MASTER COURSE OUTLINE

A. CHEM 1210 Honors General Chemistry I

B. COURSE DESCRIPTION:

This honors section of General Chemistry I is an enriched study of chemistry that includes a guided inquiry-based lab and deeper understanding of scientific experimentation. This course is also the first course of a two semester sequence in general inorganic chemistry, Atomic Theory, stoichiometry, chemical reactions, thermochemistry, chemical bonding, molecular structure, and atomic structure, periodicity, and the gas phase. Students will also develop critical thinking necessary to evaluate basic scientific publications and determine the validity of the research reported. Honors courses emphasize independent inquiry, informed discussion making, and direct application of course content. Unlike CHEM 1201, experiments performed in this course will cover multiple concepts and relate to real-world concepts to better incorporate a real-world laboratory experience. This course is for students intending to transfer or pursue Bachelor's preparation and/or careers in chemistry and the other physical sciences, engineering and health sciences (medicine, pharmacy, veterinary medicine, four-year nursing). Prerequisite: Math 1110 or higher or concurrent registration in Math 1110 or higher.
MnTC (Goals 3/NS and 10/PE); (5 Cr – 3 lect, 2 lab)

C. *MnTC Discipline: Natural Sciences **Core Theme: People and the Environment

D. RIVERLAND INSTITUTIONAL LEARNING OUTCOMES

This course addressed the following Riverland Institutional Learning Outcome(s):
☐ ILO 1: critical thinking *(Core Theme Goal 2)*
☐ ILO 2: awareness of the larger global community *(Core Theme Goal 7 or 8)*
☒ ILO 3: ethical, engaged citizenship *(Core Theme Goal 9 or Goal 10)*
☐ ILO 4: communication and collaboration *(Discipline Goal 1 and by any learning outcome(s) involving communication or collaboration)*

E. MAJOR CONTENT AREAS:

- The Scientific Method
- Nomenclature
- Atomic Structure
- Stoichiometry
- Reaction Types

- Thermochemistry
- Molecular Structure – Bonding, Geometry and Polarity
- States of Matter – Gas Phase
- Experimental Validity

F. GOAL TYPE, OBJECTIVES AND OUTCOMES:

GOAL TYPE	**OBJECTIVES** **Students will be able to**	**OUTCOMES** **The student will successfully**
MnTC Goal 3a	demonstrate understanding of scientific theories.	1. explain the primary chemical theories and laws, differentiating between a theory and a law. 2. apply knowledge of scientific theories to problem-solving applications. 3. complete a critical analysis of laboratory experimental findings.
MnTC Goal 3b	formulate and test hypotheses by performing laboratory, simulation or field experiments in at least two of the natural science disciplines. One of these experimental components should develop, in greater depth, students' laboratory experience in the collections of data, its statistical and graphical analysis, and an appreciation of its sources or error and uncertainty.	1. apply the scientific method to formulate and test hypotheses in lab experimentation. 2. conduct literature research on concepts discussed in the laboratory. 3. complete an analysis of laboratory experimental results (data) that will include calculations of accepted value, experimental value and % error design.
MnTC Goal 3c	communicate their experimental findings, analyses and interpretations both orally and in writing.	1. discuss the results of the experiments referenced in MnTC Goal 3b in oral and written formats, including predictions, graphs, and calculations.
MnTC Goal 10b	discern patterns and interrelationships of bio-physical and sociocultural systems.	1. explain how pollutants impact water quality. 2. research a current topic on the environment and its impact on the environment and human health. 3. explain how contaminated drinking water can impact human health.
MnTC Goal 10d	evaluate critically environmental and natural resource issues in light of understandings about interrelationships, ecosystems, and institutions.	1. explain sources of human impact on the environment related to a current environmental topic. 2. report on a current environmental topic as outlined below. Assess their potential impact on the environment and how to address the issue researched.
MnTC Goal 10e	propose and assess alternative solutions to environmental problems.	1. explain the potential impact of pollutants on drinking and groundwater.
MnTC Goal 10f	articulate and defend the actions they would take on various environmental issues.	1. explain their stance, using supporting information, on the

