Revised 02-07-2017

El Monte Union High School District

Course Outline

District: EMUHSD
High School: EMHS

Title: Chemistry Honors 1P

Transitional*_____(Eng. Dept. Only)

Sheltered (SDAIE)*___Bilingual*___

AP**_____Honors**____X_____

Department: _____Science____

CTE/VOC ED :
Industry Sector:_____
Pathways:_____
Check One
Introductory:_____
Concentrator:_____
Capstone:_____

Grade Level (s):_____10-12_____

Semester_____Year__X_____

*Year of State Standards Adoption 1998
*Year of NGSS 2013 / CA Frameworks 2016
(NGSS 2013 adopted into CA Frameworks 2016)

This course meets graduation requirements:

( ) English
( ) Fine Arts
( ) Foreign Language
( ) Health & Safety
( ) Math
( ) Physical Education
(X) Science
( ) Social Science
( ) Elective

Department/Cluster Approval	Date
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

*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):

Successful completion of one year of a laboratory science course (ex. Biology) and completion of Integrated Mathematics with a grade of B or better, or permission of instructor.

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

Chemistry Honors is a one year introductory course comprised of units on Chemical Foundations/Atomic Theory, Stoichiometry, Types of Chemical Reactions/Solution Stoichiometry, Gases, Thermochemistry, Atomic Structure/Periodicity, Bonding, Liquids/Solids/Solutions, Chemical Kinetics/Equilibrium, Acids/Bases & Aqueous Equilibria, Electrochemistry/Radiochemistry and Organic/Biochemistry. The course will be built around lectures coordinated with laboratory exercises, involving a lab report for each lab. The material will be covered at a more rapid pace and in greater depth than might be expected in a regular chemistry course.

The student will develop the ability to: read and listen to science related topics with a critical attitude, formulate hypotheses, gather and organize related information generated by others and themselves, reach appropriate conclusions regarding hypotheses based on analysis of data, communicate with others orally and in writing in an understandable manner, develop conceptual understanding, critical thinking and problem solving skills in each of the major areas of chemistry listed above.

3. Describe how this course integrates the schools SLO (former ESLRs- Expected School-wide Learning Results):

The following SLO's will be integrated into class work, assignments, labs, and projects.

Academic Schoolwide Learner Outcome
• Seek, access, analyze, and creatively use information to demonstrate effective communication, computation, critical thinking, and technological skills.
• Demonstrate proficiency in curricular programs aligned to the Common Core State Standards.

Interpersonal Academic Schoolwide Learner Outcomes
• Be productive community members by learning to respect diversity, exercise rights, accept responsibility, and work cooperatively with others.

Personal Skills Schoolwide Learner Outcomes
• Make informed decisions, set goals, take actions, and evaluate results while exhibiting resiliency, honesty, integrity, and personal accountability.

Career Student Learner Outcomes
• Explore a variety of career options and develop personal attributes and skills that lead to the pursuit of a post-secondary education and productive work life.

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

a) SIOP (Sheltered Instruction Observation Protocol) strategies will be incorporated into lessons.
b) SDAIE (Specially Designed Academic Instruction in English) strategies will be incorporated into lessons.
c) ELL supplementary materials will be incorporated into the lessons.
d) Glossaries will be used as available.
e) Visuals/Manipulatives will be used.

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 Word Processing, Spreadsheet and Graphing. The Media Center provides class instruction on computer applications and research when needed. These skills will be used and incorporated in coursework and projects. The students will be using English skills and Math/Computational skills as they complete work for the class, which will reinforce instruction in those departments and vice versa.

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 career pathways and employment requirements within Chemistry and the other sciences, when opportunities arise in the curriculum, as the students proceed through the course. The student will also be exploring careers when they do the College Project.

7. Materials of Instruction (Note: Materials of instruction for English Language Learners are required and should be listed below.)

   A. Textbook(s) and Core Reading(s):

Zumdahl, Steven, *Chemistry*, Houghton Mifflin, Boston, 2007, 7th edition

   B. Supplemental Materials and Resources:

   C. Tools, Equipment, Technology, Manipulatives, Audio-Visual:

Visual presentations will be made using overhead transparencies, videos, models and/or presentations with a LCD projector. A variety of standard glassware, chemistry equipment and laboratory equipment including balances, Bunsen burners, and chemicals, etc. will be used during the laboratories. Standard computer technologies including MS Office, web browsers and 3rd party software will be used as necessary.

