

**NEOSHO COUNTY COMMUNITY COLLEGE
MASTER COURSE SYLLABUS**

COURSE IDENTIFICATION

Course Code/Number: CHEM 225

Course Title: College Chemistry II Lecture

KRSN: CHM1020 Chemistry II
(Kansas Regents Shared Number)

Please visit the Kansas Board of Regents website for more information.

Division: Applied Science (AS) Liberal Arts (LA) Workforce Development (WD)
 Health Care (HC) Lifetime Learning (LL) Nursing Developmental

Credit Hour(s): 3

Effective Date: Summer 2015

Assessment Goal Per Outcome: 70 %

COURSE DESCRIPTION

This course is continuation of Chem. 215, with more advanced theoretical and mathematical concepts. A series of laboratory activities to assist in learning the lecture of inorganic chemistry, and semi-micro qualitative analysis will be done.

MINIMUM REQUIREMENTS/PREREQUISITES AND/OR COREQUISITES

Prerequisites: CHEM 215 and CHEM 216. Concurrent with CHEM 226

TEXTS

The official list of textbooks and materials for this course is found on *myNeosho*.

<http://www.neosho.edu/ProspectiveStudents/Registration/CourseSyllabi.aspx>

GENERAL EDUCATION OUTCOMES

1. Practice Responsible Citizenship through:
 - identifying rights and responsibilities of citizenship,
 - identifying how human values and perceptions affect and are affected by social diversity,
 - identifying and interpreting artistic expression.
2. Live a healthy lifestyle (physical, intellectual, social) through:
 - listing factors associated with a healthy lifestyle and lifetime fitness,
 - identifying the importance of lifetime learning,
 - demonstrating self-discipline, respect for others, and the ability to work collaboratively as a team.
3. Communicate effectively through:
 - developing effective written communication skills,
 - developing effective oral communication and listening skills.
4. Think analytically through:
 - utilizing quantitative information in problem solving,
 - utilizing the principles of systematic inquiry,
 - utilizing various information resources including technology for research and data collection.

COURSE OUTCOMES/COMPETENCIES

Upon completion of this course, students will demonstrate an understanding of:

1. Colligative Properties
 - a. Describe the origins and relative magnitudes of intermolecular forces.
 - b. Relate phase behavior to nature of intermolecular forces.
 - c. Define saturated solution, unsaturated solution, supersaturated solution, solubility, solute, and solvent.
 - d. Understand and perform calculations using Henry's Law
 - e. Calculate concentration in molality, molarity, mole fraction, and percent composition, and interconvert between these units.
 - f. Explain and calculate vapor pressure using Raoult's Law.
 - g. Explain other colligative properties, including freezing point depression, boiling, point elevation, and osmotic pressure.
 - h. Perform calculations using colligative properties, including molecular weight, freezing point depression, boiling point elevation and osmotic pressure.
 - i. Differentiate between the behaviors of non-ionizing and ionizing compounds in solution.
2. Kinetics
 - a. Discuss the meaning of the rate of a reaction.
 - b. Explain the factors that affect reaction rates.
 - c. Use the initial rate method to determine reaction order from experimental data.
 - d. Determine orders of reaction for reactants from data expressing changes in concentration as a function of longer times.
 - e. Use the rate law to determine the overall order of a reaction.

- f. Determine a reaction rate law from initial rate data.
- g. Describe the relationship between order of reaction and molecularity.
- h. Use experimental data to determine the rate law for a reaction.
- i. Use an integrated form of the rate expression to perform calculations relating reactant or product concentration with reaction time.
- j. Compare zero, first and second order rate reactions.
- k. Discuss the collision theory of a reaction rate.
- l. Use the Arrhenius equation to illustrate the relationship between energy of activation and rate law constant.
- m. Describe the relationships among the mechanism, the overall reaction and elementary steps.
- n. Identify reaction intermediates and catalysts in reaction mechanisms.
- o. Draw and interpret energy diagrams and illustrate the effect of a catalyst on the energy diagram.