		current environmental topic discussed under MnTC Goal 10d.
CS	gather factual information and apply it to a given problem in a manner that is relevant, clear, comprehensive, and conscious of possible bias in the information selected.	1. research, compile, and complete an analysis of scientific findings on the chemistry of a current environmental topic discussed in MnTC Goal 10d. 2. develop opinion on scientific topics supported by empirical facts.
CS	utilize scientific literature to explore topics in chemistry.	1. determine if a source is reliable. 2. explain the peer-review process. 3. evaluate a source for bias. 4. distinguish between primary, secondary, and tertiary sources.
CS	describe and apply the scientific method used by scientists in solving problems.	1. apply knowledge of scientific theories to problem-solving applications. 2. develop a hypothesis for a scientific experiment. 3. identify the control, independent and dependent variable for an experiment. 4. predict next steps for a scientific study using data that has been collected. 5. draw conclusions based on experimental data.
CS	apply dimensional analysis with proper attention to units and significant figures.	1. express numbers in scientific and normal notation. 2. express values using the correct number of significant figures. 3. express measurements in and convert between metric units.
CS	determine the number of significant digits in a number and round numbers and calculated results to an appropriate number of significant figures.	1. identify the number of significant figures in a value. 2. complete calculations using the correct number of significant figures. 3. determine the accuracy and precision of a set of data.
CS	demonstrate mastery of density.	1. experimentally determine the density of an object.
CS	distinguish between mixtures, compounds and elements.	1. identify a mixture and explain separation by physical means. 2. articulate the relationship between elements and compounds.
CS	demonstrate mastery of scientific laws	1. explain the Law of Conservation of Matter. 2. explain the Law of Multiple Proportions. 3. explain the Law of Definite Proportions.

CS	determine the makeup and structure of an atom.	1. describe electrons, protons, neutrons and the general structure of the atom. 2. define isotope and determine the atomic number, mass number, and number of neutrons for a specific isotope. 3. identify the atomic number and atomic mass for any element. 4. calculate the average atomic mass of an element from isotopic abundances and isotopic masses. 5. correlate wavelength, frequency, and energy of light with electron energy levels in the atom via and photoelectric effect and the Bohr model. 6. apply wave-particle duality and the uncertainty principle to describe properties of electrons. 7. apply the results of the Schrodinger quantum mechanical model of the atom to assign quantum numbers to electrons and write electron configurations of multi-electron atoms and ions. 8. identify valence vs core electrons and predict trends in atomic size, ionization energy, electron affinity, and charges on main-group ions.
CS	name chemical compounds.	1. write the name of a polyatomic ion from the formula. 2. write the formula of a polyatomic ion from the name. 3. write chemical formulas for ionic compounds from the name. 4. write names for ionic compounds given the formula. 5. write chemical formulas for covalent compounds from the name. 6. write names for covalent compounds given the formula.
CS	demonstrate stoichiometric relationships.	1. calculate molar mass from a chemical formula. 2. calculate number of particles in an amount of substance using Avogadro's number. 3. balance chemical equations. 4. calculate produce and reactant amounts using stoichiometry relationships. 5. determine the limiting reagent in a reaction. 6. calculate percent yield.

