MORENO VALLEY HIGH SCHOOL CHEMISTRY CURRICULUM

Course Title: Chemistry **Course Number:** 1721

Department: Science **ADS Number:** 1721

Prerequisites: Algebra I & II

Length of Course: 2 Semesters **Credit/PRI Area:** 0.5 credits per semester; plus 0.5 lab credits/sem **Grade Level(s):** 11-12

Important Notes: Emphasis is first year college preparatory level. The student will receive a grade on a 4-point scale. A lab is included for the lab credit.

COURSE DESCRIPTION

This is a high school general chemistry course. Course topics include: atomic theory; stoichiometry; thermochemistry; electronic structure; gasses, solids, and liquids; acid-base equilibria. Students are expected to partake in rigorous problem solving, project and laboratory work.

SYLLABUS

1. Units of Study**:**
   a) Atomic Theory: Matter and Measurement; Properties of Matter; Atoms, Molecules and Ions; The Periodic Table.
   b) Stoichiometry: Calculations with Chemical Formulas and Equations; Molecular Weights; Moles and Masses.
   c) Thermochemistry: Heat; Temperature and atomic kinetic theory; Gases, liquids, and solids; Entropy.
   d) Electronic Structure: Quantum Mechanics and Atomic Orbitals; Photons; Electron Configurations and Affinities.
   e) Gasses, Solids, and Liquids: Gas Laws; Kinetic-Molecular Theory; State Structures; Phase Diagrams.
   f) Acid-Base Equilibria: Properties of Solutions; Lewis Structure; Chemical Equilibrium.
2. Skills:
   a) Scientific thinking and practice: Prepares studends to ask scientific questions and conduct research to find solutions. Critical thinking is required.
   b) Content of Science: Knowledge and skills provide the foundation that students need for critical thinking and problem solving.
   c) Science and society: Prepares students to understand the ways in which science influences the individual and society.

STRATEGIES: Paideia Methodology

Didactic: Lecture, guided discussion, and textbook chapter summary review.
Intellectual Coaching: All students present problem solving on the board to the other students. Solution methods are shared with the class.
Seminar: Related media topics are shared, with consideration of individual impacts.

ASSESSMENTS

Weekly worksheets corresponding to chapter study
Labs
Projects and presentations
Unit tests

Cumulative exams
Seminar facilitation and participation

SUGGESTED TEXTBOOKS AND INSTRUCTIONAL MATERIALS

Chemistry: The Central Science by Brown/LeMay/Bursten
The Science of Cooking by Peter Barham
Manuscript Inks: Being a Personal Exploration of the Materials and Modes of Production by Jack C. Thompson

SUGGESTED TITLES/AUTHORS WEB SITES

http://www.chemistrycoach.com/home.htm#Links
http://apdl.rice.edu/DesktopDefault.aspx?tabindex=4&tabid=34
http://www.sciencegeek.net/Chemistry/chemware/chemware.shtml
http://www.mpcfaculty.net/ron_rinehart/index.html#fastfind
http://www.vernier.com/resources/apchema.html
http://www.chemistryteaching.com/chemsim.htm
http://www.wikipedia.org

SEMINAR PIECES OR USE: Seminar pieces are brief historical backgrounds of a scientist or a branch of chemistry**.**

STRAND I: SCIENTIFIC THINKING AND PRACTICE
CONTENT STANDARD 1: UNDERSTAND THE PROCESSES OF SCIENTIFIC INVESTIGATIONS AND USE INQUIRY AND SCIENTIFIC WAYS OF OBSERVING, EXPERIMENTING, PREDICTING, AND VALIDATING TO THINK CRITICALLY.

A. BENCHMARK: *Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results.*

GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS
11-12	1. Describe the essential components of an investigation, including appropriate methodologies, proper equipment, and safety precautions. 2. Design and conduct scientific investigations that include: • testable hypotheses • controls and variables • methods to collect, analyze, and interpret data • results that address hypotheses being investigated • predictions based on results • re-evaluation of hypotheses and additional experimentation as necessary • error analysis. 3. Use appropriate technologies to collect, analyze, and communicate scientific data (e.g., computers, calculators, balances, microscopes). 4. Convey results of investigations using scientific concepts, methodologies, and expressions, including: • scientific language and symbols • diagrams, charts, and other data displays • mathematical expressions and processes (e.g., mean, median, slope, proportionality) • clear, logical, and concise communication • reasoned arguments 5. Understand how scientific theories are used to explain and predict natural phenomena (e.g., plate tectonics, ocean currents, structure of atom	Students are provided with requirements of the lab notebook and exemplars of a model lab notebook. Lab experiments include: • Density • Photoelectric Effect • Stoichiometry • Reaction Rates • Acids and Bases • Redox Reactions. Students perform experiments write lab reports and describe results with supporting data to the rest of the class.

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B. BENCHMARK: *Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.*

GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS
11-12	1. Understand how scientific processes produce valid, reliable results, including: • consistency of explanations with data and observations • openness to peer review • full disclosure and examination of assumptions • testability of hypotheses • repeatability of experiments and reproducibility of results. 2. Use scientific reasoning and valid logic to recognize: • faulty logic • cause and effect • the difference between observation and unsubstantiated inferences and conclusions • potential bias 3. Understand how new data and observations can result in new scientific knowledge. 4. Critically analyze an accepted explanation by reviewing current scientific knowledge. 5. Examine investigations of current interest in science (e.g., superconductivity, molecular machines, age of the universe). 6. Examine the scientific processes and logic used in investigations of past events (e.g., using data from crime scenes, fossils), investigations that can be planned in advance but are only done once (e.g., expensive or time-consuming experiments such as medical clinical trials), and investigations of phenomena that can be repeated easily and frequently.	The following sample activity is one illustration of how students are to introduced scientific inquiry, processes, trial-and-error and data collection, and sharing results with peers. Students are given two puzzle pieces, each from a 1000 piece puzzle. Individual students then look at their two pieces and hypothesize what is the larger puzzle picture. Students use of data to support their hypothesis. Students rate their confidence level on a scale of 1 to 100. The exercise is repeated by changing variables, such as giving students more puzzle pieces, or peers to collaborate with. With each variation, students record their confidence level. Students examine evidence/data, use of hypothesis, peer's contrary hypothesis, and confidence levels as a simulation of scientific inquiry.

