San Bernardino Valley College
Curriculum Approved: November 18, 2002
Last Updated: November 15, 2002
Honors Course enhancements are indicated in **bold**.

I. CATALOG DESCRIPTION

A. Division: Science and Math
Department: Chemistry
Course ID: CHEM 150**H**
Course Title: General Chemistry I **- Honors**
Units: 5
Lecture: 3 hours
Laboratory: 6 hours
Prerequisites: CHEM 101 and MATH 102

B. Catalog and Schedule Description: An introduction to college-level chemistry with an emphasis on the mole concept, thermochemistry, atomic and molecular structure, interactions, periodic chart, organic chemistry, solids, liquids and gases. **Enrollment is limited to students eligible for the Honors Program.**

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One

III. EXPECTED OUTCOMES FOR STUDENTS

Upon completion of the course students will be able to:

A. **Develop** a broad grounding in Chemistry to recognize the chemical basis of biological events, properties of materials, environmental changes, and industrial processes.
B. Record and evaluate scientific observations.
C. Apply problem solving to the relationships between various chemical quantities in mixtures and in chemical reactions.
D. **Compare and** relate the historical and modern theories of atomic structure and explain how these are the underlying basis of the periodic table, of ionic and molecular bonding, and of the various types of attractions that determine the physical and chemical properties of compounds.
E. **Apply Hess's law to chemical reactions.**
F. **Write an acceptable college-level research paper on a topic in general chemistry.**
   1. **Use both Internet and Standard sources to gather information.**
   2. **Evaluate the validity of the sources.**
   3. **Organize information into an outline of the paper.**
   4. **Integrate researched information into their proposed experimental design.**
   5. **Utilize calculations where needed.**
   6. **Critically analyze the methodology and the results.**
G. **Prepare an oral presentation on the research topic.**

IV. COURSE CONTENT:

Lecture:

A. Measurements in Chemistry
   1. Significant Figures
   2. SI and Derived Units
   3. Problem Solving Methods
B. Atoms and Compounds
   1. Types of Matter
   2. The Atomic Theory
   3. The Periodic Table
   4. Types of Chemical Compounds
   5. Nomenclature
C. Chemical Reactions
   1. Writing Chemical Equations

2. Classes of Reactions
3. Ionization in Aqueous Solution
4. Molecular and Ionic Equations
5. Driving Forces for Reactions in Aqueous Solution

D. Stoichiometry
1. The Mole Concept
2. Determining Molecular Formulas
3. Stoichiometry of Chemical Reactions
4. Solution Concentrations
5. Stoichiometry of Solution Reactions

E. Thermo chemistry
1. Enthalpy and Heats of Reaction
2. Thermo chemical Equations and Stoichiometry
3. Calorimetry
4. Standard Enthalpy of Formation
5. Hess's Law

F. Atomic Structure and the Periodic Table
1. The Nuclear Model of the Atom
2. The Electronic Structure of the Atom
   a) The Dual Nature of Light and Electrons
   b) The Bohr Theory
   c) Quantum Mechanics
   d) Quantum Numbers and Atomic Orbitals
   e) Electron Configuration Description of Orbitals
   f) Orbital Diagrams

G. Bonding
1. Ionic Bonding
2. Covalent Bonding
   a) Polar Covalent Bonds
   b) Writing Lewis Dot Formulas
   c) Delocalized Bonding and Resonance
   d) Bond Length and Bond Order
3. Molecular Geometry
   a) VESPR Theory
   b) Valence Bond Theory
4. Organic Chemistry
   a) The Carbon-carbon Bond
   b) Nomenclature of Alkanes
   c) Functional Groups
   d) Examples of Functional Group Reactions

H. Gases, Liquids, and Solids
1. Gases
   a) The Ideal Gas Law and its Predecessors
   b) Stoichiometry Involving Gases
   c) Dalton's Law of Partial Pressures
   d) Kinetic Theory and the Ideal Gas
   e) Molecular Speeds
   f) Read Gases
2. Liquids and Solids
   a) Changes of State
   b) Properties of Liquids
   c) Using Intermolecular Forces to Explain Physical Properties
   d) Classification of Solids by Attractive Forces

I. Solutions
1. Solubility and the Solution Process

2. Solubility and Concentration Terms
3. Colligative Properties

J. Optional
1. Molecular Orbital Theory
2. Bond Energies
3. Phase Diagrams

K. Explore in Depth an approved topic related to general chemistry for research paper and oral presentation.

Laboratory
The labs are selected to reinforce or demonstrate points from the lecture and to teach lab skills in measurement, handling of chemicals and chemical apparatus, the analysis of chemical unknowns and to develop skills in scientific observation.

