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

<table>
<thead>
<tr>
<th>INSTITUTION</th>
<th>COURSE ID</th>
<th>COURSE TITLE</th>
<th>CREDIT HOURS</th>
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<tbody>
<tr>
<td>Allen CC</td>
<td>CHE 125</td>
<td>College Chemistry I</td>
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<tr>
<td>Barton CC</td>
<td>CHEM 1806</td>
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<tr>
<td>Butler CC</td>
<td>CH 110</td>
<td>College Chemistry 1</td>
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<tr>
<td>Cloud County CC</td>
<td>SC 131</td>
<td>Chemistry I (Inorganic)</td>
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<tr>
<td>Coffeyville CC</td>
<td>CHEM 103</td>
<td>Principles of Chemistry I</td>
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<tr>
<td>Colby CC</td>
<td>CH 177</td>
<td>Chemistry I (with Lab)</td>
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<tr>
<td>Cowley CC</td>
<td>CHM 4220</td>
<td>Chemistry I</td>
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<tr>
<td>Dodge City CC</td>
<td>CHEM 111 or CHEM 113</td>
<td>College Chemistry I or Chemistry I</td>
<td>5 or 5</td>
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<tr>
<td>Fort Scott CC</td>
<td>CHE 1015</td>
<td>General Chemistry I with Lab</td>
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<tr>
<td>Garden City CC</td>
<td>CHEM 109</td>
<td>College Chemistry I</td>
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<tr>
<td>Highland CC</td>
<td>PS 111</td>
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<tr>
<td>Hutchinson CC</td>
<td>CH 105</td>
<td>Chemistry I</td>
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<td>Independence CC</td>
<td>PHS 1025</td>
<td>Chemistry I for Majors</td>
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<tr>
<td>JCCC</td>
<td>CHEM 124 &amp; CHEM 125</td>
<td>General Chemistry I Lecture and General Chemistry I Lab</td>
<td>4 &amp; 1</td>
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<tr>
<td>KCKCC</td>
<td>CHEM 0111</td>
<td>College Chemistry I and Lab</td>
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<td>Labette CC</td>
<td>CHEM 124</td>
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<td>Neosho County CC</td>
<td>CHEM 215 &amp; CHEM 216</td>
<td>College Chemistry I and College Chemistry I Lab</td>
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<td>Pratt CC</td>
<td>CHM 186</td>
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<td>Seward County CC</td>
<td>CH 1505</td>
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<td>FHTC</td>
<td>CH 125 &amp; CH 126</td>
<td>Chemistry I Lecture and Chemistry I Lab</td>
<td>3 &amp; 2</td>
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<tr>
<td>Manhattan Tech</td>
<td>CHM 110 or CHM 110A &amp; CHM 110B</td>
<td>Chemistry I Chemistry IA and Chemistry IB</td>
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<td>WSU Tech</td>
<td>CHM 125</td>
<td>Chemistry I</td>
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<tr>
<td>ESU</td>
<td>CH 123 &amp; CH 124</td>
<td>Chemistry I and Chemistry I Lab</td>
<td>3 &amp; 1-2</td>
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<tr>
<td>FHSU</td>
<td>CHEM 120 &amp; CHEM 120L</td>
<td>University Chemistry I and University Chemistry I Lab</td>
<td>3 &amp; 2</td>
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<tr>
<td>KSU</td>
<td>CHM 210</td>
<td>Chemistry I</td>
<td>4</td>
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<td>KU</td>
<td>CHEM 130</td>
<td>General Chemistry I</td>
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<tr>
<td>PSU</td>
<td>CHEM 215 &amp; CHEM 216</td>
<td>General Chemistry I and General Chemistry I Lab</td>
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<tr>
<td>Washburn</td>
<td>CH 151</td>
<td>Fundamentals of Chemistry I</td>
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<td>WSU</td>
<td>CHEM 211 &amp; CHEM 211L</td>
<td>General Chemistry I and General Chemistry I Lab</td>
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Upon completion of this course, students will be able to:

**LECTURE PORTION OF CHEMISTRY**

Content of the course will prepare students to:

1. Explain the processes involved in the scientific method and be able to apply it to investigate natural phenomena and solve problems
2. Explain the design and significance of experiments that led to the adoption of modern atomic theory
3. Recognize and interpret isotopic notation; understanding the relationship between average atomic masses and isotopic masses (example: calculating the average mass of an element given isotopic masses and natural abundance)
4. Relate atomic mass to composition in terms of subatomic particles
5. Descriptive chemistry of ionic and covalent compounds
   a. Learn the names and symbols (or formulas) for often-used elements, simple and polyatomic ions, Arrhenius acids and bases, and simple ionic and covalent compounds
   b. Describe and identify Arrhenius, Bronsted-Lowery, and Lewis acids and bases
   c. Identify conjugate acids and bases
   d. Determine the valence electron configuration of the s and p block elements and the 3d metals
   e. Determine oxidation states and assign oxidation numbers of atoms in simple ions, and the central atoms of polyatomic ions and covalent compounds
   f. Use the valence electron configuration to predict common oxidation numbers of group 1, 2, 13, 16, and 17 elements
   g. Define periodic trends in electronegativity, ionization energy and electron affinity, and relate them to the electron configuration of the element
   a. Describe general properties of solutions
   b. Understand the forces that affect the aqueous solubility of materials
   c. Calculate the molar concentration of a solute
   d. Describe procedures for preparing a solution of known molarity
7. Chemical reactions and stoichiometry
   a. Classify chemical reactions and predict whether simple chemical reactions will proceed
   b. Employ stoichiometric reasoning in evaluating reactions of gases, liquids and solids
   c. Perform calculations that employ relationships involving masses, formula units, and the mole relationships
   d. Determine empirical and molecular formula from appropriate data
   e. Demonstrate the ability to balance chemical equations
   f. Discuss solubility rules
   g. Write net ionic equations based on solubility rules
   h. Balance simple acid base reactions
   i. Define oxidation and reduction
   j. Balance simple redox reactions and determine the identity of the oxidizing and reduction agents
   k. Determine limiting reagents from stoichiometric data; calculate the maximum product yield, and leftover reagent
   l. Calculate theoretical yield from stoichiometric data
8. Properties of solids, liquids, and gases
   a. Describe the origins and relative magnitudes of intermolecular forces
   b. Relate phase behavior to nature of intermolecular forces
   c. Compare general properties of solids, liquids and gases; including density, compressibility, heat capacity, and randomness intermolecular forces
   d. Describe phase transitions and phase diagrams (e.g. triple point and critical point)
e. Understand general properties of gases
   i. Describe properties and temperatures of gasses to kinetic molecular theory.
   ii. Understand and employ ideal gas laws
f. Understand general properties of liquids
g. Understand general properties of solids
   i. Compare and contrast properties of ionic, molecular and metallic solids

9. Describe, define, and perform calculations involving the following basic concepts of thermodynamics:
   a. Heat capacity
   b. Calorimetry
   c. Heat/Work/Energy
   d. Enthalpy/Standard states
   e. Hess’s Law
   f. Heat of formation
   g. Phase changes/Energy
   h. Use of other thermodynamic cycles in the determination of thermodynamic quantities, such as the lattice energy of an ionic solid

10. Conceptually and quantitatively relate spectroscopic observation of atoms to quantum mechanical theories
    a. Describe the historical development of and distinction between classical and wave mechanics.
    b. Describe the radial and angular dependence of solutions to the Schroedinger equation for hydrogen-like atoms (s, p, d orbitals)
    c. Describe the behavior of photons and electrons during electronic transitions between principle quantum levels and calculate the wavelength and frequency of light involved in these transitions
    d. Using the Aufbau principle, write the electron configuration of many electron atoms and monatomic ions
    e. Relate quantum mechanical theory to the organization of the periodic table and the periodic properties of elements

11. Molecular Bonding and Structure
    a. Describe the characteristics of ionic and covalent bonding
    b. Draw Lewis dot structures for atoms, simple ionic and molecular compounds
    c. Predict the shape of simple molecules and ions using VSEPR theory
    d. Explain how electronegativity differences relate to bond polarity
    e. Identify polar and non-polar molecules
    f. Understand valence bond descriptions of molecular structure and bonding
    g. Understand hybridization, including sp³, sp² and sp hybridization
    h. Predict hybridization from VSEPR structures
    i. Determine bond orders and relate them to relative bond strength
    j. Describe the MO theory description of bonding and antibonding orbitals
    k. Relate MO theory to concepts such as the structural, energetic, spectroscopic, and magnetic properties of molecules

LABORATORY PORTION OF THE CHEMISTRY I COURSE

Upon 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 principle topics in Chemistry I lecture