TAMALPAIS UNION HIGH SCHOOL DISTRICT
Larkspur, California

Course of Study

Chemistry 1-2

I. INTRODUCTION

Chemistry 1-2 is a year-long course intended for students who have completed Integrated Science 1-4. This course provides a strong background for college bound students and students who plan to take more elective science courses. Chemistry 1-2 is part of the recommended college preparatory program of Integrated Science 1-4, Chemistry, and Physics.

The goals of this course are to present chemistry as a highly organized body of knowledge held together by unifying principles and based on systematic investigations of our environment through experimentation.

Chemistry should provide maximum opportunity for students to learn through laboratory experiences, enabling them to appreciate the importance of making careful observations, weighing facts objectively and framing logical conclusions. Students should leave the course having an understanding and appreciation of how chemistry affects their daily lives.

Chemistry 1-2 is a highly quantitative science course, requiring application of basic algebra concepts and skills such as solving equations for different variables, using data to represent independent and dependent variables, applying scientific notation, solving proportions, and manipulating formulas. Students lacking such skills should consider postponing Chemistry until they have completed Intermediate or Advanced Algebra.

This course addresses the following Tam Student Learning Outcomes:

Outcome 1	Communicate articulately, effectively and persuasively when speaking and writing.
Outcome 2	Read/view and analyze material in a variety of different disciplines.
Outcome 3	Use technology to access information, analyze/solve problems, and communicate ideas.
Outcome 5	Apply mathematical knowledge and skills to analyze and solve problems.
Outcome 6	Demonstrate scientific literacy.

This course is designed to help students attain the state Chemistry Content Standards. Numbered references to specific Chemistry Content student objectives (*Science Content Standards for California Public Schools*, 2000, pages 36-41) are included in the following statement of student learning outcomes.

II. STUDENT LEARNING OUTCOMES

During Chemistry in the Tamalpais Union High School District, students will:

- develop analytical and problem-solving skills, especially the application of algebra and the concept of the mole to quantitative chemistry problems. (3a-f, 4c-e, h, 5f, 6d, 7d, 8b)

- develop laboratory skills, including the use of standard laboratory equipment; collect, analyze and draw conclusions from data; devise experiments to test specific hypotheses.

- understand and apply their knowledge of how the structure of the atom relates to the organization of the periodic table and to the properties of the elements. (1a-e)

- understand and apply their knowledge of how and why chemical elements bond and interact with each other; describe these chemical interactions in the language of chemistry (chemical equations). (2a-e, 4a, b, g, 5a-f, 6a-d, 7a-d, 8a-d, 9a, b)

Outcome indicators for the above-listed learning outcomes will be embedded in the student assessments and include:

- students will interpret word problems which include conversions to/from moles and well as other algebraic functions such as density, gas equations, thermodynamics equations. They will:
  - identify what mathematical formula(s) is/are required to solve the problem, the "knowns" and "unknowns" in the problem, including units
  - explicitly use dimensional analysis in their calculations,
  - correctly complete the calculations,
  - explicitly evaluate their answer using some type of estimate or "common sense" method.

- during a laboratory exercise, students will
  - correctly identify and safely use standard chemical laboratory equipment to make accurate measurements;
  - combine two chemicals, then identify the type of reaction, predict the products and write a balanced equation for this reaction;
  - given a problem and background information, design and conduct a laboratory experiment which accurately solves a problem;
  - perform a qualitative analysis experiment emphasizing observational skills, logic and problem-solving techniques to correctly identify an unknown substance.

- given a periodic table and the name and symbol of a representative element students
  - will draw and label diagrams of the structure of an atom of that element and one of its isotopes, showing energy levels;
  - the electron dot, orbital notation and electron configurations of this element depicting ionic and covalent bonding between it and the atom(s) of another element

Prerequisite skills and concepts
Students are expected to have gained the following skills and knowledge in Science and Mathematics courses before enrolling in Chemistry:

