HOUSTON COMMUNITY COLLEGE NORTHWEST
COURSE OUTLINE FOR CHEM 1412 – GENERAL CHEMISTRY II
Fall, 2014
Class Number 28613

Discipline/Program	Chemistry
Course Level	First Year (Freshman)
Course Title	General Chemistry II
Course Rubric and Number	CHEM 1412
Semester with Course Reference Number (CRN)	Fall 2014 CRN 28613
Course Location/Times	2:00 – 5:00 PM Tue. (lecture, room 517), Thu. (lab. or lecture room 522) Spring Branch Campus.
Course Semester Credit Hours (SCH) (lecture, lab)	4 (3 lecture, 3 lab)
Total Course Contact Hours	96
Course Length (number of weeks)	16
Type of Instruction	In-person
Instructor contact information (phone number and email address)	Dr. Mohammad Ali Phone: 713 -382-7420 E-mail: mohammad.ali@hccs.edu Learning Web: http://learning.hccs.edu/faculty/mohammad.ali
Office Location and Hours	
Course Description: ACGM or WECM	General principles, problems, fundamental laws, and theories. Course content provides a foundation for work in advanced chemistry and related sciences.
Course Description: HCC Catalog Description	Science and engineering majors study atomic structure, chemical reactions, thermodynamics, electronic configuration, chemical bonding, molecular structure, gases, states of matter, and properties of solutions. Core Curriculum Course. Note: Only one of CHEM 1305, CHEM 1405, and/or CHEM 1411 can be used toward associate degree natural science requirements. Only one of the three will count as Natural Science core; the others may count as electives in the degree plan.
Course Prerequisite(s)	One year of high school Chemistry; Must be placed into college-level reading (or take GUST 0342 as a co-requisite) and be placed into MATH 0312 (or higher) and be placed into college-level writing (or take ENGL 0310/0349 as a corequisite).
Academic Discipline Program Learning Outcomes	**1.** Distinguish between the different ways of measuring concentrations of solutions, and relate concentration to the colligative properties of solutions. **2.** Determine and analyze the rates of chemical reactions. **3.** Write equilibrium constant expressions for chemical reactions and calculate the value of the equilibrium constant and the concentration of reactants and products at equilibrium.

	4. Demonstrate proficiency in acid-base and solubility product calculations. 5. Express the three laws of thermodynamics and interrelate the enthalpy, free energy and equilibrium constant for the reaction. 6. Based on the principles of oxidation and reduction, balance oxidation-reduction reactions, calculate cell potentials of voltaic cells based on oxidation-reduction reactions, and make quantitative calculations based on electrolysis. 7. Identify modes of radioactive decay, balance nuclear reactions, calculate energy changes associated with nuclear reactions, and relate quantities of radioactive elements with time based on the kinetics of nuclear processes. 8. Classify, name, and draw the structure of basic organic compounds; student can write chemical reactions of alkanes, alkenes, and alkynes.
Course Student Learning Outcomes (SLO)	**1.** Distinguish between the different ways of measuring concentrations of solutions, and relate concentration to the colligative properties of solutions. **2.** Determine and analyze the rates of chemical reactions. **3.** Write equilibrium constant expressions for chemical reactions and calculate the value of the equilibrium constant and the concentration of reactants and products at equilibrium. 4. Demonstrate proficiency in acid-base and solubility product calculations. 5. Express the three laws of thermodynamics and interrelate the enthalpy, free energy and equilibrium constant for the reaction. 6. Based on the principles of oxidation and reduction, balance oxidation-reduction reactions, calculate cell potentials of voltaic cells based on oxidation-reduction reactions, and make quantitative calculations based on electrolysis. 7. Identify modes of radioactive decay, balance nuclear reactions, calculate energy changes associated with nuclear reactions, and relate quantities of radioactive elements with time based on the kinetics of nuclear processes. 8. Classify, name, and draw the structure of basic organic compounds; student can write chemical reactions of alkanes, alkenes, and alkynes.
Learning Objectives (Numbering system linked to SLO)	1.1. Relate the concentration of solutions to their colligative properties. 1.2. Determine if two compounds will mix to form a solution or not based on their structures. 1.3. Given the mass of a solute and the volume of a solution or the mass of the solvent, calculate the relevant concentration (molarity, molality, percent concentration, mole fraction, or ppm). Convert a given concentration from one concentration unit to another. 1.4. Determine the molecular weight of an unknown solute, given the value of a colligative property. 2.1. Determine the average rate and instantaneous rate of a reaction from

