

1. COVER PAGE

Course Title Chemistry P	Department or Discipline <input type="checkbox"/> History/Social Studies <input type="checkbox"/> English/Language Arts <input type="checkbox"/> Mathematics <input checked="" type="checkbox"/> Laboratory Science <input type="checkbox"/> Language other than English <input type="checkbox"/> Visual & Performing Arts (for 2003) <input type="checkbox"/> College Preparatory Elective: Subject Area: _____
School Arthur Andersen Community Learning Center	Grade Level(s) for which course is intended 9-12
District Alameda Unified	
City Alameda	
Name of School Contact Person Paul Bentz	Length of Course <input type="checkbox"/> Semester <input checked="" type="checkbox"/> Year <input type="checkbox"/> Other
Title/Position Facilitator	Unit Value <input type="checkbox"/> 0.5 (half year equivalent) <input checked="" type="checkbox"/> 1.0 (one year equivalent) <input type="checkbox"/> 2.0 (two year equivalent) <input type="checkbox"/> Other: _____
Contact Information Phone: 510-521-7123 x4 Fax: 510-521-7350 E-mail: pbentz1@aol.com	Seeking "Honors" distinction? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Date of School Board Approval	
Was this course previously approved by UC? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If so, in what year? <u>1996-2000</u> Under what course title? <u>Chemistry P (Encinal High School)</u>	
Pre-Requisites AACLC Integrated Science	
Co-Requisites Currently taking or having completed Algebra 1	
Brief Course Description The chemistry course provides a foundation in the principles of chemistry as articulated in the "California State Standards in Science" and the "Statement on Preparation in Natural Science Expected of Entering Freshmen" provided by the University of California.	

2. OPTIONAL BACKGROUND INFORMATION

Context for Course (optional).

How does this course fit into broader departmental and/or pathway structure? How does it fit into the overall school restructuring plans? Is the course intended to be a core course or supplemental? What are the student/school/community needs met by this course?

Chemistry is expected to be a core course. Learners take chemistry before taking biology so that they will have enough knowledge to study biology at the molecular level. After chemistry, learners can take biology or physics. Physics requires that they concurrently are taking Algebra 2. Biology and physics are also core courses. After completing chemistry, biology, and physics, learners take earth science, AP online science courses, or enroll in sciences classes taught at one of the local community colleges.

History of Course Development (optional).

Who was involved in the course development? Did you consult with UC Admissions personnel or UC professors? If so, what was the nature of such consultation and what was the result? Was this course modeled after another course at another school? If so, is that course UC approved? How does the course being submitted differ from the course after which it was modeled? Has this course received any special recognitions, designations or awards? Has it been articulated to local community colleges or universities?

Paul Bentz has been a high school chemistry teacher for 14 years and has taught college prep chemistry, honors chemistry, and advanced placement chemistry to high school students. When he became an AACLC facilitator 5 years ago, he developed this course within the context of the Arthur Andersen Community Learning Center. AACLC learners have yearly taken the California Golden State Exams in chemistry and many have received honors and recognition. For the five years prior to becoming a charter, the course was taught under the title of Chemistry P at Encinal High School.

3. COURSE CONTENT

Course Goals and/or Major Student Outcomes – A limited number of broad educational goals to be addressed by this course.

Satisfactory comprehension and completion of California State Standards for high school chemistry.

Satisfactory comprehension and completion of the course content described in the “Statement on Preparation in Natural Science Expected of Entering Freshmen” provided by the University of California.

All chemistry learners satisfactorily complete an original investigation and experiment that they use for entry into the AACLC Science Fair that is judged by UC Berkeley graduate students. This fulfills the “Investigation and Experimentation” requirement of the California State Science Standards.

Course Objectives – A list of specific student learning objectives. If you choose, you may also list appropriate academic content standards alongside each objective.

Learners will be responsible for demonstrating understanding of and able to apply to simple chemical situations all of the 20 Big Ideas of Chemistry stated on the attached course objectives.

Course Outline – A traditional course outline listing all topics and sub-topics, indicating both breadth and depth of coverage. As appropriate, please list major assignments (i.e. labs, essays, projects, etc.) alongside topics and sub-topics.

