

El Monte Union High School District

9/1/06

Course Outline

High School _____ District _____

Title: _____ CHEMISTRY 1P _____

Transitional* _____ (Eng. Dept. Only)

Sheltered (SDAIE)* _____ Bilingual* _____

AP** _____ Honors** _____

Department: _____ Science _____

Grade Level (s): _____ 10-12 _____

Semester _____ Year _____ X _____

Year of State Framework

Adoption _____ 1998 _____

This course meets
graduation requirements:

- () English
- () Fine Arts
- () Foreign Language
- () Health & Safety
- () Math
- () Physical Education
- (x) Science
- () Social Science

Department/Cluster Approval

Date

_____	_____
_____	_____
_____	_____
_____	_____
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_____	_____
_____	_____

*Instructional materials appropriate for English language learners are required.

**For AP/Honors course attach a page describing how this course is above and beyond a regular course. Also, explain why this course is the equivalent of a college level class.

1. **Prerequisite(s):**

It is recommended that students successfully complete Algebra 1 P or its equivalent with a grade of "C" or better.

2. **Short description of course which may also be used in the registration manual:**

This course is an introduction to chemistry, the study of matter and the changes it undergoes. Major topics of study to be covered include: Atomic and Molecular Structure, Chemical Bonds, Conservation of Matter and Stoichiometry, Gases and Their Properties, Acids and Bases, Solutions, Chemical Thermodynamics, Reaction Rates and Chemical Equilibria, Organic and Biochemistry, and Nuclear Processes. This course meets or exceeds all of the California Science Standards for Chemistry as well as items 1a-g,j-n of the California Science Standards for Investigation and Experimentation.

This course meets the "d – Lab Science (physical)" or "g – Other Elective" requirement of the UC/CSU "a" through "g" requirements and is counted toward the student's UC admission GPA only if taken during grades 10-12 and a grade of "C" or better is achieved.

3. Describe how this course integrates the schools ESLRS (Expected Schoolwide Learning Results):

- A. Be effective communicators:
 - i. Students will use word processing and presentation programs to present their work.
 - ii. Students will use computers for research and development of projects.
 - iii. Students will receive supervised internet instruction and utilize the net as a tool to assist them in their class work.
- B. Be ethical and responsible individuals:
 - i. Students will be expected to be in class on time and prepared to work.
 - ii. Students will be expected to complete assignments on time and submit quality work.
 - iii. Students will be expected to assume personal responsibility for their work.
- C. Be critical thinkers and self-directed learners:
 - i. Students will understand the process of goal setting and develop a personal plan for high school and beyond.
 - ii. Students will conduct lab investigations that present problems to solve and use critical thinking skills.
- D. Be healthy individuals:
 - i. Students will learn and follow all laboratory safety rules and procedures.
 - ii. Students will learn how to apply scientific concepts to improve their health.
- E. Be active community participants:
 - i. Students will be encouraged to respect diverse cultures within the classroom setting.
 - ii. Students will be given opportunities to participate in school clubs and activities that respect cultural diversity.
 - iii. Students will learn to work cooperatively with each other in groups when doing labs and projects.
 - iv. Students will develop working relationships across gender and cultural groups.

4. Describe the additional efforts/teaching techniques/methodology to be used to meet the needs of English language learners:

English Learners will receive a program of instruction at their appropriate level (ELD 2, 3 or Transitional) by a teacher trained to utilize SDAIE (Specially Designed Academic Instruction in English) or CLAD (Crosscultural Language Acquisition and Development) methodologies. Tutoring services will also be available for these students.

5. Describe the interdepartmental articulation process for this course:

When applicable, the science department is willing to work with other departments to coordinate student work on course projects. All students take a Tech Core class for an introduction to computer applications. The individual departments then build computer skills through assigning various projects requiring Power Point Presentation, Word Processing, Spreadsheet, and Graphing. The Media Center provides class instruction on computer applications and research when needed. The English department will provide students with proper writing styles and techniques for research that the students will be expected to utilize in other departments.

6. Describe how this course will integrate academic and vocational concepts, possibly through connecting activities. Describe how this course will address work-based learning/school to career concepts:

Students will be exploring occupational/ professional career pathways and employment requirements within the physical sciences as they relate to our complex technological society. Students will learn to think clearly, to use intellectual reasoning in weighing issues, solving problems and making rational decisions as required in both

family and job related environments. Students will study social issues to develop and model a sense of responsibility in the home and workplace.

7. **Materials of Instruction :**

(Note that materials of instruction for English language learners are required and should be listed below.)

