

**Newport-Mesa Unified School District
Course Description**

HNR CHEMISTRY 1AB

Content covered in this course is described in the Course of Study. Based upon student needs, teachers select appropriate materials from the Instructional Materials List. Classroom presentations of course content are determined by the instructor and described under Teacher Activities. A more detailed outline of this course can be obtained from the instructor.

PREREQUISITES:

The HNR Chemistry Course has prerequisites and these will be determined by individual sites. Any or parts of the following will be required: teacher recommendation, petition and recommendation by an honors committee, completion of summer work assignments, grade requirement in previous classes and/or work sample.

OVERVIEW:

The HNR Chemistry course is an accelerated college preparatory chemistry class for highly motivated students who have demonstrated excellent study skills and high aptitude in math. The course will cover basic organic and inorganic chemistry concepts in more depth than the Chemistry 1AB course. This class is open to students with recommendations from their biology and math teachers. Previous or concurrent enrollment in Algebra II is prerequisite.

Course of Study Objectives:

1.0 The student will name SI and other common units of length, mass and time. Students will perform unit conversions using the factor-label method and perform density calculations.

1.1 SUGGESTED STUDENT ACTIVITY:

- Laboratory: Density of pennies
- Laboratory: Density of common materials
- Calculator fun activities
- Solve quantitative problems using SI, significant figures and scientific notation

1.2 INSTRUCTIONAL MATERIALS USED:

- Calculators
- Overhead projections

1.3 TEACHER ACTIVITIES:

- Lecture
- Density demonstrations (Plimsol line, density gradients and columns)

2.0 The student will describe the atomic theory and atomic structure, including evidence for atomic theory, electron energy levels, atomic spectra and periodic relationships, and perform calculations involving frequency wavelength and energy.

2.1 SUGGESTED STUDENT ACTIVITY:

- Laboratory: Determine the formula of a compound
- Determine the molar mass by vapor density
- Atomic spectra lab
- Flame test lab
- Problem solving using Bohr's equations, equations of light and quantum numbers, and answer questions involving concepts of periodic properties
- Autobiography of an element report

2.2 INSTRUCTIONAL MATERIALS USED:

- Lab supplies
- Laserdisc
- Video
- Atomic models
- Diffraction grating
- Gas discharge tubes
- Power supply

2.3 TEACHER ACTIVITIES:

- Demonstrations
- Lectures

3.0 The student will describe and apply the concept of chemical bonding, including types of bonds, polarity of bonds and relationships to states of matter, lattice energy, molecular models, geometry of molecules. The student will perform bond energy, lattice energy and bond polarity calculations.

3.1 SUGGESTED STUDENT ACTIVITY:

- Laboratory using molecular model kits
- Laboratory comparing covalent and ionic compounds
- Activities and worksheets involving the drawing of dot and line structures including resonance and isomers. Using VSEPR theory to predict shapes and bond angles of molecules
- Answer questions about bond order, bond strength and bond length

3.2 INSTRUCTIONAL MATERIALS USED:

- Molecular model kits
- Overhead projections
- Periodic tables

3.3 TEACHER ACTIVITIES:

- Lecture
- Molecular model demonstrations
- Crystal structure demonstrations

4.0 The student will be able to write formulas and name chemical compounds as well as correctly write, name and balance chemical equations and predict chemical reactions based on reactivity. Students will be able to give mole ratio for substances in chemical reactions and perform stoichiometry calculations.

4.1 SUGGESTED STUDENT ACTIVITY:

- Reaction lab
- Formula writing game, CHEMO
- Activities and worksheets involving formula writing, balancing equations and stoichiometry

4.2 INSTRUCTIONAL MATERIALS USED:

- Guest speakers from chemistry related fields
- Video
- Computer software CSUF
- Overhead projections

4.3 TEACHER ACTIVITIES:

- Lecture
- Chemical reaction demonstrations (colorful precipitates, metal activity series)
- Quizzes and drills on polyatomic ions

5.0 The student will describe the behavior and nature of gases, including the gas laws, the kinetic molecular theory, Avogadro's hypothesis, and deviations from ideal gas behavior; explain the kinetic energy distribution in a gas sample based on the Boltzmann distribution curve; perform all gas laws calculations, including partial pressure, mole fraction, gas reaction stoichiometry, and Van der Wall's equation.