The attached detailed course objectives are covered in the following sequence:

Semester #1: Fundamentals, Bonding, Energy (heat, temperature, phases of matter and kinetic theory), Gas Laws, and Periodic Table Organization.

Semester #2: Nuclear, Patterns of Change, Equilibrium, Kinetics, and Electrochemistry.

Texts & Supplemental Instructional Materials -- A list of district-adopted core textbooks and/or core literature, followed by other readings, articles, reports, etc., indicating if materials will be used in part or in their entirety.

Text: Chemistry, D.C. Heath and Company, by Herron, Frank, Sarquis, Sarquis, Schrader, and Kukla, New Edition, 1996.

Laser disc that goes along with book.

World of Chemistry video series for high school.

Edunetics software on chemical topics.

Logal chemistry simulations software.

Instructional Methods and/or Strategies – A general description of instructional methods including lecture, discussion, group work, readings, lab work, project-based learning, service-learning, library research, internet research, interviewing, videos, audiotapes, CD Rom, etc.

Learners meet with instructor 3 days a week at an assigned time for lecture, discussion, group work, and demonstrations in a small group of 20. All appropriate readings from the textbook are assigned, as are appropriate related topics on Edunetics software. Microscale laboratory activities are conducted approximately once a week under the direction of the instructor. All learners do original research and experimentation and participate in the AACLC Science Fair. The learners also conduct several kitchen chemistry take home labs throughout the year. A field trip to the Lawrence Berkeley Laboratory coincides with the study of nuclear chemistry. Throughout the year learners are involved in projects such as creating brochures, newsletters, websites, experiments, and a creative expressions to demonstrate understanding of the concepts of chemistry.

Assessment Methods and/or Tools – A description of assessment methods, including exams, quizzes, papers, homework assignments, projects, participation, attendance, etc.

All learners take either written, oral, or take-home exams on each of 10 mastery topics: fundamentals, bonding, energy, gas laws, periodic table organization, nuclear, patterns of change, equilibrium, kinetics, and electrochemistry. Each semester they are required to take at least one exam of each kind (written, oral, or take-home). In class laboratory activities are part of their grade formula. Science fair projects and other projects such as newsletters, websites, brochures, experiments, and creative expressions are also a large part of their grade formula. All learners take an AACLC final exam on the 20 Big Ideas that form the foundation of the course. All learners review and prepare for the taking of the Golden State Exam in chemistry given each spring.

Assessment criteria – Indicate what criteria are used to assess student work. For example, has the school or department developed rubrics that define quality work? Until the State has published its academic performance standards, what is being used to define quality?

Learners are given ACLC developed project rubrics that define the grading performance standards for all projects. Examinations (written, oral, and take-home) are evaluated on a 10-point scale by the instructor who has 14 years experience assessing chemistry students at all levels in high school.

AALC Chemistry Mastery Concepts Course Objectives

Chemistry courses will be studying scientific concepts. These are sometimes called the Big Ideas of Chemistry. You will learn about them over and over again. It will take the whole year to really understand them and link them together.

These are the scientific concepts that you will be responsible for demonstrating understanding of and able to apply to simple chemical situations.

Basic Concepts and Equations

1. All matter is made up of different combinations of the same 92 naturally occurring elements. Explain. Why then are there more than 92 different substances in the world?
2. What is matter, and what is the "Law of Conservation of Matter". Why is it important?
3. What is energy, give some examples, what are energy transformations, and what is the "Law of Conservation of Energy" all about?
4. All elements are made up of the same fundamental particles: protons, neutrons, and electrons. It is the number of these particles that differentiates one element from another. Explain.

Atomic and Molecular theory

- Atoms, molecules, ions, polyatomic ions
- Protons, electrons, neutrons, nucleus, isotopes
- Notation
- Formulas (meanings, how to determine)

Understanding of the meaning of equations and stoichiometry

- Balancing
- Mole Concept
- Reversibility
- Catalysts
- Phase
- Coefficients
- Energy
- Limiting Reactant
- Mass-mass problems

Chemical Bonding

5. The chemical properties of an element are determined by its valence electrons. Explain. Give examples.
6. The force that holds two or more atoms together is called bonding. Explain three types of bonding and give examples. Draw some Lewis electron dot diagrams and explain. What are intermolecular forces, and what do they tell us about molecules?

