

HIBBING COMMUNITY COLLEGE COURSE OUTLINE

COURSE NUMBER & TITLE: CHEM 1610 - General Chemistry 1

CREDITS: 5 (4 Lec/1 Lab)

PREREQUISITES: High school chemistry or CHEM 1110: Aspects of Chemistry and high school algebra or equivalent, or consent of instructor

CATALOG DESCRIPTION:

General Chemistry 1 is a study of the fundamental theories and principles of chemistry. Topics include measurement, nomenclature, basic chemical reactions, stoichiometry, thermodynamics, kinetics, equilibrium, electron configurations, and periodic properties. General Chemistry 1 is meant for students majoring in engineering, science, or medicine, as well as liberal arts studies. MNTC goal areas: (3)Natural Science.

OUTLINE OF MAJOR CONTENT AREAS:

- I. The nature of chemistry
 - A. Definition of science
 - B. Scientific method
 - C. Definition of chemistry
- II. The nature of matter
 - A. Physical properties
 - B. Mixtures and pure substances
 - C. Elements and atoms
 - D. Compounds and molecules
 - E. Chemical change
- III. Mathematical operations
 - A. Dimensional analysis
 - B. Significant figures
 - C. Scientific notation
 - D. Units of measurement
- IV. Chemical elements
 - A. Origins of atomic theory
 - B. Atomic structure
 - C. Atomic composition
 - D. Isotopes
 - E. Atomic weight
 - F. The periodic table
- V. Chemical compounds
 - A. Molecular compounds
 - B. Ionic compounds
 - C. Nomenclature

- D. The mole
- E. Empirical and molecular formulas
- VI. Chemical reactions
 - A. Chemical equations
 - B. Properties of compounds in aqueous solution
 - C. Combination reactions
 - D. Decomposition reactions
 - E. Exchange reactions
 - F. Oxidation-Reduction reactions
- VII. Stoichiometry
 - A. Weight relations in chemical reactions
 - B. Limiting reactants
 - C. Percent yield
 - D. Chemical analysis
 - E. Working with solutions
 - D. Stoichiometry of reactions in aqueous solution
- VIII. Thermodynamics
 - A. Energy units
 - B. Heat capacity and specific heat
 - C. Calorimetry
 - D. Enthalpy
 - E. Hess's Law
 - F. Standard enthalpies of formation
 - G. Entropy
 - H. Gibb's free energy
- IX. Kinetics
 - A. Reaction rate
 - B. Effects of concentration
 - C. Mechanisms
 - D. Activation energy
 - E. Effects of temperature
 - F. Catalysts
- X. Equilibrium
 - A. Equilibrium constant
 - B. Le Chatelier's Principle
- XI. Electron configurations and periodicity
 - A. EM radiation
 - B. Models of the atom
 - C. Electron configurations
 - D. Periodic trends in atomic properties
 - E. Periodic trends in properties of the elements

COURSE GOALS/OBJECTIVES/OUTCOMES:

Students will

1. explain the difference between chemical and physical change.

2. explain the difference between elements and compounds, and homogeneous and heterogeneous mixtures.
3. use dimensional analysis to carry out conversions and other calculations.
4. use density as a way to connect volume and mass of a substance.
5. use the concept of percent in calculations in chemistry.
6. explain the historical development of the atomic theory and identify some of the scientists who made important contributions.
7. describe electrons, protons, neutrons, and the general structure of the atom.
8. define isotope, give mass number and number of neutrons for a specific isotope, and calculate atomic weight of an element from isotopic abundances.
9. identify chemical families within the periodic table of the elements and use the periodic table to predict properties of elements and formulas of simple compounds.
10. interpret the meaning of molecular formulas, condensed formulas, and structural formulas.
11. predict the charges on simple ions of metals and non-metals and give the name, formulas and charges of common polyatomic ions.
12. write the formulas and name selected ionic compounds and simple binary compounds of the non-metals.
13. explain the concept of the mole and calculate the number of moles of an element or compound that are represented by a given mass, and vice versa.
14. express molecular composition in terms of percent composition and then use percent composition and molar mass to determine the empirical and molecular formulas of a compound.
15. balance simple chemical equations and interpret the information conveyed by a balanced chemical equation.
16. explain how aqueous solutions are formed, and summarize the differences between electrolytes and non-electrolytes.
17. predict the solubility of ionic compounds in water.
18. write net ionic equations.
19. predict products of common types of chemical reactions: combination, decomposition, exchange, precipitation, acid-base, and gas forming.
20. recognize oxidation-reduction reactions and common oxidizing and reducing agents.
21. calculate the mass of one reactant or product from the mass of another reactant or product using the balanced chemical equation.
22. determine which of two reactants is the limiting reactant.
23. explain the differences among actual yield, theoretical yield, and percent yield, and calculate theoretical and percent yield.
24. define concentration (molarity) and calculate the molarity of a given solution from amounts of solute and solvent, or by dilution of a more concentrated solution.
25. explain how a titration is carried out, explain standardization, and calculate concentrations or amounts of reactant from titration data.
26. recognize and use the language of thermodynamics.
27. apply Hess's Law to find enthalpy changes for a reaction.
28. describe how one can measure the quantity of heat energy transferred in a

- reaction by using a calorimeter.
29. explain the concept of entropy and use it to determine the direction of the entropy change for a process.
 30. describe the connection between enthalpy and entropy changes for a reaction and the Gibbs free energy.
 31. describe the effect on reaction rates of changes in temperature and reactant concentrations.
 32. show by using an energy plot what happens as two reactant molecules interact to form product molecules and how a catalyst affects a reaction rate.
 33. use rate data to write a rate equation, and use a rate equation to predict how a reaction rate varies with changing concentration.
 34. write equilibrium constant expressions, given balanced chemical equations.
 35. make qualitative predictions about the extent of reaction based upon equilibrium constant values.
 36. calculate a value of K using equilibrium concentrations or calculate an equilibrium concentration if K is known.
 37. show by using Le Chatelier's Principle how changes in concentrations and temperature affect chemical equilibria.
 38. list the factors affecting chemical reactivity.
 39. explain the relationship between Planck's Quantum Theory and the energy absorbed or emitted when electrons in atoms change energy levels.
 40. explain the use of the quantum mechanical model of the atom to represent the energy and probable location of electrons.
 41. use the periodic table to write the electron configurations of atoms and ions, and to predict trends in the radii of atoms and ions, ionization energies, and periodic properties.
 42. explain variations in electron configurations, ion formation, and paramagnetism of transition metals.
 43. perform laboratory experiments relevant to the lecture material studied.
 44. collect and interpret data, both statistically and graphically.
 45. present written findings of their experiments.
 46. gain a deeper understanding of the role of science in everyday life and the implications of a scientifically illiterate public.

MNTC GOALS AND COMPETENCIES MET:

Natural Sciences

HCC COMPETENCIES MET:

Thinking Creatively & Critically

STUDENTS ASSESSMENT SHALL TAKE PLACE USING INSTRUMENTS SELECTED/DEVELOPED BY THE COURSE INSTRUCTOR

SPECIAL INFORMATION: (SPECIAL FEES, DIRECTIVES ON HAZARDOUS MATERIALS, ETC)

Hazardous chemicals will routinely be used in laboratory. Students will be supplied with pertinent information relating to these materials at the appropriate time.

AASC APPROVAL DATE: December 19, 2012

REVIEW DATE: December 2017

CHEM1610:so
121912