5.1 SUGGESTED STUDENT ACTIVITY:

- Laboratories: Synthesis of oxygen, hydrogen and carbon dioxide gas
- Laboratory on determining the molar volume of a gas
- Laboratory to determine molar mass by gas density
- Boyle's Law Syringe
- Solve problems involving ideal gas law, Dalton's law of partial pressures and Graham's law of diffusion

5.2 INSTRUCTIONAL MATERIALS USED:

- Video
- Health professional to discuss the use of gas
- Vacuum apparatus
- Dry ice and liquid nitrogen

5.3 TEACHER ACTIVITIES:

- Cartesian diver demonstration, can demonstrations
- Dry ice and liquid nitrogen demonstrations
- Lecture

6.0 The student will describe liquids and solids in terms of the kinetic molecular theory; draw the phase diagram of one component system; explain changes in state, critical temperature and pressure, and the structure of solids in terms of the kinetic molecular theory and these phase diagrams.

6.1 SUGGESTED STUDENT ACTIVITY:

- Laboratory on alloys the Alchemist Lab
- Crystal growing contest
- Sulfur allotrope lab
- Graphing activities involving phase diagrams, solubility and colligative properties

6.2 INSTRUCTIONAL MATERIALS USED:

- Video microscope
- Stereomicroscopes

6.3 TEACHER ACTIVITIES:

- Lecture
- Kinetic motion demonstration
- Solution, colloid, suspension demonstration

7.0 The student will describe the nature of solutions, the solvation process and the relationships between solvents and solutes; determine the concentration (molality and molarity) of various solutions; describe the behavior of solutions in terms of Raoult's law and colligative properties, deviations from ideal behavior; perform solution calculations involving solution concentrations and colligative properties.

7.1 SUGGESTED STUDENT ACTIVITY:

- Solutions and solubility lab
- Make ice cream
- Colligative properties laboratory Effects of Antifreeze on Water
- Problem solving involving colligative properties, heat of solution

7.2 INSTRUCTIONAL MATERIALS USED:

- Video
- Overheads

7.3 TEACHER ACTIVITIES:

- Osmotic pressure demonstration
- Conductivity demonstrations

8.0 The student will identify, predict the products of, and balance several acid/base reactions using the theories of Arrhenius, Bronsted-Lowry, and Lewis.

8.1 SUGGESTED STUDENT ACTIVITY:

- Laboratory on the characteristics and properties of household acids and bases
- Laboratory comparing the various strengths of acids and bases
- Predict products and write complete acid/base reaction given only the reactants
- Acid rain report and discussion

8.2 INSTRUCTIONAL MATERIALS USED:

- PH Meters
- Video

8.3 TEACHER ACTIVITIES:

- Demonstrate acid/base, indicators (natural and synthetic)
- Lecture
- Discussion on acid/base reaction in human digestion

9.0 Students will perform acid/base titrations and be able to calculate number of equivalents and equivalent mass for a given acid or base in an acid-base reaction; and calculate normality from solution concentration for a given acid or base.

9.1 SUGGESTED STUDENT ACTIVITY:

- Acid/base titration lab
- Worksheets on normality

9.2 INSTRUCTIONAL MATERIAL USED:

- Burets
- Titration apparatus

9.3 TEACHER ACTIVITIES:

- Lecture
- Demonstrate the conductivity of water
- Demonstration on indicators

10.0 Students will write and balance oxidation/reduction reactions by the oxidation number and the half reaction method.

10.1 SUGGESTED STUDENT ACTIVITY:

- Worksheets on oxidation/reduction reactions
- Laboratory on oxidation/reduction titrations

10.2 INSTRUCTIONAL MATERIALS USED:

- Lab supplies

10.3 TEACHER ACTIVITIES:

- Lecture
- Oxidation/reduction demonstrations

11.0 Students will solve electrochemical problems involving Faraday's Laws, voltage, Nernst equations and thermodynamic equations.**11.1 SUGGESTED STUDENT ACTIVITY:**

Construct electrochemical cells to determine voltage and compare with predicted voltage