Valence

- Principles of ionic, covalent, and metallic bonding
- Types of bonding from formula
- Bonding in polar and non-polar substances
- Hydrogen Bonding
- Attractions among particles in relation to observed physical and chemical properties

Heat, Temperature, Phases of Matter, and the Kinetic Theory

7. What is heat and what does it have to do with chemical reactions?
8. What is the "Kinetic Theory of Matter"? Explain the behavior of particles in solids, liquids, and gases. What is temperature all about, and explain the three temperature scales most commonly used.
9. Why is water truly a unique substance?

The concept of solids, liquids, and gases

- Kinetic theory
- Temperature
- Sublimation

Changes of state and the energy changes involved

Energy changes during reactions

- Exothermic and endothermic
- Potential energy diagrams
- Activation energy
- Heating and cooling curves

Patterns of Change

10. There are patterns of change in chemical reactions. Explain as many of these types of reactions as you can and give examples.

- a. Acid - base reactions. What is pH all about? What are buffers and why are they important? What is the difference between weak and strong acids? What is a titration? Explain how to find the concentration of an unknown acid.
- b. Oxidation - reduction reactions
- c. Synthesis reactions
- d. Decomposition reactions
- e. Replacement reactions (single and double)
- f. Combustion of carbon based fuels
- g. Photosynthesis and cellular respiration

Physical and chemical change

Important reactions

- Combustion
- Methane (greenhouse)
- Acid rain
- Photosynthesis
- Respiration

Familiarity with various types of reactions in aqueous solutions

- Single replacement
- Double replacement
- Combination
- Decomposition
- Combustion

Acid/base reactions

pH

Neutralization

Titration $M(a)V(a) = M(B)V(b)$

Oxidation/ reduction reactions (Answers the question: Who wants the electrons?)

Redox equations

Electrochemical cells

Predicting equations and voltage

Electroplating

Electrolysis

Solutions, Properties of Water, and Polarity

11. Some molecules are polar and some are nonpolar. Why would any normal person care? How can you determine whether or not a molecule is polar? What is the golden rule of dissolving related to polarity?

12. Water is a unique substance. Why?

Solutions

Aqueous

Saturated

Unsaturated

Supersaturated

Conductivity

Special properties of water

Boiling point

Freezing point

Boiling point elevation

Freezing point depression

Effects of pressure on bp

Polarity

Conductivity

Shape

Bonding

Solubility

Specific heat

Precipitation

Soluble, insoluble

Gas Laws

13. The gas laws are good to know. What are they and what do they have to do with normal life? Give examples.

Applications of the gas laws

- Pressure, temperature, volume
- Vapor pressure
- Kelvin, Celsius, liters, mmHg, torr, atmospheres, psi
- Gas molecule distribution
- Boyles Law
- Charles Law
- Gay-Lussac's Law
- Ideal Gas law
- Avogadro's Law

Nuclear Chemistry

14. How are nuclear reactions different from normal chemical reactions? What is this radioactivity stuff all about? What is this $E = mc^2$ all about? What is fission and fusion and why should you care?

Simple Nuclear Models and Equations

- Fission and Fusion
- Radioactivity types
- Half-life
- Radioactive dating
- Synthetic elements
- Energy and mass in nuclear reactions
- Radioactive isotopes and tracers
- Nuclear Waste

Periodic Table Organization

15. The Periodic Table is a useful tool in chemistry because of its repeating patterns and trends. What useful information can you get from it if you understand what the numbers mean? How is the table organized?

Periodic table as an organizing principle

- Atomic number
- Atomic mass
- Formulas from periodic table
- Ionic charges from periodic table
- Valence electrons from periodic table (Lewis electron dots)
- Metals, nonmetals, metalloids, halogens, noble gases, alkaline, alkaline earth, transition
- Bonding from periodic table
- Trends in size
- Solids, liquids and gases

16. How do you conduct a "controlled experiment"? Why are they important?

17. What is chemical kinetics all about and what do catalysts have to do with reaction rates? How do catalysts work?

Kinetics (Answers the question: How fast?)