Student should be able to

- use the metric system and make conversions (IS 1-4, Algebra and Geometry)
- use dimensional analysis in algebraic problem-solving (IS 1-4, Algebra and Geometry)
- manipulate and apply the equation for density (D=M/V) when given two out of the three variables (IS 1-4, Algebra)
- use the scientific process to design simple experiments (IS 1-4)
- distinguish among hypothesis, law and theory (IS 1-4)
- graphically present data using independent and dependent variables (IS 1-4, Algebra)
- identify and use basic chemical laboratory equipment such as beakers, graduated cylinders, thermometers, balances (IS 1-4)
- define energy and its forms (kinetic, potential, thermal, radiant, electrical, chemical, nuclear) (IS 3/4)
- count the number of each atom given the chemical formula (IS 3/4)
- describe the atom using Bohr's model (IS 3/4)
- define what an element is, and how to describe its properties by its location on the periodic table (IS 3/4)
- define the law of conservation of mass and apply it to balancing simple chemical equations, including those central to life, photosynthesis and respiration (IS 1-4)
- describe what an ion is, and the roles of ions in living cells (IS 1-4)
- describe what is meant by polar and nonpolar molecules and how the interactions of polar and nonpolar molecules in the lipid bilayer allow cells to function (IS 1-4)
- recognize that the bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes, and chemical properties; the names and basic structure of the common organic molecules in living organisms (DNA, protein, carbohydrates, lipids, water); provide the biochemical basis of life (IS 1-4) (fulfills Science Content Standards for California Public Schools for Chemistry, 2000, 10a-c)
- describe what hydrogen bonding is and why it is important in biological systems (IS 1-4)
- describe what a radioisotope is; how radioisotopes decay over time; the names of the emitted particles; ratio of stable isotopes to radioisotopes; fission vs. fusion reactions (IS 3/4) (fulfills Science Content Standards for California Public Schools for Chemistry, 2000, 11a-e)
- describe and compare the three types of chemical bonds in general terms: covalent, ionic and metallic (IS 3/4)
- define the terms "solubility" and "crystal structure" and apply these terms to examples (IS 3/4)
- explain, in basic terms, what the electromagnetic spectrum is (IS 1/2)
- describe the basic concept and real-world application of pH (IS 1-4)
- describe what rocks are made of (chemistry of lava; mineral) (IS 3/4)
- state the relative abundance of certain elements in our world (e.g. earth's crust, atmosphere: Si, O_2, etc.) and how they have changed via evolution (IS 1-4)

Content Area Descriptions

1. **Matter and Energy--**Chemistry is a study of matter and energy and their relationship to each other. The basic classification of matter is reviewed and the physical and chemical properties of matter are defined.
2. **Atomic and Molecular Structure--**The periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure.
3. **Chemical Bonds--**Biological, chemical, and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms and molecules.
4. **Conservation of Matter and Stoichiometry--**The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants.
5. **Gases and Their Properties--**The kinetic molecular theory describes the motion of atoms and molecules and explains the properties of gases.
6. **Acids and Bases--**Acids, bases, and salts are three classes of compounds that form ions in water solutions.
7. **Solutions--**Solutions are homogenous mixtures of two or more substances.
8. **Chemical Thermodynamics--**Energy is exchanged or transformed in all chemical reactions and physical changes of matter.
9. **Reaction Rates--**Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules. As a basis for understanding this concept:
10. **Chemical Equilibrium--**Chemical equilibrium is a dynamic process at the molecular level.
11. **Laboratory Skills**--These lab skills are demonstrated, taught and evaluated throughout all of the above units.

III. ASSESSMENT

A. Student Assessment

Students will be evaluated by teacher observation, written projects, quizzes and examinations, lab performance (including reports, quizzes, and technique), homework performance, and oral presentations.

B. Course Assessment

The course will be evaluated through district assessments.

IV. METHODS AND MATERIALS

A. Methods

Lecture, individual and group problem solving, inquiry activities, lab activities

(inquiry, skill development, application), individual and group projects, research papers, and oral presentations.

B. Materials

A textbook; laboratory directions; teacher generated lecture notes, activities and practice problems; laboratory equipment and consumable materials; reference materials as needed (internet, periodicals, reference texts); audiovisual materials.

C. Technology

1. Laboratory Equipment
2. Calculators
3. Visual Media (DVD's, LCD projectors, videos, laser discs, overhead projector)
4. Computers (internet research, data collection and analysis)

D. School to Career Goals

Practical applications of chemistry, including careers, are embedded in all aspects of the course. Careers related to chemistry are an integral part of the textbook and World of Chemistry videos. Relevant newspaper and magazine articles, book reports about chemists, publicity of talks and lectures outside of class and occasional guest speakers are other avenues used to introduce chemistry students to chemistry-related careers.

E. Suggested Instructional Time Allocation

General Time Allocation: 40% of time will be spent on lab work and analysis; 30% of the time spent on information delivery and discussion; 30% on individual and group student practice and assessment.

Topic Organization (suggested):

1. Introduction and Review of Scientific Principles and Safety (2 wks)
2. Atomic Structure (4 wks)
3. Periodic Table (3 wks)
4. Gases (4 wks)
5. Chemical Bonding (5 wks)
6. Types of chemical reactions (3 wks)
7. Balancing Equations and Stoichiometry (3 wks)
8. Solutions, Ions and Solubility (3 wks)
9. Thermodynamics (4 wks)
10. Equilibrium (3 wks)
11. Acids and Bases (3 wks)

V. GENERAL INFORMATION

Chemistry 1-2 is a 10 credit course open to 10th to 12th grade students.

A. Prerequisites

Students must have passed Algebra 1-2 or equivalent with a grade of "C" or better and Integrated Science 3-4 with a grade of "C" or better each semester. Students must have completed or be concurrently enrolled in Advanced Algebra. Students must pass Chemistry 1 to enroll in Chemistry 2 (i.e. receive at least a "D" in Chemistry 1).

Students may enroll concurrently in Chemistry and Integrated Science 3/4, with prior approval of the Chemistry teacher in consultation with the Integrated Science 1/2 teacher.

B. Requirements Met

This course may be used as elective credit towards graduation but does not meet any specific graduation requirement. This course is accepted towards the UC/CSU "d" or "g" admissions requirement.

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