- Solve electrochemical problems

11.2 INSTRUCTIONAL MATERIALS USED:

- Electrochemical lab supplies

11.3 TEACHER ACTIVITIES:

- Lecture
- Demonstrations of electrolysis and electroplating

12.0 Students will solve equilibrium problems including gas equilibrium, solubility products, acid/base equilibrium and buffers.**12.1 SUGGESTED STUDENT ACTIVITY:**

- Solve equilibrium problems determining concentrations and equilibrium constants
- Perform titration experiments making volume and pH measurements
- Use data to determine molarity of a solution and equilibrium constant

12.2 INSTRUCTIONAL MATERIALS USED:

- Lab materials

12.3 TEACHER ACTIVITIES:

- Lecture
- Demonstrations of buffer solutions

13.0 Students will describe the factors that effect the rate of reaction.**13.1 SUGGESTED STUDENT ACTIVITY:**

- Explain how and why certain changes effect the rate of reaction
- Laboratory on reaction rates

13.2 INSTRUCTIONAL MATERIALS USED:

- Lab materials

13.3 TEACHER ACTIVITIES:

- Lecture
- Demonstration of catalysts, clock reactions, 30% peroxide

14.0 Students will explain internal energy and enthalpy, and solve related calculations, including heats of reaction, formation, Hess' Law, bond energies, heat of vaporization and fusion.**14.1 SUGGESTED STUDENT ACTIVITY:**

- Problem solving involving work, heat, volume, pressure, mass and temperature
- Perform calorimetry solving for heat of reaction experiment

14.2 INSTRUCTIONAL MATERIALS USED:

- Lab materials

14.3 TEACHER ACTIVITIES:

- Lecture
- Demonstrations of enthalpy and internal energy

15.0 Students will explain changes in entropy, Gibb's free energy and the direction of a reaction and solve related calculations.**15.1 SUGGESTED STUDENT ACTIVITY:**

- Predict the change of entropy of a reaction, change in free energy and the direction of a reaction
- Solve problems involving enthalpy, entropy and free energy

15.2 INSTRUCTIONAL MATERIALS USED:

- Lab Materials

15.3 TEACHER ACTIVITIES:

- Lecture
- Demonstrate reactions

16.0 Students will discuss the structure and bonding of carbon atoms, identify allotropic forms of carbon and describe the uses of various forms of carbon and substituted hydrocarbons.**16.1 SUGGESTED STUDENT ACTIVITY:**

- Reports on uses of organic materials
- Draw structures of various organic compounds
- Predict reactions involving carbon compounds
- Perform laboratory on ester formation
- Labs on differences between inorganic and organic compounds
- Text for alkanes and alkenes

16.2 INSTRUCTIONAL MATERIALS USED:

- Lab supplies

16.3 TEACHER ACTIVITIES:

- Lecture
- Modeling of organic compounds
- Demonstrations on oxidation of alcohols
- Make superballs and other polymers

17.0 Students will describe the chemistry of living things and describe the formation of macromolecules. Students will describe the genetic code, genetic engineering and biotechnology.**17.1 SUGGESTED STUDENT ACTIVITY:**

- Making DNA fingerprints
- Enzyme lab
- Debate on the pros and cons of genetic engineering
- Field trip to biotechnology firm or lab

17.2 INSTRUCTIONAL MATERIALS USED:

- Videos
- DNA electrophoresis plates
- Restriction enzymes

17.3 TEACHER ACTIVITIES:

- Lecture
- Demonstrations

INSTRUCTIONAL MATERIALS:

TEXTBOOKS

Suggested textbooks:

Modern Chemistry, Metcalf (Holt, Rinehart and Winston)
Chemistry: Study of Matter, Dorin, Dennison, Gabel (Prentice Hall)
Introductory Chemistry: A Foundation, Zumdahl (D.C. Heath)
Chemistry, Zumdahl (D.C. Heath)
Chemistry, Wilbraham, Staley, et.al. (Addison Wesley)
Chemistry, Laboratory Manual, Wilbraham, Staley, et. al. (Addison Wesley)

SUPPLEMENTARY MATERIALS

Overhead transparencies and test banks – available from many book publishers

AUDIO-VISUAL MATERIALS

Laserdiscs:

“Cosmic Chemistry”
“Chemistry at Work”

Videos:

The RETAC series, “Creation of the Universe”
“The World of Chemistry” series

Films:

“Chemical Families”
“Reaction Kinetics”
“Chemical Equilibrium”