Catalysts
Effects of temperature
Effects of concentration
Effects of pressure

18. Chemical equilibrium. What is it? Why is it important? What is Le Chatelier's Principle and how do you apply it? Who was Fritz Haber, and what does the Haber Process have to do with WW 1 and why there are so many people on this planet?

Equilibrium (Answers the question: How much?)

Application of Le Chatelier's Principle
Effect of catalysts on equilibrium
Effect of temperature on equilibrium

19. Explain entropy and entropy change, enthalpy and enthalpy change, and the relationship between entropy and enthalpy called Free Energy. What does all of this tell us about chemical reactions?

Entropy, enthalpy, and spontaneity

AACLK CHEMISTRY LABORATORY ACTIVITIES

Reaction Rates

Effects of catalysts and temperature on chemical reactions.

Identification of Chemical Reactions

Single replacement, double replacement, synthesis, decomposition and combustion. Solubility rules and use of activity series.

Acids and Bases

Determination of unknowns by titration, pH

Energy Changes

Exothermic and endothermic reactions, potential energy diagrams, calorimetry, determination of specific heat of metals

Analysis of Simple Mixtures

Examining compounds, mixtures, colloids, solutions, and suspensions by separations and reactions.

Enzymatic Hydrolysis

Determine the time it takes for varying concentrations of the enzyme Diastase to break down starch molecules into dextrins.

Determining Chemical Formulas

Observing various reactions and the concentrations at which they form precipitates, determine the chemical formulas of some compounds.

Determining an Activity Series

Using a series of different metals and ionic solutions, determine the metal reactivity series.

Serial Dilution

Preparing solutions, ppm, ppb, determining concentrations of unknowns

Testing for Chlorine in Water

Determine the lowest concentration of chlorine in ppm that kills green algae. Test the three provided water samples to determine their chlorine concentrations.

Chemical Testing for Unknowns

Identifying unknown chemical by comparisons with observed reactions.

Acids, Bases and Indicators

By testing many solutions, develop definitions that you can use to identify acids and bases.

Serial Dilution of Acids and Bases

Create serial dilutions of acids and bases and learn to relate to pH.

Acid-Base Neutralization

Conduct neutralizations to develop a quantitative model of neutralization.

Quantitative Analysis of an Acid

Quantitatively determine the concentration of an unknown acid sample.

Used Water (Acid-Base Neutralization)

Neutralize the pH level of a water sample and determine how much base will be needed to neutralize 100 liters of the “used “ water.

Is Neutralization the Solution to Pollution?

Investigate the properties of the neutralized solution to obtain more evidence about the product of the interaction of the acid and base solutions.

Water Quality Testing

Perform water quality testing for pH, salinity, nitrates, and Hg.

Properties of Materials

Determine the properties of numerous materials for hardness, conductivity, and density.

Conductors and Insulators

Determining and comparing thermal conductivity.

Preventing Corrosion

Determine the advantages and disadvantages, including environmental effects, of different approaches to preventing the corrosion of iron.

Properties of Plastics

Determine the relative and absolute densities of four different plastics and use this information to determine the best choice of a plastic for various products. Identifying unknown plastic samples.

Synthesizing Polymers

Determine the properties of a cross-linked polymerized material you create.

Investigating a New Plastic

Determining the properties of polystyrene and cornstarch foam.

Chemical Change - Al/CuCl Reaction

Testing for copper concentrations.

Heavy Metals

Tests for Fe.

Constructing Chemical Cells

Test different combinations of metals to determine which ones create the highest voltage.

Electroplating

Investigating the use of energy in electroplating copper.

Electrolysis

Electrolysis of various solutions and prediction of products.

Electrolysis of Water

Electrolysis of water, collect products, and test.

Ice and Energy Transfer

Thermal conductivity calculations, heat of fusion, etc.

Calorimetry

Determining heats lost and gained by materials.

Solar Energy Exploration

Investigation of how a solar cell can directly transform solar energy into electricity.

Synthesis, Testing, and Redesign of White Glue

Synthesize and test white glue. Redesign your approach; to produce higher quality glue while minimizing the amount of waste.

**Independent Investigation and Experimentation
Required Science Fair Project**