	concentration-time data. 2.2. Determine the order of a reaction with respect to each reactant and write the rate law for the reaction. Determine the value of the rate constant, k. 2.3. Write the integrated rate law of first and second order reactions and use the rate law to relate concentration of the reactant with reaction time, rate constant, and half-life. 2.4. Given different initial reactant concentrations and the respective initial rate of the reaction, determine the value of the exponents in the rate law and the value of the rate constant. 2.5. Relate the effect of temperature and activation energy to reaction rate using the Arrhenius equation. 2.6. Relate the rate law to the mechanism of the reaction and to the molecularity of the elementary reactions comprising the mechanism 3.1. Write the equilibrium constant expression for homogeneous and heterogeneous reactions. 3.2. Given one or more concentrations at equilibrium, calculate the value of the equilibrium constant for the reaction and/or the equilibrium concentrations of the other substances in the reaction. 3.3. Given one or more initial concentrations, calculate the concentrations of the reactants and products at equilibrium and/or the value of the equilibrium constant, using the "ICE" table method. 3.4. From the value of the reaction quotient, Q, determine whether a reaction is at equilibrium, and if not, which direction the reaction will initially proceed in order to reach equilibrium. 3.5. Apply LeChâtelier's Principle to determine the effects of changes in concentrations, temperature on compositions of equilibrium mixtures. 4.1. Know the three different definitions and principles of acids and bases (Arrhenius, Bronsted-Lowry, and Lewis). 4.2. Calculate $[H^{+}]$, $[OH^{-}]$, pH, and pOH. 4.3. Use dissociation constants for weak monoprotic acids and bases to determine the pH of their aqueous solutions. 4.4. Differentiate between acidic, basic and neutral salts and determine the pH of aqueous solutions of salts. 4.5. Understand the common ion effect and its relevance to buffers;

	determine the pH of buffered solutions using the Henderson-Hasselbalch equation. 4.6. Calculate the pH at various stages of titration curves for (i) strong acids & strong bases, (ii) weak acids & strong bases, (iii) strong acids & weak bases. 4.7. Write solubility product expressions and interconvert between the solubility constant, Ksp and concentrations of dissolved ions in saturated solutions of slightly soluble salts. 4.8. Given Ksp, determine whether precipitation will occur when two aqueous solutions of salts are mixed that react to form a sparingly soluble salt. 5.1. Express the concept of entropy and predict the sign of the entropy change for a given reaction. 5.2. Calculate the entropy change of a reaction using Hess's law or standard entropies. 5.3. From the Gibbs equation, relate and calculate the values of the entropy, enthalpy, free energy, and temperature of a reaction. 5.4. Relate and calculate the value of the equilibrium constant to the entropy, enthalpy, free energy and temperature of the reaction. 6.1. Determine the oxidation state of elements in compounds. 6.2. Based on changes in oxidation states, determine which substance in a reaction is oxidized and which is reduced. 6.3. Balance oxidation-reduction reactions in acidic and basic solution using the method of half-reactions. 6.4. Sketch voltaic and electrolytic cells, identifying the anode, cathode, anode compartment, cathode compartment, salt bridge, and direction of electron flow. 6.5. Calculate standard cell potentials from standard reduction potentials. 6.6. Rank reducing agents and oxidizing agents based on standard reduction potentials. 6.7. Determine non-standard cell potentials from standard cell potentials using the Nernst equation. 6.8. Interconvert between time, current, and masses of reactants and

