

# FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

## Final Course Outline Honors Chemistry

**Date:** February 2006

**Subject Area:** Science

**Proposed grade level:** 10-12

**Course length:** 1 year

**Grading A-F**

**Number of credits 5 per Semester**

**Prerequisites:** Biology with an A or B grade

### **BRIEF COURSE DESCRIPTION:**

Honors Chemistry is a rigorous, college-prep, laboratory science class that provides a foundation in general inorganic chemistry for the college bound science major. This class will equip students to be successful in a first year college chemistry course. Students will participate in many qualitative and quantitative hands-on labs to develop theoretical aspects of chemistry. Honors Chemistry progresses at a rapid rate, covers more depth, and applies more complex mathematics than Chemistry. Students need to be able to apply math previously learned to solve a variety of problems encountered in Honors Chemistry. This course is a prerequisite for AP Chemistry.

### **GENERAL GOALS / PURPOSES:**

1. To provide students with a working knowledge and understanding of general inorganic chemistry so they will be successful in rigorous college chemistry courses.
2. Students will use hands-on experiences to develop scientific models and use their models to predict physical behavior.
3. Students will discover scientific concepts and apply them to more complex problems.
4. Students will be able to organize data, analyze it, and arrive at a logical conclusion.
5. Extensive applications of algebra II will be stressed.

### **STUDENT READING COMPONENT:**

Students will:

- Be expected to read a laboratory assignment and will be able from the reading to interpret information and follow instructions.
- Be assigned reading from a textbook to understand chemical principles.
- One of the following two texts will be used.

*The World of Chemistry*, Zumdahl 2002

*Chemistry: The Central Science*, Brown, 1997

### **STUDENT WRITING COMPONENT:**

- Written lab assignments will be given on a regular basis with detailed written reports required.
- Activities will be conducted by students requiring written reports.
- Students will be expected to write in complete, grammatically correct sentences.

## **STUDENT ORAL COMPONENT:**

### **Students will:**

- Work collaboratively during lab experiments
- Be expected to participate in class discussions on an on-going basis. These discussions may include homework, lab work or other related topics.
- Be expected to discuss and develop scientific concepts after labs or other related activities.

## **DETAILED UNITS OF INSTRUCTION:**

As students become actively involved in exploring chemical principles and concepts within each unit, the time line will be adjusted to allow for student initiated activities and projects. In these cases, subsequent units may be shortened or lengthened at the teacher's discretion. While all of the California State Standards will be met, time lines are flexible.

The learning of science is an ongoing process. As such, Chemistry will build on the conceptual foundation built by previous science courses.

Those students that show an aptitude for science should be encouraged to participate in science research projects, and enter their project in local science fairs. These projects will not only strengthen the student's understanding of science, but also open career and scholarship opportunities.

**Note: These units are taken directly from California's State Standards. The state's lettering and numbering system was incorporated into this outline.**

**Letters marked with an \* are currently not tested by the state but are considered fundamental to the understanding of chemical principles.**

### **One Semester**

#### **Atomic and Molecular Structure (10% of California State Test [CST])**

- 1. 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. As a basis for understanding this concept;**
  - a. Students know how to relate the position of an element in the periodic table to its atomic number and atomic mass.
  - b. Students know how to use the periodic table to identify metals, semimetals, non-metals and halogens.
  - c. Students know how to use the periodic table to identify alkali metals, alkaline earth metals, transition metals, trends in ionization energy, electro-negativity, and the relative sizes of ions and atoms.
  - d. Students know how to use the periodic table to determine the number of electrons available for bonding.
  - e. Students know the nucleus of an atom is much smaller than the atom yet contains most of its mass.
  - f.\* Students know how to use the periodic table to identify the lanthanide, actinide and transactinide elements, and know that the transuranium elements were synthesized and identified in laboratory experiments through the use of nuclear accelerators.

**This unit correlates to: Chapters 3, 11 (pages 348-350) *World of Chemistry*  
Chapters 2, 7 *Chemistry: The Central Science***

### **Chemical Bonds (11.7% of CST)**

**2. 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. As a basis for understanding this concept;**

- a. Students know atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electron to form ionic bonds.
- b. Students know chemical bonds in molecules such as H<sub>2</sub>, CH<sub>4</sub>, NH<sub>3</sub>, H<sub>2</sub>CCH<sub>2</sub>, N<sub>2</sub>, Cl<sub>2</sub> and many large biological molecules are covalent
- c. Students know salt crystals, such as NaCl, are repeating patterns of positive and negative ions held together by electrostatic attraction.
- d. Students know the atoms and molecules in liquids move in a random pattern relative to one another because the intermolecular forces are too weak to hold the atoms or molecules in a solid form.
- e. Students know how to draw Lewis dot structures.