A. Textbook(s) and Core Reading

Davis, Raymond E., H. Clark Metcalfe, John E. Williams, and Joseph F. Catska. *Modern Chemistry*. Holt, Rinehart & Winston. 1999.

B. Supplemental Materials and Resources

A sufficient supply and variety of inorganic and organic chemicals.

C. Tools, Equipment, Technology, Manipulation, Audio-Visual

Visual presentations will be made using overhead transparencies and/or presentations with LCD projector. A variety of standard glassware and laboratory equipment including centogram and/or electronic balances, hotplates, and Bunsen burners will be used during the practical exercises. Internet access will be made available for research and use of online virtual labs.

8. **Objectives of Course (including unit detail, pacing plan, California Standards References, student performance objectives, and evaluation requirements):**

Student Performance Goals: (The student will be able to...)	Chapter
Semester One: <u>Foundations:</u> (3 weeks) <ol style="list-style-type: none"> 1. Convert numbers to scientific notation and reverse. 2. Identify total number of significant figures. 3. Perform calculations using significant figures' rules. 4. Perform metric conversions and identify standard prefixes. 5. Round numbers using scientific rules. 6. Distinguish between physical and chemical properties. 7. Identify and/or describe physical and chemical changes. 8. Define and describe different branches of chemistry. 9. Identify and explain standard lab safety rules. <u>Atoms:</u> (10 weeks) <ol style="list-style-type: none"> 1. Describe Dalton's theory. (I&E 1g, 1k, 1n) 2. Describe Thomson's discovery of the electron and how the atomic model changed. (*1h, I&E 1g, 1k, 1n) 3. Describe Rutherford's gold-foil experiment and how the atomic model changed. (*1h, I&E 1g, 1k, 1n) 4. Describe Millikan's oil drop experiment and how the atomic model changed. (*1h, I&E 1g, 1k, 1n) 5. Compare and contrast the location, charge and size of each sub-atomic particle. (1a) 6. Describe a quark and its relationship to protons and neutrons. (*11g) 	

7. Describe the relationship between an element's unique properties and each sub-atomic particle. (1a)
8. Relate position on the periodic table to atomic number and mass number. (1a)
9. Calculate the number of protons, neutrons and electrons of an atom/ion based on atomic number and mass number. (1a)
10. Describe how isotopes differ. (1a)
11. Describe alpha, beta, and gamma radiation in terms of depth of penetration and amount of damage. (11e)
12. Describe alpha, beta, and gamma radiation in terms of nuclear change. (11d)
13. Describe nuclear decay in terms of parent isotope and daughter products. (11c)
14. Define "fission" and "fusion" and their relative amounts of energy released.
15. Compare energy released by chemical reactions to energy released by nuclear reactions. (11b)
16. Define "half life."
17. Calculate change in mass after decay using whole numbers of half-lives. (*11f, I&E 1i)
18. Define "photon" and explain photoelectric effect. (*1h)
19. Describe the Bohr model of the atom (*1i, I&E 1g, 1k, 1n)
20. Use the equation $c = \lambda\nu$ to calculate properties of a wave. (none)
21. Use the equation $E = h\nu$ to calculate properties of a photon. (*1j)
22. Relate the energy of a photon to spectral lines. (*1j)
23. Define the Heisenberg Uncertainty Principle. (*1j)
24. Describe an element's quantum electron configuration. (*1g)
25. Explain the Aufbau principle, the Pauli exclusion principle and Hund's rule. (*1i)
26. Correlate an element's quantum electron configuration to position on the periodic table. (*1g)
27. Compare and contrast core electrons with valence electrons. (1d)
28. Determine the number of valence electrons (available for bonding) based on position on the periodic table. (1d)
29. Classify specific elements as: metals, non-metals, and semi-metals/metalloids. (1b)
30. Classify specific elements as: alkali metals, alkaline earth metals, transition metals, halogens, or noble gases. (1b, 1c)
31. Classify specific elements as lanthanides or actinides and identify the transuranium/transactinide elements as man-made using nuclear accelerators. (*1f)
32. Describe trends on the periodic table in relation to: electronegativity, ionization energy, atomic radius, and ionic radius. (1c) Identify common cations and anions from position on the periodic table. (2a)
33. Identify bond type (% ionic character) using electronegativity difference. (2a, 2f, 2g)
34. Compare and contrast covalent, ionic and metallic bonds. (2a)
35. Describe nuclear forces and their relative strengths. (11a)
36. Construct models of biological molecules to show covalent bonding. (2b, I&E 1n)
37. Construct models of ionic crystalline structures. (2c, I&E 1n)
38. Identify the attractive force between positive and negative ions. (2c)
39. Compare and contrast intermolecular forces present during solid, liquid and gas phases. (2d)
40. Compare and contrast molecular arrangement of solid, liquid and gas phases. (2d)
41. Draw Lewis dot structures of single elements, molecular compounds, and ionic compounds. (ex. CH_4 , NH_3 , NaBr) (2e)
42. Predict 3-D molecular shape based on Lewis dot structures (VSEPR). (*2f)
43. Predict polarity of molecules based on Lewis dot structures. (*2f)