	products in electrolysis processes. 7.1. Identify common modes of radioactive decay. 7.2. Write balanced nuclear reactions. 7.3. Differentiate between the different modes of decay and predict the likely mode of decay. 7.4. Interconvert between rates of nuclear decay, half-lives of radioactive nuclei, and amounts of radioactive nuclei. 7.5. Determine energy changes of nuclear reactions and stability of nuclei using Einstein's equation. 7.6. Distinguish between subcritical, critical, and supercritical masses; contrast nuclear fission with nuclear fusion processes. 7.7. Identify the major components and principle of operation of nuclear reactors. 8.1. Given the structure, name alkanes using the IUPAC rules of nomenclature, and vice-versa. 8.2. Classify organic compounds based on the functional group present in their structures. 8.3. Given the structure, name alkenes and alkynes using the IUPAC rules of nomenclature, and vice-versa. 8.4. Optional if time permits. Write combustion and halogenation reactions of alkanes; write addition reactions of alkenes and alkynes
SCANS and/or Core Curriculum Competencies	Reading, Speaking/Listening, Critical Thinking, Computer/Information Literacy
EGLS: Evaluation of Greater Learning Student Survey	At Houston Community College, professors believe that thoughtful student feedback is necessary to improve teaching and learning. During a designated time, you will be asked to answer a short online survey of research-based questions related to instruction. The anonymous results of the survey will be made available to your professors and division chairs for continual improvement of instruction. Look for the survey as part of the Houston Community College Student System online near the end of the term.
Course Calendar	**Tentative Course Schedule** Aug. 26: Begin Chapter 11: Properties of Solutions. Aug. 28: Complete Chapter 11; Begin Chapter 12: Chemical Kinetics

	Sep. 2 : Complete Chapter 12 Sep. 4: ***Experiment 1- Solubility & Metathesis Reactions in Aqueous Solutions: Metathesis Reactions and Net Ionic Equation*** (Answer prelab questions and submit before lab) Sep. 9: Begin Chapter 13: Chemical Equilibrium Sep. 11: ***Experiment 2: Molecular Weight Determination by Freezing Point Depression*** (Answer prelab questions and submit before lab)***;*** Completed Lab. 1 due (prelab + report + post lab) Sep. 16: Complete Chapter 13 Sep. 18: ***Experiment 4: Kinetics of a Chemical Reactions: The Iodine Clock Reaction*** (Answer prelab questions and submit before lab); Completed Lab. 2 due (prelab + report + post lab) Sep. 23: **EXAM 1: Chapters 11, 12, 13** Sep. 25: Chapter 14: Acids and Bases Sep. 30: Begin Chapter 15: Acid Base Equilibria Oct. 2: ***Experiment 5: Hydrolysis Reactions of Anions & Cations of Salts*** (Answer prelab questions and submit before lab); Completed Lab. 4 due (prelab + report + post lab) Oct. 7: Complete Chapter 15; Oct. 9: ***Experiment 6: Acid-Base Titration: Determination of the Purity of Potassium Hydrogen Phthalate*** (Answer prelab questions and submit before lab.); Completed Lab. 5 due (prelab + report + post lab) Oct. 14: Begin Chapter 16: Solubility & Complex ion Equilibria Oct. 16: Complete Chapter 16; ***Experiment 7: Determination of the dissociation Constant of a weak Acid*** (Answer prelab questions before lab); Completed Lab. 6 due (prelab + report + post lab) Oct. 21**:** **EXAM 2: Chapters 14, 15, 16,** Oct. 23: Chapter 17: Spontaneity, Entropy and Free Energy Oct 28: Complete Chapter 17; Begin Chapter 18: Electrochemistry; Oct. 30: Complete Chapter 18***; Experiment 13: Electrochemistry: New, Used, Rechargeable Batteries*** (Answer prelab questions and submit before lab)

	(Completed Lab. 7 due (prelab + report + post lab) **Oct. 31: Last Day to Withdraw (by 4:30 PM)** Nov. 4: Begin Chapter 19: The Nucleus: A Chemist View Nov. 6: Complete Chapter 19: The Nucleus: A Chemist View; ***Experiment 11:Spectrophotometric Determination of Copper*** (Answer prelabs before lab); Completed Lab. 13 due (prelab + report + post lab) Nov. 11: Begin Chapter 22- Organic and biological Molecules Nov. 13: Complete Chapter 22, ***Experiment 15: Structural Formulas and Isomerism*** (Take home lab) Nov. 18: Unfinished Topics Nov. 20: ***Experiment 9: Qualitative Analysis of Cations*** (Answer prelabs before lab); Completed Lab. 11 due (prelab + report + post lab) Nov. 25: **EXAM 3: Chapters 17, 18, 19, , 22** Dec. 2: Unfinished Topics Dec. 4: Final Exam Review; Completed Lab. 9 due (prelab + report + post lab) ***Thu.: Dec. 11: Comprehensive (chapters 12, 13, 14, 15, 16, 18, 19, 21, 24) Two Hour Final Exam 2PM – 4:30 AM): Scantron required***
Instructional Methods	Standard class lectures using the white board and power point slides
Student Assignments	Outside of laboratory reports, special assignments are normally not required. I will recommend practice problems but these are not graded. Practice problems, such as those at the end of the chapters, are highly beneficial, indeed essential, to learning chemistry. I recommend that you work as many of the even-numbered end of chapter problems as you can (these have answers in the back of your textbook); similar additional problems follow in the "Additional Problems" section. Get a spiral leaf notebook just for working chemistry problems. That will keep your work more organized and you (or I) can easily review your work.
Student Assessment(s)	The overall score is based on the following: • Three regular exams 45% • Graded Assignments and Quizzes: 10% • Laboratory 20% • Final Exam 25% Overall Score = 0.45(Average of three regular exams) + 0.10 (Average of quizzes and assignments) + 0.20(Laboratory grade) + 0.25(Final Exam)
Instructor's Requirements	**Laboratory Policy** Lab safety will be reviewed before the first lab. Each student will then sign a statement affirming his or her commitment to following safe procedures in the laboratory, and turn the form in to the instructor. Be especially aware of

