EFFECTIVE: MAY 2002

Douglas College

CURRICULUM GUIDELINES

A. Division: Instructional
B. Department / Program Area: Science and Technology

Date: November 6, 2001
New Course [ ] Revision [X]
If Revision, Section(s) Revised: M, N, P
Date Last Revised: November 18, 1998

C: CHEM 108 **D:** Introductory Chemistry **E:** 4

Subject & Course No.	Descriptive Title	Semester Credits

F: Calendar Description:

This course quickly reviews the content of CHEM 104, including stoichiometry and atomic structure, and then continues with the study of the following topics: thermochemistry, equilibrium, gases and liquids, acids and bases, redox reactions and electrochemistry, and several examples of descriptive chemistry

G: Allocation of Contact Hours to Type of Instruction / Learning Settings

Primary Methods of Instructional Delivery and/or Learning Settings:

Lecture and Laboratory

Number of Contact Hours: (per week / semester for each descriptor)

Lecture: 4 hours
Laboratory: 2 hours

Number of Weeks per Semester: 14

H: Course Prerequisites:

CHEM 104 (C or better) or CHEM 11 (C or better) **AND** MATH 101 or equivalent.

I: Course Corequisites:

None

J: Course for which this Course is a Prerequisite
CHEM 110

K: Maximum Class Size: 36

L: PLEASE INDICATE:

[ ] Non-Credit
[ ] College Credit Non-Transfer
[X] College Credit Transfer: Requested [ ] Granted [X]

SEE BC TRANSFER GUIDE FOR TRANSFER DETAILS (www.bccat.bc.ca)

M: Course Objectives / Learning Outcomes

The student will be able to:

1. Express the precision of a calculated quantity given the uncertainties in the measurements used in the

calculation.

2. Given the mass of a substance, calculate the number of moles, and the number of particles in the sample.

3. Given the percent composition of a compound and the molar mass, find the empirical and molecular formulas.

4. Given the balanced equation for a chemical reaction, carry out the required stoichiometric calculations. The substances in the reaction may be gases, solids, liquids, or solutions.

5. Define any of the terms used in the course, for example: mole, specific heat capacity, ideal gas, common ion effect, etc.

6. Carry out thermochemical calculations based on data obtained in calorimetric measurements.

7. Use thermochemical tables to calculate ΔH° for a given chemical reaction.

8. Solve problems involving gases, assuming ideal gas behavior.

9. Describe the Kinetic Molecular Theory of Gases and use this to explain any of the observed properties of gases.

10. Given the solubility of ionic compounds in water, write the net ionic equation for any reaction occuring in aqueous solution.

11. Use the Principle of Le Chatelier to predict the direction of change in a system in equilibrium as the result of a given change in temperature, pressure, or volume of the system.

12. Solve problems involving the use of the concentration equilibrium constant, K_c, for gaseous systems.

13. Write balanced equations for all reactions or equilibria involving acids and bases.

14. Calculate the pH of a given solution of any strong acid or base.

15. Calculate the pH and percent ionization of a solution of given concentration of a weak acid or base (or the salt of a weak acid or base).

16. Given the concentration and volume of a strong acid which is titrated with a given concentration of strong base, calculate the initial pH, and the pH after the addition of various volumes of the base.

17. Balance any redox reaction.

18. For any given galvanic cell, write the cell reaction equation and calculate the standard cell emf.

19. Use tables of standard electrode potentials to predict reaction spontaneity for a given redox reaction.

20. Explain how the principles learned in this course can be applied to the following areas: corrosion of metals, the atmosphere and air pollution, industrial processes such as sodium by electrolysis, production of chlorine, sodium hydroxide, and aluminum, magnesium from the sea, and metals and their ores.

N: Course Content:

1. **Introduction and Review**

(a) **Scientific Measurements:**
Measurements, errors, precision and accuracy, uncertainty, average deviation, significant figures.

(b) **Atoms, Molecules, and Ions**.
Isotopes, mole, formulas, percentage composition, nomenclature.

(c) **Stoichiometry Review:**
Types of reactions, calculation of percentage yield, limiting reactant problems, solutions: concentration units and stoichiometry, titrations.

2. **Principles of Reactivity: Thermochemistry**

Energy units, heat capacity, energy transfer, enthalpy, calorimetry, phase changes, Hess's Law, standard heats of formation, fuels.

3. **Chemical Equilibrium**

The equilibrium constant, interpretation of equilibrium constant values, calculations involving K, Le Chatelier's Principle, controlling chemical reactions.

4. **Gases and Liquids**

Properties of gases, Boyle's Law, Charles Law, and the Ideal Gas equation, calculations, gas mixtures, Dalton's Law of partial pressures, Kinetic Molecular Theory, the atmosphere. The liquid state, vaporization and condensation, $\Delta H_{phase\ change}$ and calculation of heat of phase changes.

5. **Introduction to Acids and Bases**

Properties, definitions, conjugate acid/base pairs, autoionization of water, pH scale, relative acid strengths, K_a and K_b, calculations, salts and hydrolysis, common ion effect.

6. **Redox Reactions and Electrochemistry**

Redox reactions, oxidation numbers, half reactions, balancing redox equations. Electrochemical cells, calculation of cell voltage, using standard cell potentials.

7. **Descriptive Chemistry**

Several topics will be selected from the following list: Applications of Electrochemistry; Industrial Applications of Chemistry: sodium by electrolysis, chlorine and sodium hydroxide, aluminum production; Environmental Chemistry, the atmosphere, pollutants, sulfur; Descriptive Inorganic Chemistry: qualitative analysis.

Laboratory Content

The following laboratory experiments will be performed during the lab period:

1. Analytical balance and metric conversions.
2. Density measurements
3. Acid-Base Titrations
4. Thermochemistry
5. Redox: Determination of Water of Hydration
6. Chemical Equilibrium
7. Ideal Gas Constant
8. Redox: Water of hydration of Copper (II) Sulfate
9. Acid Dissociation Constant
10. Electrochemistry

O: Methods of Instruction

The course will be presented using lecture, problem sessions and class discussions. In-class demonstrations of computer-based educational materials and videos will be used where appropriate. The laboratory consists of experiments performed by students, either individually or in pairs, which illustrate the lecture material, or encourage good experimental technique.

P: Textbooks and Materials to be Purchased by Students

The Chemical World: Concepts and Applications, Moore, Stanitski, Wood, and Kotz, 2nd Edition, Harcourt Brace and Company, 1998.

Chemistry 108 Laboratory Manual, Douglas College

Q: Means of Assessment

The student's performance in the course will be based on the following evaluations:

1. **Lecture Material (75%)**

   (a) Two or three in-class tests will be given during the semester (30%).

   (b) A final exam covering the entire semester's work will be given during the final examination period (30%).

   (c) Any or all of the following evaluations, at the discretion of the instructor: problem assignments, quizzes, class participation (5% maximum). (15% in total)

2. **Laboratory (25%)**

   (a) Written reports for each experiment will be handed in and graded. These reports will either be complete reports, to be handed in in the laboratory notebook, or short reports, to be handed in on report sheets (18%).

   (b) Quantitative results of experiments performed on unknown samples will be graded (2%).

   (c) A practical laboratory exam will be given in the last lab period of the semester (5%).

R: Prior Learning Assessment and Recognition: specify whether course is open for PLAR

Not open for PLAR

Course Designer(s)

Education Council / Curriculum Committee Representative

Dean / Director

Registrar