KRSN CHM1020 Chemistry II and Lab for Majors

Equivalent courses from Kansas public institutions for which core outcomes apply:

INSTITUTION	COURSE ID	COURSE TITLE	CREDIT HOURS
Allen CC	CHE 136	Chemistry II	5
Barton CC	CHEM 1808	College Chemistry II	5
Butler CC	CH 115	College Chemistry 2	5
Cloud County CC	SC 132	Chemistry II	5
Coffeyville CC	CHEM 104	Principles of Chemistry II and Qualitative Analysis	5
Colby CC	CH 178	Chemistry II (with LAB)	5
Cowley CC	CHM 4230	Chemistry II	5
Dodge City CC	CHEM 112 or CHEM 114	College Chemistry II or Chemistry II	5 or 5
Fort Scott CC	CHE 1025	General Chemistry II with Lab	5
Garden City CC	CHEM 110	College Chemistry II	5
Highland CC	PS 112	College Chemistry II	5
Hutchinson CC	CH 106	Chemistry II	5
Independence CC	PHS 1035	Chemistry II for Majors	5
JCCC	CHEM 131 & CHEM 132	General Chemistry II Lecture and General Chemistry II Lab	4 & 1
KCKCC	CHEM 0112	College Chemistry II and Lab	5
Labette CC	CHEM 126	College Chemistry II	5
Neosho County CC	CHEM 225 & CHEM 226	College Chemistry II and College chemistry II Lab	3 & 2
Pratt CC	CHM 187	General Chemistry II and Qualitative Analysis	5
Seward County CC	CH 1515	College Chemistry II and Lab	5
FHTC	Not Offered	Not Offered	
Manhattan Tech	Not Offered	Not Offered	
NCK Tech	Not Offered	Not Offered	
NWKTC	Not Offered	Not Offered	
SATC	Not Offered	Not Offered	
WSU Tech	CHM 135	Chemistry II	5
ESU	CH 126 & CH 127	Chemistry II and Chemistry II Lab	3 & 1-2
FHSU	CHEM 122 & CHEM 122L	University Chemistry II and University Chemistry Lab	3 & 2
KSU	CHM 230	Chemistry II	4
KU	CHEM 135	General Chemistry II	5
PSU	CHEM 225 & CHEM 226	General Chemistry II and General Chemistry II Lab	3 & 2
Washburn	CH 152	Fundamentals of Chemistry	5
WSU	CHEM 212 & CHEM 212L	General Chemistry II and General Chemistry II Lab	5 & 0

For specific Institutional Transfer Articulation information, visit: kansasregents.org/institutional-transfer-information.

Revised 11/01/2019

Chemistry II and Lab for Majors - *KRSN CHM1020* CORE OUTCOMES

Course Effective Date: Summer 2014
Outcome Approval Date: Fall 2017
Next Outcome Review Date: Fall 2022

Upon completion of this course, students will be able to:

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 affect 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 Keq 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 Kc and Kp and the relation of either to Qc
i. Explain the difference between an equilibrium position and an equilibrium constant
j. Given Keq 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 LaChatelier'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, Ka, and Kb 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-week 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 Ksp from molar solubility and molar solubility from Ksp
   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

6. 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 reactions
    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)
7. Optional Topics (alphabetical)
    a. Biochemistry
    b. Coordination chemistry
    c. Descriptive chemistry
    d. Nuclear and radiochemistry
    e. Organic chemistry
    f. Solid state chemistry

LABORATORY PORTION OF THE CHEMISTRY II COURSE

Upon successful completion of this course, students will be able to:

1. Work in the laboratory in accordance with good laboratory practices
    a. Dress in an appropriate manner as to promote safety in the laboratory, wearing appropriate laboratory attire and goggles when anyone is working with chemicals in the laboratory
    b. Follow written directions accurately
    c. Work safely and effectively, using equipment and chemical carefully and correctly
    d. Demonstrate use of required techniques
    e. Dispose of waste products in a proper manner
    f. Know how to find and understand MSDS's for the chemicals used in a particular laboratory
2. Gather and record qualitative and quantitative data accurately
    a. Acquire data using balances and volumetric glassware
    b. Make and record visual observations
    c. Use computers, when appropriate, as data acquisition tools
    d. List or describe experimental assumptions made and any deviations from the written experimental procedures
3. Handle and evaluate data in logical, productive, and meaningful ways
    a. Create notebooks and laboratory reports that are clear, understandable, and accurately represent the data collected
    b. Display computer data in a spreadsheet or graphically, as appropriate
    c. Correlate observations with chemical or physical processes
    d. Carry out suitable calculations with quantitative data, recognizing when data and calculations are within a reasonable range
    e. Use observations of experimental data to present relevant conclusions pertaining to the experimental procedure
4. Correlate laboratory work with principal topics in College Chemistry II lecture