	the need for adequate eye protection and proper dress in the laboratory. Safety glasses or goggles must be worn at all times during the laboratory period. Normally, experiments will be performed in groups of two students. Students should arrive at the lab on time with their lab manual. After you have finished the experiment, show me your results for me to examine briefly, and I will initial ("MS") your lab report before you leave. Laboratory reports are due on the next lab day. Each report must be done individually, but of course you can work with your lab partners on it. Each report will be graded on a 100-point basis. Come to lab prepared. Read through the experiment beforehand and do the pre-lab questions at the end of the lab report. You will be much better organized when doing the experiments, and your laboratory experience will be much more rewarding! **Exams and Make-up Policy** Examinations will consist of three non-cumulative regular exams (45%), periodic quizzes and graded homework (10%) plus a comprehensive final (25%). Programmable calculators, such as the TI 83 Plus, are not allowed during exams! The department has calculators that you can use on test days if you do not have a "regular" calculator. Make-up exams will not normally be given, so make every effort to take the exams on their scheduled dates. In the event that you must miss a regular exam, I will count the grade made on the final exam as the grade for the missed exam (for one missed exam only), and calculate the final course grade accordingly. If you do not miss any of the regular exams, I will replace your lowest exam score with your final exam score if the final exam grade is higher. This is intended to provide you a "second chance" if you do not do well on a particular exam. Remember that the final exam will be comprehensive (meaning that it will cover all of the material from the whole semester, not just the last part). Please note that all students are required to take the final (no student can be exempted).
Program/Discipline Requirements	At the program level, the Chemistry Discipline strives to accomplish the Program Learning Outcomes, Student Learning Outcomes, and Learning Objectives as described above. We desire that you receive a challenging and rewarding experience in your chemistry classes at HCC which will prepare you well for future chemistry and related science courses that you may take in the future.
HCC Grading Scale	A = 100 – 90;……4 points per semester hour B = 89 – 80: ……3 points per semester hour C = 79 – 70: ……2 points per semester hour D = 69 – 60: ……1 point per semester hour 59 and below = F……..0 points per semester hour IP (In Progress) ……0 points per semester hour W(Withdrawn)……..0 points per semester hour I (Incomplete)……0 points per semester hour AUD (Audit) ……0 points per semester hour IP (In Progress) is given only in certain developmental courses. The student must re-enroll to receive credit. COM (Completed) is given in non-credit

	and continuing education courses. To compute grade point average (GPA), divide the total grade points by the total number of semester hours attempted. The grades "IP," "COM" and "I" do not affect GPA.
Instructor Grading Criteria	See the above descriptions of the lab, exams, quizzes, and final. The course grade is based on these four criteria according to the Assessment section above.
Instructional Materials	**Textbook**  Chemistry, The Ninth Edition Steven S. Zumdahl, Susan A. Zumdahl ISBN: 978-1-305-03343-6 www.cengage.com www.cengagebrain.com **Laboratory Manual**  **Laboratory Manual for CHEM 1412,** Blue Door Publishing: 2011. **ISBN-13: 978-1-59984-381-0** **Optional Study Guide and Solutions Manual:** Student Study Guide to Accompany Chemistry, 10th Edition, by Raymond Chang. McGraw-Hill: 2010. Description: http://catalogs.mhhe.com/mhhe/viewProductDetails.do?isbn=0073226769 Student Solutions Manual to Accompany Chemistry, 10th Edition, by Raymond Chang. McGraw-Hill: 2010. Description: http://catalogs.mhhe.com/mhhe/viewProductDetails.do?isbn=0073226742
HCC Policy Statement: **ADA** **Academic Honesty** **Student attendance** **3-peaters** **Withdrawal deadline**	Access Student Services Policies on their Web site: http://hccs.edu/student-rights **Disability Support Services (DSS)** "Any student with a documented disability (e.g. physical, learning, psychiatric, vision, hearing, etc.) who needs to arrange reasonable accommodations must contact the Disability Services Office at the respective college at the beginning of each semester. Faculty are authorized to provide only the accommodations requested by the Disability Support Services Office." If you have any special needs or disabilities which may affect your ability to succeed in college classes or participate in any college programs or