44. Explain the influence of Van der Waals forces and hydrogen bonding on physical properties. (ex. melting point, volatility, etc.) (2h)
45. Define “atomic mass unit” and explain its relationship to Carbon-12. (3b)
46. Name monatomic cations and anions using standard nomenclature.
47. Name covalent molecules using the traditional prefix nomenclature system.
48. Name ionic compounds using the Stock nomenclature system.
49. Name and identify formulas of standard polyatomic ions.
50. Define “polymer” and identify the repeating unit. Examples must include proteins, DNA/RNA, and starch molecules. (10a, 10c)
51. Relate carbon’s valence electrons to its large variety of compounds. (10b)
52. Name simple (mono- through deca-) alkanes, alkenes, and alkynes given a structural formula. (*10d)
53. Draw structural formulas of simple alkanes, alkenes, and alkynes given the correct name. (*10d)
54. Name simple molecules that contain one benzene ring. (*10d)
55. Identify the functional group of alcohols, ketones, ethers, esters, aldehydes, amines, and carboxylic acids. (*10e)
56. Define Avogadro’s number and its relationship to the mole. (3c, 3b)
57. Calculate molar/formula mass involving subscripts, parentheses, and hydrates using the Periodic Table. (3d)
58. Convert atoms/particles to moles. (3d)
59. Convert moles to mass. (3d)
60. Convert atoms/particles to mass. (3d)
61. Convert moles to liters (gases at STP only). (3d)

Reactions: (5 weeks)

1. Identify types of reactions.
2. Balance chemical equations by changing coefficients. (3a)
3. Calculate mass of products or reactants using molar/formula masses and the mole ratio of an equation. (3e)
4. Identify limiting reactant using mole calculations.
5. Compare theoretical values to experimental values by calculating percent yield. (*3f)
6. Calculate oxidation numbers of elements in a compound. (none/*3g)
7. Identify redox reactions using analysis of oxidation numbers. (*3g)
8. Balance oxidation and reduction half-reactions. (*3g)
9. Combine and balance half-reactions to form redox reactions. (*3g)

Semester Two:

Thermochemistry: (3 weeks)

1. Describe temperature and heat flow in terms of kinetic molecular theory. (7a)
2. Define exothermic and endothermic. (7b)
3. Describe potential energy in terms of phase change. (7c)
4. Define specific heat capacity. (7d)
5. Calculate temperature change or heat flow using the equation: $Q = m \Delta T c$. (7d)
6. Calculate heat flow during phase change (freezing/boiling) using the equation: $Q = m \Delta H_{\text{fus/vap}}$. (7d)
7. Explain phase diagrams (temperature vs. energy and pressure vs. temperature) using kinetic molecular theory. (7d)
8. Define standard enthalpy of formation (H_f°). (none)
9. Calculate the change in enthalpy of a reaction using Hess’s Law. (*7e)

10. Define entropy (ΔS). (none)
11. Predict spontaneity of reactions using Gibbs free energy. (*7f)

Kinetic Molecular Theory: (10 weeks)