8.

- **Objectives of Course**
- **Unit detail including projects and activities including duration of units (pacing plan)**
- **Indicate references to state framework(s)/standards (If state standard is not applicable then national standard should be used)**
- **Student performance standards**
- **Evaluation/assessment/rubrics**
- **Include minimal attainment for student to pass course**

Lab Reports (The labs average 2-3 laboratory periods with some labs taking 4 days.)
The labs require following processes and procedures, taking observations, and data manipulation. (See labs listed in the units below.) Students communicate and collaborate in lab groups: however, each student writes a laboratory report for every lab that they perform. A minimum of 20% of student contact time is spent doing hands-on laboratory activities.

Pre-Lab Work: All pre-lab work is to be done prior to arriving to class on lab day. The pre-lab includes the Title, Purpose, Procedure, Pre-lab Questions/Calculations and any necessary Data Tables.

During the lab: During the lab the students will communicate with each other clearly to perform the lab and to solve problems as they arise. The students will practice proper laboratory techniques and use various types of laboratory equipment. Students will record all of their data on their pre-lab in the procedure section or in data tables. Students will underline, use capital letters or any other device to help organize their data.

Post-Lab Work: Students will perform calculations, graphs as needed, and answer questions to attain the overall purpose of each lab. Conclusions will be made for each lab and Error Analysis will be performed.

I. Chemical Foundations/ Atomic Theory (13 days)

CA Science Content Standards: Physics 4i, Chem 1b,1c,1e,1h.
NGSS/CA Frameworks: HS-PS 1-1

Students will:

-work with Significant Figures and Exponential Notation, using the Rules for Adding/Subtracting and Multiplying/Division Significant Figures to round off answers while solving/calculating problems.
-solve problems with Combined Significant Figure Operations.
-solve Conversions, using squares/cubes and with SI Units in the numerator as well as in the denominator.
-solve Temperature Conversions and Density problems, solving for all variables and changing units as needed.
-learn the States of Matter, the Types of Mixtures, and typical Physical/Chemical Changes/Characteristics.
-learn and understand the Law of Conservation of Mass, the Law of Definite Proportions, the Law of Multiple Proportions, Dalton's Atomic Theory, and Avogadro's Hypothesis.
-learn the discoveries made by Thompson and Milikan, which lead to the atomic models.
-learn and be able to draw the Plum Pudding Model, the Rutherford Model, and the Modern Model as well as knowing their differences.
-learn the groups on the Periodic Table.
-know the difference between Ionic and Covalent Chemical Bonds.
-Write Formulas for Ionic and Covalent Compounds from names.
-Name Ionic and Covalent Compounds from formulas.

Density of Carbon Dioxide Lab: Students calculate the density of carbon dioxide, using alka seltzer and water displacement.

II. Stoichiometry (9 days)

CA Science Content Standards: Chem 1a,3a,3b,3c,3d,3e,3f.
NGSS/CA Frameworks: HS-PS 1-2,1-7

Students will:
-calculate the Periodic Table Atomic Mass of elements from Mass Spectrometry data of Isotope percentages.
-determine the Molar Mass and solve gram/mol/molecule conversions, using Avogadro's number as necessary.
-calculate the Percent Composition of compounds.
-calculate the Empirical Formula from grams or percent.
-calculate the formula of Hydrates.
-Balance Chemical Reactions and know the 5 Types of Chemical Reactions.
-solve Stoichiometry problems, including Limiting Reagent.
-determine % Yield
-solve Stoichiometry problems from combustion reactions to determine the Empirical formula of organic compounds.

Determination of the Formula of a Hydrate Lab: Students calculate the formula of a copper sulfate hydrate using crucibles.

Fractional Distillation Lab: Students fractionally distill a mixture of alcohol and water. Students test their fractions for alcohol and water, then graph results.

