DeAnza College

Credit- Degree applicable
Effective Quarter: Fall 2015

I. Catalog Information

CHEM 10 Introductory Chemistry 5 Unit(s)

(See general education pages for the requirement this course meets.)

Advisory: EWRT 211 and READ 211 (or LART 211), or ESL 272 and 273; MATH 212 or equivalent.

Four hours lecture, three hours laboratory (84 hours total per quarter).

An introduction to the discipline of chemistry, including chemical laboratory techniques and methods and a survey of important chemical principles. The course emphasizes chemistry as a subject of scientific inquiry and is designed to give the student a general appreciation for chemistry as a science.

Student Learning Outcome Statements (SLO)

Develop problem solving techniques by applying the "Scientific Method" to chemical data.

Analyze and solve chemical questions utilizing information presented in the periodic table of the elements.

Evaluate current scientific theories and observations utilizing a scientific mindset and an understanding of matter and the changes it undergoes.

II. Course Objectives

A. Examine the historical development of concepts concerned with the fundamental building blocks of matter - atoms and molecules - and their concomitant effect on our understanding of molecular structure.

B. Assess the importance of the mole concept in stoichiometric calculations.

C. Explore the relationship between the molecular structures of compounds and their effect on the chemical properties of compounds.

D. Explore the contributions of men and women from a variety of cultures and ethnic backgrounds to the field of chemistry.

E. Evaluate ethical issues and environmental effects, from local to global, that have arisen from the extraction, use and disposal of chemicals.

III. Essential Student Materials

Safety glasses, laboratory notebook

IV. Essential College Facilities

Fully equipped chemical laboratory including, at a minimum, the following: consumable chemicals, chemical balances, glassware, molecular models, fume hoods, chemical disposal facilities, lockable student storage areas, and laboratory technician.

V. Expanded Description: Content and Form

A. Examine the historical development of concepts concerned with the fundamental building blocks of matter - atoms and molecules - and their concomitant effect on our understanding of molecular structure.

- **1.** Atomic theory of matter
  - **a.** Law of definite proportions
  - **b.** Law of multiple proportions
  - **c.** Dalton's atomic theory
  - **d.** Bohr model of the atom
- **2.** Periodic table of the elements
- **3.** Radiodecay
- **4.** Quantum mechanics

B. Assess the importance of the mole concept in stoichiometric calculations.

- **1.** Establishing chemical formulas
  - **a.** The mole and its relationship to the gram
  - **b.** Atomic and molecular mass
  - **c.** Percent composition
  - **d.** Nomenclature of simple molecules
- **2.** Reaction stoichiometry
  - **a.** Dimensional analysis and conversion factors
  - **b.** Solutions and calculating concentration
  - **c.** Theoretical yield, actual yield, and percent yield
  - **d.** Acid-base reactions and titration

C. Explore the relationship between the molecular structures of compounds and their effect on the chemical properties of compounds.

- **1.** Covalent and ionic bonding
- **2.** Molecular geometries
- **3.** Molecular dipoles and polarity

4. Intermolecular forces and their effects on physical properties of a substance.

D. Explore the contributions of men and women from a variety of cultures and ethnic backgrounds to the field of chemistry.

1. Contributions of individuals to areas of chemical research, such as but not limited to the following:
   - **a.** Greek origins of atomic theory - Leucippus and Democritus
   - **b.** Alchemy and the flourishing of science in the Islamic world - al-Razi
   - **c.** Development of the Scientific Method - Francis Bacon, Rene Descartes
   - **d.** Discovery of gasses and the development of quantitative analysis - Joseph Black, Joseph Priestly, Robert Boyle, Antoine Lavoisier, Marie-Anne Lavoisier
   - **e.** Early atomic theory - Joseph Proust, John Dalton, Ameleo Avogadro
   - **f.** Electricity and the prelude to modern atomic theory - Benjamin Franklin, Luigi Galvani, Alessandro Volta, Michael Faraday, Joseph Thomson, Robert Millikan
   - **g.** Modern atomic theory - Ernest Rutherford, Niels Bohr, Max Planck, Albert Einstein, Louis-Victor de Broglie, Erwin Schrodinger
   - **h.** Bonding and molecular structure - Jacobus Henricus van't Hoff, Joseph Achille Le Bel, Gilbert Newton Lewis, Irving Langmuir
   - **i.** Radioactivity - Marie Curie
   - **j.** Organic and biological chemistry - Hermann Emil Fischer, Rosalind Franklin
2. Examples of chemistry and its relationship to society in various cultures

E. Evaluate ethical issues and environmental effects, from local to global, that have arisen from the extraction, use and disposal of chemicals.