3. Equilibrium Principles

- a. Explain the relationship between the terms reversible reaction and dynamic equilibrium.
- b. Write the general equilibrium constant expression and explain its significance.
- c. Calculate K_{eq} given equilibrium concentrations of reactants and products.
- d. Calculate equilibrium concentrations of reactants and products given the equilibrium concentration of other reactants and products.
- e. Calculate new equilibrium concentrations of reactants and products after an increase or decrease in the concentration of one of the reactants or products.
- f. Explain why the concentrations of pure liquids and solids are never used in equilibrium constant expressions.
- g. Show how the numerical value of the equilibrium constant changes when the stoichiometric coefficients are changed or the reaction is reversed.
- h. Explain the differences between the terms K_c and K_p and the relation of either to Q_c .
- i. Explain the difference between an equilibrium position and an equilibrium constant.
- j. Given K_{eq} and initial concentration of reactants and/or products, calculate the final concentrations of reactants and/or products.
- k. List and explain the external factors that can affect equilibria.
- l. Using LeChatelier's Principle, explain how changes in temperature, pressure, volume, or concentration affect the equilibrium position for a chemical reaction.

4. Equilibrium of Aqueous Solutions

- a. Use the definition of acids and bases to distinguish between strong and weak acids and bases, equilibrium relationships among them, and the aqueous properties of their salts.
- b. Use the concepts of pH, pOH, K_a , and K_b to calculate the pH of aqueous solutions of acids, bases, and their salts.
- c. Determine the specific species present in an aqueous solution and the concentrations of those species.
- d. Describe the shape of acid-base titration curves for strong acid-strong base, weak acid-strong base, strong acid-weak base and weak acid-weak base titrations.
- e. Describe the effect of common ions and calculate concentrations of all species present in solutions of weak acids and bases.
- f. Describe the ionization of polyprotic acid in aqueous solution.

- g. Explain the buffer effect, predict the influence of added acids and bases on buffers, and calculate the concentrations of species in solution (using acid or base dissociation constant expressions, or Henderson-Hasselbach equation).
- h. Calculate the pH of a buffer solution outside of the buffer region.
- i. Identify titration curves for strong, weak, and polyfunctional acids and bases.
- j. Understand the use of volumetric methods to determine the concentrations of species in solution.
- k. Understand application of indicators in titration.
- l. Write an equation to express the relationship between a solid solute and its constituent ions in a saturated solution.
- m. Calculate the K_{sp} from molar solubility and molar solubility from K_{sp} .
- n. Calculate the effect of a common ion on the molar solubility of a salt.
- o. Predict whether precipitation will occur when salt solutions are mixed and determine the concentration of ions remaining in solution after precipitation

5. Thermodynamics

- a. Explain the similarities and differences between such terms as enthalpy, entropy, and free energy.
- b. Explain how the First, Second, and Third Laws of Thermodynamics apply chemical and physical processes.
- c. Predict whether the entropy change in a given process is positive, negative, or near zero.
- d. Use data tables to determine enthalpy, entropy, and free energy changes.
- e. Explain how ΔH° , ΔS° , and ΔG° are related to reaction spontaneity.
- f. Explain how knowledge of ΔH° , ΔS° , and ΔG° allows one to predict the conditions under which a reaction will occur.
- g. Describe and calculate the relationship between the standard free energy of reaction and the equilibrium constant.
- h. Calculate ΔG for a chemical reaction that occurs under nonstandard conditions.

VI. Electrochemistry

- a. Describe galvanic and electrolytic cells and their operation, including the identification of half reactions at the anode and cathode.
- b. Write half reactions given a balanced redox reaction, and generate a balanced redox reaction given redox half reaction.
- c. Calculate cell potentials and determine spontaneity of oxidation/ reduction reactions.
- d. Understand and use-Faraday's Law.
- e. Understand and apply the relationship of thermodynamics to electrochemistry.
- f. Understand and use the Nernst Equation.
- g. Understand the relationship between the cell potential E and ΔG , and use this relationship in problem solving.
- h. Give examples of natural and/or commercial applications of electrochemical processes
- i. Use the activity series of metals (optional).

6. Optional Topics (alphabetical)

- a. Biochemistry.
- b. Coordination chemistry.
- c. Descriptive chemistry.
- d. Nuclear and radiochemistry.

- e. Organic chemistry.
- f. Solid state chemistry.

MINIMUM COURSE CONTENT

The following topics must be included. However, the course is not limited to these topics. The order of topics is up to the discretion of the instructor.