III. Types of Chemical Reactions/Solution Stoichiometry (14 days)

CA Science Content Standards: Chem 3g

Students will:
-understand and be able to explain Solvation and Electrolytes (Strong, Weak and Non)
-calculate and solve Molarity problems.
-complete and balance Precipitation Reactions (Molecular, Complete & Net Ionic).
-complete and balance Acid Base Reactions (Molecular, Complete & Net Ionic).
-solve Titration problems, including ones with Extra Acid or Base.
-determine and balance Oxidation/Reduction (Redox) Reactions.

Alkaline Earth Double Displacement Lab: Students test the solubility of the alkaline earths, find the solubility trend, and write double displacement reactions.

Acid Base Titration Lab: Students calculate an unknown concentration of NaOH, using standardized HCl and then calculate unknown HCl, using the unknown NaOH with burets.

IV. Gases (16 days)

CA Science Content Standards: Physics 2a, Chem 3d,4a,4b,4c,4d,4e,4f,4g,4h, 4i, Earth 4c,4d,5a,6d,8c.
NGSS/CA Frameworks: HS-ESS 2-4

Students will:
-calculate Pressure, using Manometers (Open/Closed).
-solve Ideal Gas Law problems, being able to, with any combination of variables, make the appropriate equation, such as Boyle's Law, Charles' Law, Avogadro's Law etc.
-calculate and solve Gas Density problems.
-use Dalton's Law of Partial Pressures to solve problems with gas collected over water and problems with multiple gases mixed together.
-solve Gas Stoichiometry problems.
-know and understand the Kinetic Molecular Theory of Gases.
-solve problems using the Kinetic Energy for gases, the Root Mean Square Velocity and the Graham's Law of Effusion equations..
-solve problems using the Van der Waals Equation for Real Gases.

Charles Law Lab: Students graph gas volume and temperature results and extrapolate to find the temperature at zero volume.

Molar Relationship between Mass and Volume Lab: Students do a gas stoichiometry, involving Mg and HCl, to calculate the theoretical volume of H_2 gas and then do a percent error analysis with the experimental amount of H_2 produced.

Acid Rain / Ozone Hole / Global Warming (3 days of the 16 days)
Students investigate the pollutants in car exhaust that produce smog and acid rain. The ozone produced from car exhaust then leads to a discussion of "good" and "bad" ozone. Then the reactions for ozone depletion are studied (ozone hole). The importance of UV light is discussed. Also, the other important reactions that cause acid rain are studied. The causes of the Greenhouse Effect and Earth's history of global warming/cooling are studied.

V. Thermochemistry (10 days)

CA Science Content Standards: Physics 3a,3c,3d,3e,3f, Chem 7a,7b,7c,7d,7e.
NGSS/CA Frameworks: HS-PS 1-4, 3-4

Students will:
-know and understand the Law of Conservation of Energy and the First Law of Thermodynamics.
-solve problems using Internal Energy, Work, and Enthalpy.
-solve problems using Heat and Calorimetry.
-solve problems using Hess's Law.
-solve problems using Entropy.
-know and understand the Second & Third Law of Thermodynamics.
-solve problems using Gibb's Free Energy and the equation relating ΔH, ΔG, & ΔS.

Specific Heat Lab: Students calculate the specific heat of a metal and determine which metal they used.

VI. Atomic Structure/Periodicity (12 days)

CA Science Content Standards: Physics 4a,4c,4e, Chem 1c,1g,1i,1j.
NGSS/CA Frameworks: HS-PS 1-1, 1-2, 4-1, 4-3,

Students will:
-know and understand Emission Spectra and why it occurs.
-know and understand Electromagnetic Radiation.
-solve problems with the equation relating wavelength and frequency as well as Planck's Equation, separately and conjointly.
-solve problems with De Broglie's Equation and the Bohr Model equation for Hydrogen.
-know how Schrodinger's Quantum Mechanics lead to electron orbitals.
-solve problems with Heisenberg's Uncertainty Principle.
-write Electron Configurations for elements.
- use the Pauli Exclusion Principle and Hund's Rule to write out Orbital Diagrams for elements, including exceptions and f-orbitals.
-understand Periodicity in order to solve problems with Atomic Radius, Ionization Energy, Electron Affinity, and Electronegativity.