1. Define solid, liquid and gas in terms of motion of molecules.
2. Explain the dissolving process by describing the motion of molecules. (6b)
3. Identify and contrast the solute and solvent in a variety of mixtures. (ex. gas-gas, gas-liquid, solid-liquid, etc.) (6a)
4. Explain the effect of temperature on the motion of molecules and the dissolving process. (6c)
5. Explain the effect of pressure on the motion of molecules and the dissolving process. (6c)
6. Explain the effect of surface area on the motion of molecules and the dissolving process. (6c)
7. Calculate concentration using grams per liter. (6d)
8. Calculate concentration using molarity. (6d)
9. Calculate concentration using parts per million. (6d)
10. Calculate concentration using percent composition. (6d)
11. Calculate concentration using molality. (6e)
12. Explain the effect of molality on freezing point and boiling point. (*6e)
13. Explain chromatography and distillation in relation to molecular arrangement. (6f)
14. Categorize observable properties of acids, bases, and salt solutions. (5a)
15. Name standard binary acids and oxyacids.
16. Students are to create several acid-base reactions and to explain why these reactions work by explaining that acids are hydrogen-ion donating and bases are hydrogen-ion accepting substances. (5b)
17. Characterize strength of acidic and basic solutions using pH values and K_a/K_b values. (5c)
18. Characterize acids and bases using the pH scale. (5d)
19. Compare and contrast Arrhenius, Bronsted-Lowry, and Lewis acids and bases. (*5e, 5b)
20. Use the formula: $-\log [H^+]$ to calculate pH values for acidic and basic solutions. (*5f, I&E 1e)
21. Explain the function of a buffer in acid-base reactions. (*5g)
22. Explain pressure as a function of collisions and the random motion of molecules. (4a)
23. Convert between standard units of pressure. (none)
24. Describe the difference between air and water pressure. (4a)
25. Convert between Kelvin and $^{\circ}C$. (4e)
26. Define absolute zero in terms of temperature and particle motion. (4f)
27. Describe the kinetic molecular theory of gases. (*4g)
28. Describe the relationship between temperature and kinetic energy. (*4g)
29. Define Standard Temperature and Pressure. (4d)
30. Perform calculations using Boyle's, Charles', and the Combined Gas Laws. (4c)
31. Predict the effects of changing pressure or temperature on a gas's volume. (4c)
32. Perform calculations using the Ideal Gas Law for any variable. (*4h)
33. Explain diffusion in terms of kinetic molecular theory. (4b)
34. Explain the difference between diffusion and effusion. (*4i)
35. Perform calculations using Dalton's Law of Partial Pressures. (*4i)
36. Explain Graham's Law of diffusion. (*4i)

Equilibria & Rates: (5 weeks) <ol style="list-style-type: none"> 1. Explain the concept of equilibrium in terms of reactants and products. (9b) 2. Predict the effects of change in concentration, temperature, and pressure on equilibrium using Le Chatelier's Principle. (9a) 3. Formulate an equilibrium constant equation. (*9c) 4. Calculate an equilibrium constant. (*9c) 5. Define reaction rate in terms of concentration of reactants and products. (8a) 6. Describe the effects of concentration, temperature and pressure on reaction rate. (8b) 7. Define activation energy. (8d) 8. Describe the role of activation energy in a chemical reaction. (8d) 9. Describe the role of a catalyst. (8c) 		
Unit Detail Including Projects and Activities and Duration of Units.		Evaluation/Assessment (including minimal attainment for student to pass course.)
Fall Semester: Foundations Atoms Reactions	3 weeks 10 weeks 5 weeks	"A"-level work (90-100%): (Excellence overall; no major weaknesses.) This student demonstrates real achievement in grasping scientific thinking, along with development of specific skills and abilities. This student's work is clear, precise, and well reasoned.
Spring Semester: Thermochemistry Kinetic-Molecular Theory Equilibria & Rates	3 weeks 10 weeks 5 weeks	"B"-level work (80-89%): (Moderate level of understanding and skill in scientific thinking with some distinctive weaknesses; more strengths than weaknesses.)

<p>Laboratory Activities:</p> <p>Students will be expected to address issues of variables, controls, error and the limitations of a practical nature when using experimental models to explore natural phenomena. Students will also be expected to develop solutions to problems that involve more than one area of science (I/E b, c, g, j, l)</p> <p>Research Projects:</p> <p>Students will complete one research-based project in which they will demonstrate their knowledge and awareness of societal obligations as related to scientific issues. (I/E m)</p>	<p>This student demonstrates a good level of achieving scientific thinking with occasional areas of weakness. This student's work is essentially clear and precise with occasional lapses into weak reasoning.</p> <p><u>"C"-level work (70-79%):</u> (More than a minimum level of understanding and skill in scientific thinking, but highly inconsistent with as many weaknesses as strengths.)</p> <p>This student demonstrates a mediocre level of achieving scientific thought with pronounced areas of weakness. This student's work is inconsistent and shows only modest skills and reasoning.</p> <p><u>"D"-level work (60-69%):</u> (Minimal level of understanding and skill in scientific thinking.)</p> <p>This student demonstrates a lack of clarity and discipline and appears to be only going through the motions. This student's work does not show good scientific reasoning and skills and only rarely shows any attempt to take charge of ideas.</p> <p><u>F-level work (59% and below):</u> (Far below minimal level of understanding and skill in scientific thinking.)</p> <p>This student does not display any discernable scientific reasoning. This student failed to do the required work of the course, even at a level approaching the standard.)</p> <p>In this course, there will be cumulative, standards-based, semester exams to assess student achievement.</p> <p>Students must obtain an overall score of 60% or better to pass this course.</p>
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