States, Nomenclature (Ch. 3)
D – Reaction Types, Stoichiometry (Ch. 4)

March 2012

Monday	Tuesday	Wednesday	Thursday
5 **Lab 4** Topic F, G	6	7 **Exam 2** Topic G	8
12 **Lab 5** Topic G, H	13	14 ***Midterm*** Topic H	15
19 **Lab 6** Topic H, I	20	21 Topic I	22
26 **Lab 7** Topic I, J	27	28 Topic J	29

E – Reactions in Aqueous Solutions (Ch. 5)
F – Gas Behavior (Ch. 6)
G – Thermochemistry (Ch. 7)
H – Atomic Theory continued (Ch. 8)
I – Periodicity (Ch. 9)
J – Chemical Bonding Basics (Ch. 10)
K – Chemical Bonding continued (Ch. 11)
L – Intermolecular Forces: Liquids & Solids (Ch. 12)
M – Solutions and Their Physical Properties (Ch. 13)
N – Acids & Bases (Ch. 16.1-16.5)

Note: This schedule, including the list of topics and lab experiments, is subject to change.

Chem 201 PQR **M 5:30 – 9:40 Room 3175**
W 5:30 – 9:40 Room 3152

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April 2012

Monday	Tuesday	Wednesday	Thursday
2 Spring Break	3 Spring Break	4 Spring Break	5 Spring Break
9 **Lab 8** Topic J, K	10	11 **Exam 3** Topic K	12
16 **Lab 9** Topic K, L	17	18 Topic L	19
23 ***Last day to withdraw*** Topic L, M **Lab 10**	24	25 Topic M	26

J – Chemical Bonding Basics (Ch. 10)
K – Chemical Bonding continued (Ch. 11)
L – Intermolecular Forces: Liquids & Solids (Ch. 12)
M – Solutions and Their Physical Properties (Ch. 13)
N – Acids & Bases (Ch. 16.1-16.5)

May 2012

Monday	Tuesday	Wednesday	Thursday
Apr. 30 **Lab 11** Topic M, N Notebooks due	1	2 Topic N	3
7 Topic N Final Exam Review	8	9 LAST CLASS Lab Check-out **Final Exam**	10

Lab 0 – Check-In
Lab 1 – Simple Qualitative Analysis
Lab 2 – Quantitative Analysis of a Mixture
Lab 3 – Neutralization/Titration
Lab 4 – Molar Mass of a Volatile Liquid
Lab 5 – Calorimetry
Lab 6 – Atomic spectra
Lab 7 – Single & Double Displacement Reactions
Lab 8 – Periodicity
Lab 9 – Qualitative Analysis & Molecular Geometry
Lab 10 – Chromatography
Lab 11 – Freezing Point Depression

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