activities, please contact the DSS office for assistance. At Southwest College, contact Dr. Becky Hauri, 713-718-7909. Contact numbers for the other HCC colleges are found in the Annual Schedule of Classes, and more information is posted at the HCC web site at Disability Services.

Academic Honesty

"Students are responsible for conducting themselves with honor and integrity in fulfilling course requirements. Disciplinary proceedings may be initiated by the college system against a student accused of scholastic dishonesty. Penalties can include a grade of "0" or "F" on the particular assignment, failure in the course, academic probation, or even dismissal from the college. Scholastic dishonesty includes, but is not limited to, cheating on a test, plagiarism, and collusion." In **this class**, the penalty for willful cheating on exams is a **grade of F in the course**. This is the standard policy of the Physical Sciences department at Southwest College.

Attendance Policy

The HCCS attendance policy is stated as follows: "Students are expected to attend classes regularly. Students are responsible for materials covered during their absences, and it is the student's responsibility to consult with instructors for make-up assignments. Class attendance is checked daily by instructors. *Although it is the responsibility of the student to drop a course for non-attendance, the instructor has full authority to drop a student for excessive absences. A student may be dropped from a course for excessive absences after the student has accumulated absences in excess of 12.5% of the hours of instruction (including lecture and laboratory time).*"

Note that 12.5% is approximately 4 classes or labs for a 4 semester hour course, such as this one, which meets 2 times per week in a 16 week semester. If circumstances significantly prevent you from attending classes, please inform me. I realize that sometimes outside circumstances can interfere with school, and I will try to be as accommodating as possible, but please be aware of the attendance policy.

Policy Regarding Multiple Repeats of a Course

"NOTICE: Students who repeat a course three or more times may soon face significant tuition/fee increases at HCC and other Texas public colleges and universities. If you are considering course withdrawal because you are not earning passing grades, confer with your instructor/counselor as early as possible about your study habits, reading and writing homework, test-taking skills, attendance, course participation, and opportunities for tutoring or other assistance that might be available."

Last Day for Administrative and Student Withdrawals

For 16-week fall classes, this date is **Nov. 1**. I urge any student who is contemplating withdrawing from the class to see me first! I want to be

	accessible and supportive. I do not believe in "weed out" classes, and I consider you to be much more than just a name or number! Note my office hours above; if you need assistance, I'm here to help. ☞ **Policy Regarding Withdrawals** ☜ Students desiring to withdraw from a class must do so by the above withdrawal date by filling out a **withdrawal form** at the registrar's office. *After this date, instructors can no longer enter a grade of "W" for the course for any reason.*
Distance Education and/or Continuing Education Policies	Access DE Policies on their Web site: http://de.hccs.edu/Distance_Ed/DE_Home/faculty_resources/PDFs/DE_Syllabus.pdf Access CE Policies on their Web site: http://hccs.edu/CE-student-guidelines
Test Bank	Extra practice problems by chapter, sample exams, and sample finals may be found at the following web sites: http://learning.hccs.edu/faculty/mohammad.ali
Scoring Rubrics	Regular exams and the final will consist of multiple-choice and show-work questions. These are graded in the standard manner. The regular exams will include extra questions for extra credit, for a total possible score of about 110 points. The lab reports are graded on the basis of completeness, neatness, and the correctness of the calculations tied to the experimental result. The pre- and post-lab questions are also checked. Each report is graded on a 100 point basis.
Sample Assignments	N/A
Sample Instructional Methods/Activities	See the PowerPoints at my Learning Web site for an overview of the content of each chapter: http://learning.hccs.edu/faculty/mohammad.ali