		7. determine the empirical formula of an unknown compounds using composition by mass or combustion analysis data. 8. calculate the mass, volume or molarity using molarity. 9. determine how to prepare a solution of a given molarity form the solute and water or by dilution of a more concentrated solution. 10. apply titration principles to determine the concentration of a known aqueous solution.
CS	write chemical reactions.	1. identify insoluble ionic compounds. 2. predict products in chemical reactions. 3. write net ionic equations. 4. identify spectator ions. 5. identify strong and weak acids and bases. 6. identify oxidizing and reducing agents in precipitation reactions. 7. identify acid-base and redox reactions.
CS	demonstrate an understanding of thermochemistry.	1. explain the First Law of Thermodynamics and express relationships among heat, work, energy, and enthalpy. 2. apply thermochemical equations to relate amount to heat energy to the quantity of substance reacted. 3. calculate heat transferred using temperature measurements, heat capacity or specific heats. 4. apply Hess's Law and enthalpies of formation to determine enthalpies of reaction. 5. calculate reaction enthalpies using calorimetry data.
CS	demonstrate an understanding of molecular structure.	1. describe bonding in pure covalent, polar covalent, and ionic structures. 2. draw Lewis structures for compounds including resonance, formal charge, and exceptions to the octet rule. 3. interpret VSPER Theory, Valance Bond Theory, and Molecular Orbital Theory to predict molecular shape, polarity and bonding.
CS	demonstrate an understanding of the gas phase of matter.	1. explain the major points of the kinetic molecular theory of gases. 2. describe the relationship between pressure, volume, moles, and temperature using gas laws.

		3. write the equation for the ideal gas law and use it in calculations. 4. apply Dalton's Law to determine the mole fraction, partial pressures, and the total pressure of a gas mixture.
CS	demonstrate proper laboratory technique.	1. conduct laboratory work in compliance with guidelines for personal lab safety and responsible management of chemical waste; this includes appropriate use of personal protective equipment and interpretation of Globally Harmonized System for Hazard Communication (GHS) labels. 2. measure quantities such as mass, volume, temperature, and absorbance with proper technique, and record the results of measurements with the appropriate number of significant figures and units. 3. record observations of chemical processes (such as precipitate formation, gas evolution, etc.) and write chemical reactions consistent with their observations. 4. demonstrate proper techniques for laboratory procedures, such as titration, filtration, solution preparation, spectrophotometric measurements, etc. 5. demonstrate proper use of glassware and equipment including beakers, Erlenmeyer flasks, volumetric pipets, burets, volumetric flasks, watch glasses, graduated cylinders, filtration apparatus, single-beam spectrophotometer, pH meter, balances. 6. communicate lab procedures, observations, and results in the form of laboratory notebook, written reports, and verbal presentations effectively. 7. interpret and analyze qualitative observations and quantitative results, incorporating graphs and tables as appropriate. 8. develop laboratory procedures for basic chemistry experiments while meeting the outcomes listed above.

G. SPECIAL INFORMATION:

This course may require use of the Internet, the submission of electronically prepared documents and the use of a course management software program. Students who have a disability and need accommodations should contact the instructor or the Student Success Center at the beginning of the semester. This information will be made available in alternative format, such as Braille, large print, or current media, upon request. This course will cover the characteristics of hazardous wastes and its safe handling, storage, and disposal.

H. COURSE CODING INFORMATION: Course Code C/B; Class Maximum 48/24; Letter Grade

Revision date: 9/22/20; 2/24/22
AASC Approval date: 12/18/18; 10/27/20; 4/19/22

***Riverland Community College Disciplines**	**MnTC Goal Number**
Communication (CM)	**1**
Natural Sciences (NS)	**3**
Mathematics/Logical Reasoning (MA)	**4**
History and the Social & Behavioral Sciences (SS)	**5**
Humanities and Fine Arts (HU)	**6**

****Riverland Community College Core Themes**	**MnTC Goal Number**
Critical Thinking (CT)	**2**
Human Diversity (HD)	**7**
Global Perspective (GP)	**8**
Ethical and Civic Responsibility (EC)	**9**
People and the Environment (PE)	**10**

*These five MnTC Goals have been identified as Riverland Community College Disciplines.
** These five MnTC Goals have been identified as Riverland Community College Core Themes.
NOTE: The Minnesota Transfer Curriculum "10 Goal Areas of Emphasis" are reflected in the five required discipline areas and five core themes noted in the Riverland Community College program of study guide and/or college catalog.