**CHEMISTRY 112—General Chemistry I**

**Department:** Chemistry

**Designation:** Required

**Catalog Data:** (3-0) 3 credits. Prerequisite: MATH 102. An introduction to the basic principles of chemistry for students needing an extensive background in chemistry (including chemistry majors, science majors, and pre-professional students). Completion of a high school course in chemistry is recommended.

**Prerequisites:**

1. A minimum of one year of high school chemistry.
2. Concurrent enrollment in, or completion of, Math 102 or a score on the math placement exam sufficient to place in Math 115 or higher.

**Textbook:** Chang, Raymond. *Chemistry,* 9th ed., McGraw-Hill: New York, 2007

Optional: Cruickshank, Brandon and Chang, Raymond. *Student Solutions Manual for use with Chemistry,* 9th ed., McGraw-Hill: New York, 2007.

**Course Learning Outcomes:**

1. Understand, and use correctly, the symbolic representations, chemical notation, formulas, and systematic rules of nomenclature that characterize the language of chemistry.
2. Understand and apply the mole concept in a variety of chemical calculations, including calculating the number of particles in a given mass of substance (and vice versa), and the quantitative relationships between reactants and products in a chemical reaction.
3. Recognize the different types of chemical transformations: acid-base, precipitation, combination, decomposition, single-replacement, oxidation-reduction, double replacement, and combustion.
4. Understand the basic principles of energy transfer involving chemical systems, including the transfer of heat and work between system and surroundings, the qualitative and quantitative interpretation of thermochemical equations, and the application of Hess’s Law.
5. Understand the various models of atomic structure, the basic principles of quantum theory, and the experiments that led to those principles.
6. Write ground-state electron configurations for atoms and ions of any representative element and the 3d transition series elements.
7. Understand the fundamental aspects of chemical bonding, including writing Lewis structures, describing the bonding in molecules by simple valence-bond theory, and using Valence Shell Electron Pair Repulsion Theory to predict the geometries of molecules and ions.
8. Use modern atomic theory to understand and predict the properties of different elements.
9. Understand the properties of the different states of matter.
10. Qualitatively and quantitatively describe the properties of the gaseous state and the fundamental laws governing the behavior of gases.
11. Understand, qualitatively and quantitatively, the behavior of solutions and their colligative properties.
12. Understand how fundamental intermolecular interactions among particles determine the physical and chemical properties of a system.
13. Understand the fundamental postulates of kinetic-molecular theory and use them to explain the physical behavior of the three states of matter.

**Topics:** Topics treated in the first semester are: measurements, atomic theory, stoichiometry, thermochemistry, states of matter, periodicity, bonding, and physical properties of solutions.

**Class/Laboratory Schedule:** Varies

**Contribution to Criterion 5:** 3 credits of math / basic sciences

**Relationship of Course to ABET Outcomes (a) through (k)**

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| --- | --- | --- | --- |
|  | **Level of Emphasis** | | |
|  | Low | Medium | High |
| **ABET Outcome** |  |  |  |
| (a) an ability to apply knowledge of mathematics, science, and engineering |  |  | X |
| (b) an ability to design and conduct experiments, as well as to analyze and interpret data |  | X |  |
| (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability |  |  |  |
| (d) an ability to function on multidisciplinary teams |  |  |  |
| (e) an ability to identify, formulate, and solve engineering problems |  | X |  |
| (g) an ability to communicate effectively |  |  |  |
| (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context |  |  |  |
| (i) a recognition of the need for, and an ability to engage in life-long learning |  |  |  |
| (j) a knowledge of contemporary issues |  |  |  |
| (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. |  | X |  |

**Prepared By:** Dr. Duane Hrncir, Ph.D. Chemistry and Provost and Vice President for Academic Affairs, June 1, 2010