MINNESOTA WEST COMMUNITY & TECHNICAL COLLEGE
COURSE OUTLINE

DEPT. CHEM **COURSE NUMBER: 1102**

NUMBER OF CREDITS: 4 **Lecture: 3 Lab: 1 OJT: 0**

Course Title:
General Chemistry II

Catalog Description:
General Chemistry II continues CHEM 1101 with emphasis on liquids, solids, solutions and solubility, kinetics, equilibrium, acids and bases, thermodynamics, electrochemistry, coordination compounds, and nuclear chemistry. This course is for students considering a major in science, pre-engineering, or pre-health (medicine, pharmacy, veterinary medicine, four-year nursing). This course includes a lab. Prerequisite: CHEM 1101.

FULFILLS MN TRANSFER CURRICULUM AREA(S) *(Leave blank if not applicable)*

Goal 3: Natural Sciences: _X_ by meeting the following competencies:

- Demonstrate understanding of scientific theories.
- 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 collection of data, its statistical and graphical analysis, and an appreciation of its sources of error and uncertainty.
- Communicate their experimental findings, analyses, and interpretations both orally and in writing.
- Evaluate societal issues from a natural science perspective, ask questions about the evidence presented, and make informed judgments about science-related topics and policies.

Prerequisites or Necessary Entry Skills/Knowledge:
CHEM 1101

Topics to be Covered
Liquids and solids
Solutions and colloids
Kinetics
Fundamental equilibrium concepts

Acid-base equilibrium
Equilibria of other reaction classes
Thermodynamics
Electrochemistry
Nuclear chemistry

Student Learning Outcomes

States of matter: intermolecular forces, liquids, and solids

1. Identify the dominant intermolecular force for a molecular compound
2. Make qualitative predictions (rankings) concerning the physical properties (such as melting point, boiling point, viscosity, surface tension, vapor pressure etc.) of various liquids on the basis of their intermolecular forces
3. Describe the molecular interactions that differentiate solids, liquids, and gases
4. Describe and calculate the energies of phase changes
5. Identify phase changes and interpret phase diagrams

States of matter: solutions

6. Describe the energetics of solution formation
7. Calculate and convert between the solution concentrations of percent, molarity, molality, and mole fraction
8. Describe and perform mathematical calculations of solution colligative properties (such as vapor pressure lowering, freezing point depression, boiling point elevation, and osmotic pressure)

Kinetics

9. Determine the order of a reaction from the rate law
10. Apply the integrated rate law and half-life equations for zero-order, first-order, and second-order reactions
11. Describe how temperature, activation energy, and molecular orientation influence reaction rates, including the Arrhenius equation
12. Determine the rate law from a reaction mechanism
13. Describe how a catalyst influences the rate of a reaction

Equilibrium: general

14. Write equilibrium constant expressions for chemical equations and find equilibrium concentrations from initial concentrations and the equilibrium constant
15. Determine the effect of concentration change, volume change, temperature change, and addition of a catalyst on equilibrium using Le Chatelier's Principle

Equilibrium: acid-base

16. Define and identify acids and bases using the Arrhenius, Brønsted-Lowry, and Lewis definitions; relate strengths of acids and bases to their conjugate pairs
17. Analyze equilibria of acids and bases using acid and base dissociation constants
18. Calculate pH of acids, bases, and buffers solutions and construct acid/base titration curves

Equilibrium: solubility

19. Calculate Ksp using solubility data
20. Use Ksp to determine solubility of pure compounds and in the presence of a common ion
21. Describe the factors the affect solubility, including the common ion effect, pH, and complex ion formation

Equilibrium: electrochemistry

22. Determine oxidation numbers and balance aqueous redox reactions in acidic and basic solutions

23. Calculate standard potentials for electrochemical cells and relate to standard free energy, potentials under nonstandard conditions, and the equilibrium constant

Equilibrium: thermodynamic foundations

24. Calculate ΔH, ΔS, and ΔG for phase transitions and chemical reactions, using appropriate standard values from thermodynamic tables. This includes finding the temperature range (and the value of T*), over which a reaction is spontaneous
25. Apply the relationships between thermodynamic quantities such as enthalpy, entropy, and Gibbs energy, and the direction of change in natural processes
26. Predict, on the basis of qualitative reasoning, the sign of ΔS for reactions and phase transitions
27. Relate thermodynamic data (ΔH, ΔS, and ΔG) to the value of the equilibrium constant for a reaction (and vice versa)

Nuclear chemistry

28. Write balanced nuclear equations
29. Identify types of nuclear reactions including radioactive decay, fission and fusion
30. Analyze first-order decay of radionuclides

Broad-based laboratory competencies

31. 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
32. 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
33. Record observations of chemical processes (such as precipitate formation, gas evolution, etc.) and write chemical reactions consistent with their observations
34. Use proper techniques for laboratory procedures, such as titration, filtration, solution preparation, spectrophotometric measurements, etc.
35. Properly use glassware and equipment including beakers, Erlenmeyer flasks, volumetric pipets, burets, volumetric flasks, watch glasses, graduated cylinders, filtration apparatus, single-beam spectrophotometer, pH meter, balances
36. Effectively communicate lab procedures, observations, and results in the form of laboratory notebook, written reports, and verbal presentation
37. Interpret and analyze qualitative observations and quantitative results, incorporating graphs and tables as appropriate

Is this course part of a transfer pathway: Yes	**X**	**No**	

Revised 10/21