**This unit correlates with: Chapter 12 *World of Chemistry*  
Chapter 8, 9 *Chemistry: The Central Science***

### **Conservation of matter and Stoichiometry (16.7% of CST)**

**3. The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate mass of products and reactants. As a basis for understanding this concept;**

- a. Students know how to describe chemical reactions by writing balanced equations.
- b. Students know the quantity of one mole is set by defining one mole of carbon 12 atoms to have a mass of exactly 12 grams.
- c. Students know one mole equals  $6.02 \times 10^{23}$  particles (Atoms or molecules).
- d. Students know how to determine the molar mass of a molecule from its chemical formula, a table of atomic masses, and how to convert the mass of a molecular substance to moles, number of particles, or volume of a gas at standard temperature and pressure.
- e. Students know how to calculate the masses of reactants and products in a chemical reaction from the mass of one of the reactants or products and the relative atomic masses.
- f.\* Students know how to calculate percent yield in a chemical reaction.

**This unit correlates with: Chapters 4, 5, 6, 7, 8, 9 *World of Chemistry*  
Chapters 3, 4 *Chemistry: The Central Science***

### **Gases and Their Properties (10% of CST)**

**4. The kinetic molecular theory describes the motion of atoms and molecules, and explains the properties of gases. As a basis for understanding this concept;**

- a. Students know the random motion of molecules and their collisions with a surface create a pressure on that surface.
- b. Students know the random motion of gases explains the diffusion of gases.
- c. Students know how to apply the gas laws to relations between the pressure, temperature, and volume of any amount of an ideal gas or mixture of ideal gases.
- d. Students know the values and meanings of standard temperature and pressure (STP).
- e. Students know how to convert between the Celsius and Kelvin temperature scales.
- f. Students know there is no temperature below zero degrees Kelvin.
- g.\* Students know the kinetic theory of gases relates the absolute temperature of a gas to the average kinetic of its molecules or atoms.
- h.\* Students know how to solve problems using the Ideal gas law in the form  $PV=nRT$ .

**This unit corresponds to: Chapter 13 *The World of Chemistry*  
Chapter 10 *Chemistry: The Central Science***

### **Acids and Bases (8.3% of CST)**

**5. Acids, bases, and salts are three classes of compounds that form ions in water solutions. As a basis for understanding this concept;**

- Students know the observable properties of acids, bases, and salt solutions.
- Students know that acids are hydrogen-ion-donating and bases are hydrogen-ion-accepting substances.
- Students know strong acids and bases fully dissociate and weak acids and bases partially dissociate.
- Students know how to use the pH scale to characterize acid and base solutions.
- \* Students know how to calculate pH from the hydrogen-ion concentration.

**This unit corresponds to: Chapter 16 *The World of Chemistry***

**Chapters 2, 16 *Chemistry: The Central Science***

### **Solutions (5% of CST)**

**6. Solutions are homogenous mixtures of two or more substances. As a basis for understanding this concept;**

- Students know the definitions of solvent and solute.
- Students know how to describe the dissolving process at the molecular level by using the concept of random molecular motion.
- Students know temperature, pressure, and surface area affect the dissolving process
- Students know how to calculate the concentration of a solute in terms of grams per liter, molarity, parts per million, and percent composition.

**This unit correlates to: Chapter 15 *The World of Chemistry***

**Chapters 4, 13 *Chemistry: The Central Science***

### **Chemical Thermodynamics (8.3% of CST)**

**7. Energy is exchanged or transformed in all chemical reactions and physical changes of matter. As a basis for understanding this concept;**

- Students know how to describe temperature and heat flow in terms of the motion of molecules.
- Students know that chemical processes can either release (Exothermic) or absorb (endothermic) thermal energy.
- Students know energy is released when a material condenses or freezes and is absorbed when a material evaporates or melts.
- Students know how to solve problems involving heat flow and temperature changes, using known values of specific heat and latent heat of phase change.