Emission Spectra/ Flame Spectra Lab: Students determine four gases in gas spectrum tubes by using emission spectra and state the overall color of five metal cations in solution, by using flame tests. There is also practice using the Bohr equation, Planck's Equation when calculating the wavelength of the Hydrogen spectral lines from layer transitions.

VII. Bonding (12 days)

CA Science Content Standards: Physics 1m, Chem 1d,2a,2b,2e,2f,2g.
NGSS/CA Frameworks: HS-PS 1-2, 1-4

Students will:
-determine Bond Character.
-solve Coulomb's Law.
-calculate ΔH from bond energies (breaking/forming).
-solve Lattice Energy problems, including using lattice energy with ionization, electron affinity, sublimation and bond energies to calculate ΔH for a reaction.
-understand the Localized Electron Model.
-understand the VESPR Model and draw the structures of chemical compounds, stating the molecular name and bond angles.
-draw structures with Resonance.
- calculate the Formal Charge.
-determine the Polarity and Hybridization.
-understand how hybridization works in Multiple Bonds.
-understand sigma and pi bonds.
-solve molecular orbital theory problems for homonuclear diatomic molecules using both s and p electrons.

Polarity Lab: Students determine the polarity of some ionic and covalent compounds, using the rule "like dissolves like".

VIII. Liquids/Solids/Solutions (16 days)

CA Science Content Standards: Chem 2c,2d,2h,6a,6b,6c,6d,6e,6f.
NGSS/CA Frameworks: HS-PS 1-3, 2-6

Students will:
-know and determine the Type of Solids and their Interparticle Forces: Ionic and Molecular (Dipole-Dipole, Hydrogen, LDF)
-explain Liquid Forces (Adhesive/ Cohesive) and solve problems relating cohesive forces to interparticle force strengths.
-solve problems for Solid Crystals, using the Bragg equation used in X-ray diffraction.
-know and determine the Types of Solids and Interparticle Forces: Metallic (Packing, Bonding theories, Alloys), Network (Semiconductors), and Group VIII.
-solve Body Centered/ Face Centered Problems going between radius and density (both directions).
-understand Vapor Equilibrium and solve Change of State/heat problems, using ΔH (vap & fusion) and Q for states of matter.
-be able to graph and solve problems with Vapor Pressure & Temperature, including using the Clausius Clapeyron equation.
-solve problems with Molarity, molality, mass %, and mol fraction.
-solve Enthalpy of Solution problems, using Hydration and Lattice Energies.
-understand factors affecting Solubility, including the "like dissolves like" rule.
-solve problems using Henry's Law.
-understand how temperature affects solubility of solids and gases differently.
-solve problems using Raoult's Law.
-solve Boiling Pt. Elevation/ Freezing Pt. Depression problems.
-solve Osmotic Pressure problems.

-understand Colloids.

Boiling Point Elevation and Freezing Point Depression to Determine Molecular Mass Lab: Students determine molecular masses of KNO_3 and $C_6H_{12}O_6$, using boiling point elevation and freezing point depression.

IX. Chemical Kinetics/ Equilibrium (12 days)

CA Science Content Standards: Chem 7f,8a,8b,8c,8d,9a,9b,9c.
NGSS/CA Frameworks: HS-PS 1-5, 1-6

Students will:
-solve Reaction Rate problems and write Integrated Rate Laws.
-graph and solve problems for First, Second, Zero Order Rate Law Equations, ½ lives, and rate constants.
-determine rate laws from Reaction Mechanisms.
-understand the Chemical Kinetics/ Collision Model.
-solve Arrhenius Equation problems.
-understand Catalysis and types of catalysts.
-solve problems with Equilibrium Equations (Molarity and Pressure).
-understand the Applications of K_{eq} to determine which way the equilibrium needs to shift.
-solve K_{eq} problems using the quadratic, if necessary.
-solve Le Chatelier's Principle problems.
-solve K_{eq} problems, when given non-equilibrium concentrations for all compounds.

Determination of a Rate Law Lab: Students determine the rate law of a reaction and then calculate a rate, given certain conditions.

X. Acids/Bases & Aqueous Equilibrium (15 days)

CA Science Content Standards: Chem 5a,5b,5c,5d,5e,5f,5g.

