DeAnza College

Credit- Degree applicable
Effective Quarter: Fall 2015

I. Catalog Information

CHEM 25 Preparation Course for General Chemistry 5 Unit(s)

(Formerly CHEM 50.)

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

Prerequisite: MATH 114 or equivalent.

Advisory: EWRT 1A or EWRT 1AH or ESL 5.

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

An introduction to the core theory and problem-solving techniques of chemistry as preparation for CHEM 1A and other science related fields. An introduction to gravimetric and volumetric analysis, rudimentary laboratory equipment and operations, and the preparation and maintenance of a laboratory notebook.

Student Learning Outcome Statements (SLO)

Assess the fundamental concepts of modern atomic and molecular theory.

Evaluate the standard classes of chemical reactions.

Demonstrate a fundamental understanding of mathematical concepts pertaining to chemical experimentation and calculations.

II. Course Objectives

A. Explore the core concepts of modern atomic and molecular theory.

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

C. Apply fundamental mathematical concepts to the proper collection and evaluation of experimental data.

D. Explore the various gas laws and understand the relationships between pressure, temperature, and volume of a gas.

E. Differentiate between standard classes of chemical reactions.

F. Acquire an elementary understanding of thermochemistry

III. Essential Student Materials

Chemistry department approved safety goggles

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. Explore the core concepts of modern atomic and molecular theory.

1. Atomic theory

a. Isotopes, subatomic particles, and isotopic distribution

b. Identification of periodic trends and development of the periodic table

c. Lewis electron dot structures and the octet rule

2. Molecular theory

a. Covalent and ionic bonding

b. Molecular geometry

c. Bond versus molecular polarity

d. Intermolecular forces and their effect on the physical properties of a liquid

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

1. Development of the mole concept

a. Law of conservation of mass

b. Law of definite proportions

c. Law of multiple proportions

d. Avogadro's number and its implicit relationship to the gram

2. Establishing molecular formulas

a. Atomic and molecular mass

b. Percent composition

c. Empirical versus molecular formulas

d. Nomenclature of simple molecules

3. Reaction stoichiometry

a. Balancing chemical equations

b. Conversion factors

c. Concentration

d. Limiting reagents

e. Theoretical yield, actual yield, and percent yield

C. Apply fundamental mathematical concepts to the proper collection and evaluation of experimental data.

1. Numerical representation

a. Scientific notation

b. Significant figures

c. Rounding

2. Accuracy versus precision

3. Systems of units

a. Imperial units

b. SI units

4. Dimensional analysis

D. Explore the various gas laws and understand the relationships between pressure, temperature, and volume of a gas.

1. Boyle's law; Charles law; Avogadro's law

2. Combined gas law

3. Gas-forming reactions

4. Stoichiometric calculations using gas laws

E. Differentiate between standard classes of chemical reactions.

1. Acid-base reactions

a. Definitions and properties of acids and bases

b. The pH scale

c. Acid-base neutralization

d. Titration

2. Oxidation-reduction (redox) reactions

a. Oxidation states

b. Half-reactions

c. Oxidizing and reducing agents

3. Gas-forming reactions

F. Acquire an elementary understanding of thermochemistry

1. Law of conservation of energy

2. Exothermic versus endothermic reactions

3. Heat flow

4. Measurement of heat of a reaction by calorimetry

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
Collaborative learning and small group exercises
Laboratory experience which involve students in formal exercises of data collection and analysis
Laboratory discussion sessions and quizzes that evaluate the proceedings weekly laboratory exercises

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. Pre-lab assignments will be evaluated for completeness and level of preparedness required for safe and timely execution of laboratory protocols and experiments.

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

G. 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. *Corwin, Charles H. "Introductory Chemistry: Concepts & Connections", 7th Ed. Prentice Hall, 2013.
2. Corwin, Charles H., "Introductor Chemistry, Concepts & Connections: Laboratory Manual", 7th Ed. Prentice Hall.

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 by hazard
   - **d.** Secondary containment
4. Personal Safety

   a. Safety goggles
   b. Limiting chemical exposure
   c. Safety showers
   d. Eyewash stations
   e. Proper use of the fire extinguishers
5. Emergency Situations
   a. Fires
   b. Earthquakes
   c. Evacuation procedures

C. Physical Measurements
1. Gravimentric Analysis
   a. Taring
   b. Mass by difference
2. Boiling Points

D. Laboratory Techniques
1. Proper ignition of Bunsen burners
2. Use of pipettes

E. Chemical Analysis
1. Gravimetric analysis of a hydrate
2. Acid-base titration and use of indicators
3. Conductivity
4. Classes of chemical reactions
5. Physical vs. chemical properties
6. Stoichiometric analysis