V. METHODS OF INSTRUCTION:

A. Lecture
B. Laboratory
C. Work groups
D. Video
E. Multimedia
F. Discussion
G. Examination
H. Demonstration
I. Computer drills
J. **Field trips to universities or scientific meeting relevant to course research and topics.**
K. **Guest speakers on research techniques, oral presentations, or other pertinent topics.**
L. **Small interactive groups for developing topics, comparing resources, and evaluating progress.**

VI. TYPICAL ASSIGNMENTS:

A. Lecture: Read chapter on Aqueous Stoichiometry. Do all exercises and the problems assigned.
B. Laboratory: Do the laboratory experiment, Molarity and Chemical Analysis - Analysis of H3PO4 in Water, showing all data, calculations where indicated and answering any questions.
C. **Research Paper Project: The students will develop their research paper and oral presentation based on a variety of acceptable topics in general chemistry. Topics are approved or suggested by the faculty for the section of general chemistry. The paper will be evaluated before the preparation of the poster or oral presentation. An example of a topic for research is: how does quantum theory relate to LASERS? Using information about atomic structure, the equations for calculating energy levels of electrons, and equations for photon emission, investigate the theory and mathematical applications for LASER development. Include an evaluation of the wavelength of light and the electromagnetic radiation energy of several types of LASERS.**

VII. EVALUATION(S):

A. Methods of Evaluation
1. Examinations and quizzes: Typical Multiple Choice type of question: "When water evaporates at constant pressure, the sign of the enthalpy change for the reaction:"
a) depends on the reaction

b) depends on the temperature
c) is positive
d) cannot be determined
e) is negative

2. Typical Written Answer questions:
   a) "What is the difference between the mass number of a particular atom and its atomic number?"
   b) "Explain @h the melting point of MgO is so much higher than NaF when the distances between the nuclei in the two compounds are about the same."
3. Typical Problem Solving question: A compound is composed of 14.6@o carbon, 39.0@o oxygen, and 46.37o fluorine. If the molecular mass is 82 g/ mole what are the empirical and molecular formulas?
4. Laboratory: Students are graded on their lab reports or using quizzes with questions about the lab. The lab reports are graded on accuracy of results, calculations and answers to questions.
5. Optional Evaluations: Homework collected and checked; computer assignments checked.

B. Frequency of Evaluations: Lecture exams are given 4 to 5 times a semester. Lecture quizzes can be given from 0 to 10 times a semester. A comprehensive final exam is given in lecture and a practical final may be given in the laboratory. Students are evaluated on each laboratory experiment.

C. **The research paper is expected to be 8-10 pages. Information from this paper can be reformatted for a poster presentation. An oral presentation will also be given based on the paper or the poster.**

VIII. TYPICAL TEXT(S):

Lecture:
Kotz & Trichel, Chemistry and Chemical Reactivity 3rd ed., New York, Saunders College Publishing, 1996
Ebbing, General Che@stly,4th *Edition, 1993,* Houghton-Mifflin. Scott, Chemistry, 8th Ed., 1998, Harper's Printing

Optional books include Student Solutions Manuals and Study Guides for the text assigned. Also Multimedia Chemistry, Scott, lst Ed., SBVC Learning Center is a compilation of the multimedia lectures used by Mr. Scott

Laboratory:
The students are presently using customized labs being purchased as a package or being created by the instructor. These are equivalent to commercial lab manuals such as General Chemistry in the Laboratory- 4th Edition, 1994, Roberts, Hollenberg, and Postma, W. H. Freeman & Co.

IX. OTHER SUPPLIES REQUIRED OF STUDENTS: A scientific calculator which can do exponential notation and logarithms is required for the course. The students are required to bring soap, towels, and matches for the laboratory.