1. Environmental impacts and reclaimation
2. Human impacts of chemical industrialization (example: Bhopal disaster)
3. Human impacts of medical research (examples: thalidomide)

VI. Assignments

A. Reading

1. Required readings from the textbook in preparation for the scheduled lecture. This may include entire chapters or sections from the chapters covering topics included in this outline.
2. Required readings from the laboratory manual as a preparation for the scheduled experiment in order to provide students with familiarity about the specific laboratory protocols and related safety precautions necessary for successful completion of the experiment.

B. Writing

1. Homework assignments based on classroom discussion/lecture may include answering questions from end-of-chapter exercises or other sources as deemed appropriate by the instructor.

2. Periodic quizzes and mid-term examinations based on material discussed in lectures and/or reading assignments

C. Laboratory Assignments

1. Pre-lab exercise: The pre-lab assignment for the scheduled laboratory experiment to be completed prior to beginning of each new experiment. This assignment may be identical to that provided in the laboratory manual or substituted with other appropriate assignments determined by the instructor.

2. Report: Data obtained in laboratory exercises are to be entered in the assigned laboratory manual or a laboratory notebook. Necessary calculations required to obtain the final results from the experiment must be completed in the manual or the notebook as to be determined by the instructor. Detailed lab reports incorporating results and discussions from the experiment will be required.

VII. Methods of Instruction

Lecture and visual aids
Discussion of assigned reading
Discussion and problem solving performed in class
Quiz and examination review performed in class
Homework and extended projects
Collaborative learning and small group exercises
Laboratory experience which involve students in formal exercises of data collection and analysis

VIII. Methods of Evaluating Objectives

A. Homework assignments based on end-of-chapter problems from the primary text will be evaluated for completion to test comprehension of lectures.

B. Periodic quizzes will be used to test the comprehension of topics covered during the lecture and will be evaluated for accuracy of responses.

C. A minimum of three mid-term examinations will be used to evaluate the ability of students to a) solve problems, b) outline various concepts covered in the lecture, and c) demonstrate an understanding of reading assignments. These will be evaluated for accuracy to assess student progress in achieving various learning outcomes.

D. A comprehensive final examination in any chosen format (multiple choice questions or free response) will be based on all the course material covered during the entire quarter and evaluated for accuracy of responses.

E. Report sheets and/or laboratory reports will be evaluated for successful completion of laboratory experiments as well as accuracy of data analysis and interpretation.

F. A comprehensive laboratory examination will be used to evaluate the student understanding of the various concepts discussed in the different experiments performed during the course. Concepts evaluated will include: a) general laboratory protocol b) comprehension of data analysis and interpretation and c) critical thinking as it pertains to the scientific method.

IX. Texts and Supporting References

A. Examples of Primary Texts and References

1. Hill, John W. and Kolb, Doris K. Chemistry for Changing Times. 13th Edition. New York, NY.

Macmillan, 2013.

2. Suchocki, John. Conceptual Chemistry, 4th edition, Prentice Hall, 2011. ISBN: 0-321-68171-1

B. Examples of Supporting Texts and References

1. None

X. Lab Topics

A. Laboratory methodology

1. Maintaining a laboratory notebook
2. Writing laboratory reports

B. Chemical safety

1. Materials safety data sheets (MSDS)
2. Chemical disposal
   - **a.** Separation of waste streams
   - **b.** Proper disposal methods
   - **c.** Environmental hazards of improper waste disposal
3. Laboratory environment
   - **a.** Maintaining laboratory cleanliness
   - **b.** Chemical labeling
   - **c.** Segregation of chemicals in storage
   - **d.** Secondary containment
4. Personal safety
   - **a.** Safety goggles
   - **b.** Limiting chemical exposure
   - **c.** Safety showers
   - **d.** Eyewash stations
   - **e.** Types and use of fire extinguishers
5. Emergency situations
   - **a.** Fires
   - **b.** Earthquakes
   - **c.** Chemical spills
   - **d.** Evacuation procedures

C. Gravimetric analysis

1. Taring

2. Mass by difference
3. Mass percentage

D. Laboratory techniques

1. Proper ignition of Bunsen burners
2. Use of pipettes

E. Chemical analsysis

1. Acid-base titration and use of indicators
2. Physical versus chemical properties
3. Stoichiometric analysis