1. Liquids and solids
2. Properties of solutions
3. Chemical kinetics
4. Chemical equilibrium
5. Acids and bases
6. Applications of aqueous equilibria
7. Spontaneity, entropy, and free energy
8. Electrochemistry

STUDENT REQUIREMENTS AND METHOD OF EVALUATION

90 – 100 %	→ A
80 – 89 %	→ B
70 – 79 %	→ C
60 – 69 %	→ D
Below 60%	→ F

ASSESSMENT OF STUDENT GAIN

The purpose of assessing student learning at Neosho County Community College is to ensure the educational purposes of the institution are met and appropriate changes are made in program development and classroom instruction to allow for student success. The instructor(s) of this course will determine the methods of assessment most appropriate and complete an assessment report at the end of the course.

ATTENDANCE POLICY

1. NCCC values interactive learning which promotes student engagement in the learning process. To be actively engaged, the student must be present in the learning environment.
2. Unless students are participating in a school activity or are excused by the instructor, they are expected to attend class. If a student's absences exceed one-eighth of the total course duration, (which equates to one hundred (100) minutes per credit hour in a face-to-face class) the instructor has the right, but is not required, to withdraw a student from the course. Once the student has

been dropped for excessive absences, the registrar's office will send a letter to the student, stating that he or she has been dropped. A student may petition the chief academic officer for reinstatement by submitting a letter stating valid reasons for the absences within one week of the registrar's notification. If the student is reinstated into the class, the instructor and the registrar will be notified. Please refer to the Student Handbook/Academic Policies for more information

3. Absences that occur due to students participating in official college activities are excused except in those cases where outside bodies, such as the State Board of Nursing, have requirements for minimum class minutes for each student. Students who are excused will be given reasonable opportunity to make up any missed work or receive substitute assignments from the instructor and should not be penalized for the absence. Proper procedure should be followed in notifying faculty in advance of the student's planned participation in the event. Ultimately it is the student's responsibility to notify the instructor in advance of the planned absence.

ACADEMIC INTEGRITY

NCCC expects every student to demonstrate ethical behavior with regard to academic pursuits. Academic integrity in coursework is a specific requirement. Definitions, examples, and possible consequences for violations of Academic Integrity, as well as the appeals process, can be found in the College Catalog, Student Handbook, and/or Code of Student Conduct and Discipline.

ELECTRONIC DEVICE POLICY

Student cell phones and other personal electronic devices not being used for class activities must not be accessed during class times unless the instructor chooses to waive this policy.

NOTE

Information and statements in this document are subject to change at the discretion of NCCC. Students will be notified of changes and where to find the most current approved documents.

ACCOMMODATIONS

If you are a student with a disability who may need accommodation(s), in compliance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) of 1990, please notify the Dean of Student Services in the Student Services Office, Sanders Hall, 620-432-0304, on the Chanute Campus, or the Dean for the Ottawa and Online Campuses, 785-248-2798, on the Ottawa Campus as soon as possible. You will need to bring your documentation for review in order to determine reasonable accommodations, and then we can assist you in arranging any necessary accommodations.

NON-DISCRIMINATION POLICY

The following link provides information related to the non-discrimination policy of NCCC, including persons with disabilities. Students are urged to review this policy.

<http://www.neosho.edu/Departments/NonDiscrimination.aspx>

SEXUAL MISCONDUCT POLICY (TITLE IX)

At NCCC, it is the responsibility of an instructor to help create a safe learning environment in the classroom, including both physical and virtual classrooms. All instructors are considered mandatory reporters at NCCC, therefore any information regarding sexual misconduct that is shared by a student in one-on-one meetings with the instructor must be reported to appropriate personnel at the College. Instructors will keep the information private to the greatest extent possible, but it is not confidential. Generally, climate surveys, classroom writing assignments or discussions, human subjects research, or events such as Take Back the Night events do not provide notice that must be reported to the Coordinator by employees, unless the reporting party clearly indicates that they wish a report to be made.

The following link provides information related to the sexual misconduct policy of NCCC, including resources, reporting options, and student rights. Students are urged to review this policy.

<http://www.neosho.edu/TitleIX.aspx>

COURSE NOTES