Students will:
-understand and be able to explain the 3 Theories of Acids/Bases.
-solve pH problems for Strong Acids/Bases.
-solve pH problems for Weak Acids/Bases.
-solve pH problems for Polyprotic Acids.
-solve pH problems given Acid/Base Salts.
-solve pH problems, using the Common Ion Effect.
-solve pH problems, using the Henderson/Hasselbach Equation.
-solve pH problems for Buffered Solutions (Weak Acid with Strong Base & Weak Base with Strong Acid).
-solve Solubility Equilibria/ Precipitation Reaction problems.
-solve Gibb's Free Energy and Equilibrium problems.

Effect of Temperature on Solubility Lab: Student lab groups determine the solubility of a solid at different temperatures. All of the classes data is pooled together and graphed.

Ksp Solubility Lab: Students predict (calculate) whether a solid will form, and then carry out the reaction, calculating the % error for the amount of solid formed.

XI. Electrochemistry/ Radiochemistry (10 days)

CA Science Content Standards: Chem 1f,11a,11b,11c,11d,11e,11f, 11g, Earth 1e.
NGSS/CA Frameworks: HS-PS 1-8

Students will:
-draw Galvanic Cells and calculate the Electrical Work/Free Energy.
-solve Electrolysis Stoichiometry problems.
-write out Nuclear Decay/ Bombardment Reactions.
-solve First Order Rate Reaction problems, including Half-Lives.
-understand Nuclear Fission/Fusion.
-calculate the Binding Energy for nuclei and the Energy Released in Fission/Fusion reactions.
-understand how a Nuclear Power Plant works.

XII. Organic Chemistry/ Biochemistry (5 days)

CA Science Content Standards: Chem 10a,10b,10c,10d,10e,10f.

Students will:
-be able to name Alkanes with substituents and other groups.
-be able to name Alkenes, cis/trans, cyclo's, and Aromatics.
-be able to name and recognize Alkynes, Alcohols, Ethers, Aldehydes, Ketones, Carboxylic Acids, Esters, Amides, and Amines.

Projects:

First Semester:

Element Project: Students describe step by step how their element is separated from ore, separated from air or made (if man-made). Students discuss physical and chemical properties of their element relating to uses/dangers etc. of their element. Students write decay reactions for 4 of their element's isotopes.

Second Semester:

College Project: Students pick a college and an undergraduate major. Students list all courses they would need to take to graduate, picking courses, when options arise. This list includes their General Education courses as well as those for their major. The list will also include course descriptions. Honors Chemistry also does the same for a graduate major. For both undergraduate and graduate degrees, the students research careers relating to their majors and degree attained. Students find average salaries for those careers.

Evaluation/ Assessment/ Rubrics including Attainment for Student to Pass Physical Science

"A"-level work (90-100%): (Excellence overall; no major weaknesses).
This student demonstrates real achievement in grasping scientific thinking, along with development of specific physical science thinking skills and abilities. This student's work is clear, precise, and well reasoned.

"B"-level work (80-89%): (Moderate level of understanding and skill in scientific thinking with some distinctive weaknesses, showing more strengths than weaknesses).
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.

"C"-level work (70-79%): (More than a minimum level of understanding and skill in scientific thinking, but highly inconsistent with as many weaknesses as strengths.)
This student demonstrates a mediocre level of achieving scientific thought with pronounced areas of weakness. This student's work is inconsistent, showing only modest skills and reasoning.

"D"-level work (60-69%): (Minimal level of understanding and skill in scientific thinking).
This student demonstrates a lack of clarity and discipline. This student's work does not show good scientific reasoning and skills, only rarely showing any attempt to take charge of ideas.

"F"=level work (<59%): (Far below the minimal level of understanding and skill in scientific thinking).
This student does not display any discernible scientific reasoning. This student failed to do the required work of the course.

Requirement for Honors UCOP Designation:

Students will have already completed a previous year of laboratory science. The course will be built around lectures coordinated with laboratory exercises, involving a lab report for each lab. The curriculum will be covered at a more rapid pace and in greater depth than might be expected in a regular chemistry course, involving in depth and advanced analysis and research. There will be a comprehensive written final exam, including laboratory concepts and skills.