**This unit correlates to: Chapters 7, 10 *The World of Chemistry***

**Chapter 5 *Chemistry: The Central Science***

### **Reaction Rates (6.7% of CST)**

**8. Chemical reaction rates depend on factors that influence the frequency of collision of reaction molecules. As a basis for understanding this concept;**

- Students know the rate of a reaction is the decrease in concentration of reactants or the increase in concentration of products with time.
- Students know how reaction rates depend on such factors as concentration, temperature, and pressure.
- Students know the role a catalyst plays in increasing the reaction rate.
- \* Students know the definition and role of activation energy in chemical reactions.

**This unit corresponds to: Chapter 17 *The World of Chemistry***

**Chapter 14 *Chemistry: The Central Science***

### **Chemical Equilibrium (6.7% of CST)**

**9. Chemical equilibrium is a dynamic process at the molecular level. As a basis for understanding this concept:**

- a. Students know how to use Le Chatlier's Principle to predict the effect of changes in concentration, temperature, and pressure.
- b. Students know equilibrium is established when forward and reverse reaction rates are equal.

**This unit correlates to: Chapter 17 *The World of Chemistry***

**Chapters 15, 16 *Chemistry: The Central Science***

### **Organic and Biochemistry (3.3% of CST)**

**10 The bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes, and chemical properties, and provide the biochemical basis for life. As a basis of understanding this concept:**

- a. Students know large molecules (polymers), such as proteins, nucleic acids, and starch is formed by repetitive combinations of simple subunits.
- b. Students know the bonding characteristics of carbon that result in the formation of a wide variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules.

**This unit correlates to: Chapters 20, 21 *The World of Chemistry***

**Chapter 25 *Chemistry: The Central Science***

### **Nuclear Process (3.3% of CST)**

**11. Nuclear processes are those in which an atomic nucleus changes, including radioactive decay of naturally occurring and human-made isotopes, nuclear fission, and nuclear fusion. As a basis of understanding this concept;**

- a. Students know protons and neutrons in the nucleus are held together by nuclear forces that overcome the electrostatic repulsion between protons.

**This unit corresponds to: Chapter 19 *The World of Chemistry***

**Chapter 21 (pages 771-775) *Chemistry: The Central Science***

### **Investigation and Experimentation (10% of CST)**

**1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will:**

- a. Select and use appropriate tools and technology (such as computer inked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
- b. Identify and communicate sources of unavoidable experimental error.
- c. Identify possible reasons for inconsistent results, such as, sources of error or uncontrolled conditions.
- d. Formulate explanations by using logic and evidence.
- f. Distinguish between hypothesis and theory as scientific terms.
- g. Recognize the usefulness and limitations of models and theories as scientific representations of reality.
- j. Recognize the issues of statistical variability and the need for controlled tests.
- k. Recognize the cumulative nature of scientific evidence.
- l. Analyze situations and solve problems that require combining and applying concepts from more than one area of science.
- n. Know that when an observation does not agree with accepted scientific theory, the observation is sometimes mistaken or fraudulent and that theory is sometimes wrong.
- o. Be able to conduct student-based research projects or science fair projects, individually or collaboratively.

**THIS COURSE WILL PREPARE STUDENTS FOR THE CAHSEE AND/OR THE FCUSD EXIT EXAMS IN:**

Writing, Reading, Math, and Science

**LAB FEE IF REQUIRED**

None

**SUBJECT AREA CONTENT STANDARDS TO BE ADDRESSED:**

Chemistry standards for California High Schools.

**DISTRICT ESLR'S TO BE ADDRESSED:**

- **Self-Directed Learners:** Students will be expected to take responsibility for their learning by participating in class activities, labs, and discussions. Students will be expected to keep up with homework and lab prep assignments.
- **Collaborative Workers:** Students will participate in cooperative groups for laboratory assignments and in class activities. They will be expected to collaborate with each other in developing class concepts.
- **Effective Communicators:** Students will actively participate in class discussions on a regular basis.
- **Quality Producers/ Performers:** Assessment of class work requires students to be quality producers in order to be successful in class.
- **Constructive Thinkers:** Students will participate in many hands-on activities and labs that require them to analyze their results critically and apply what they have learned to new situations. Students will also develop models for molecular behavior.
- **Responsible Citizen:** In order to become responsible citizens, students will use their knowledge of chemistry and scientific inquiry to make informed decisions about issues related to chemistry and the environment, and in their daily lives.