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C. BENCHMARK: *Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.*

GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS

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11-12	1. Create multiple displays of data to analyze and explain the relationships in scientific investigations. 2. Use mathematical models to describe, explain, and predict natural phenomena. 3. Use technologies to quantify relationships in scientific hypotheses (e.g., calculators, computer spreadsheets and databases, graphing software, simulations, modeling). 4. Identify and apply measurement techniques and consider possible effects of measurement errors. 5. Use mathematics to express and establish scientific relationships (e.g., scientific notation, vectors, dimensional analysis).	Using the above exercise, students graph confidence levels, examine correlations between confidence level and number of puzzle pieces students have, etc. Students write a lab report and present it to the class. This simulation provides the foundation for required criteria in experimental process and reporting.

STRAND II: CONTENT OF SCIENCE: PHYSICAL SCIENCE
CONTENT STANDARD I : UNDERSTAND THE STRUCTURE AND PROPERTIES OF MATTER, THE CHARACTERISTICS OF ENERGY, AND THE INTERACTIONS BETWEEN MATTER AND ENERGY.

A. BENCHMARK: *Understand the properties, underlying structure, and reactions of matter.*

GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS
11-12	**Properties of Matter** 1. Classify matter in a variety of ways (e.g., element, compound, mixture; solid, liquid, gas; acidic, basic, neutral). 2. Identify, measure, and use a variety of physical and chemical properties (e.g., electrical conductivity, density, viscosity, chemical reactivity, pH, melting point). 3. Know how to use properties to separate mixtures into pure substances (e.g., distillation, chromatography, solubility). 4. Describe trends in properties (e.g., ionization energy or reactivity as a function of location on the periodic table, boiling point of organic liquids as a function of molecular weight).	Students will read the textbook, Internet resources and other provided by the teacher. Labs and seminars will supplement the text. Sample labs/experiments include: • Making ice cream in a baggie: Freezing point depression and colligative properties • Chromatography: M&Ms and food coloring • Rate of Solution-Using four household solids and liquids

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GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS
11-12	**Structure of Matter** 5. Understand that matter is made of atoms and that atoms are made of subatomic particles. 6. Understand atomic structure, including: • most space occupied by electrons • nucleus made of protons and neutrons • isotopes of an element • masses of proton and neutron 2000 times greater than mass of electron • atom held together by proton-electron electrical forces 7. Explain how electrons determine the properties of substances by: • interactions between atoms through transferring or sharing valence electrons • ionic and covalent bonds • the ability of carbon to form a diverse array of organic structures. 8. Make predictions about elements using the periodic table (e.g., number of valence electrons, metallic character, reactivity, conductivity, type of bond between elements). 9. Understand how the type and arrangement of atoms and their bonds determine macroscopic properties (e.g., boiling point, electrical conductivity, hardness of minerals). 10. Know that states of matter (i.e., solid, liquid, gas) depend on the arrangement of atoms and molecules and on their freedom of motion.	Students will study topics such as: • The Bohr Theory of the Atom: Assumptions • The Bohr Theory of the Atom: Derivation • The Bohr Theory Worksheet • Quantum Numbers and Electron Configurations Sample labs, demonstrations, and activities include: • Students will use a Bohr model of an atom and Skittles, students build an atom model and create an atom dictionary. • Combustion product of sulfur • Flame test for metallic ions • Oleic Acid lab • Emission and Absorption spectra • Bonding Model for Projection: Bonding in ionic solids • Magnetic Analogy for Bonding Forces

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11-12	**Chemical Reactions** 12. Know that chemical reactions involve the rearrangement of atoms, and that they occur on many timescales (e.g., picoseconds to millennia). 13. Understand types of chemical reactions (e.g., synthesis, decomposition, combustion, redox, neutralization) and identify them as exothermic or endothermic. 14. Know how to express chemical reactions with balanced equations that show: conservation of mass products of common reactions. 15. Describe how the rate of chemical reactions depends on many factors that include temperature, concentration, and the presence of catalysts.	Students will study topics such as: • Chemical Equations • Types of Reactions • Moles and Molar Mass • Calculations for Chemical Equations • Empirical Formulas • Calculations for Chemical Equations (Stiochiometry) Sample labs, demonstrations, and activities include: • Single replacement reactions • Double replacement reactions • Gas-producing reactions • Red, white, and blue demonstration • Surface area and reaction rate • Reaction of Magnesium Oxide and an Indicator • Redox titration • Lead Acid Battery - Charging and Discharging

STRAND III: SCIENCE AND SOCIETY
CONTENT STANDARD: UNDERSTAND HOW SCIENTIFIC DISCOVERIES, INVENTIONS, PRACTICES, AND KNOWLEDGE INFLUENCE, AND ARE INFLUENCED BY, INDIVIDUALS AND SOCIETIES.

A. BENCHMARK: *Examine and analyze how scientific discoveries and their applications affect the world, and explain how societies influence scientific investigations and applications.*

GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS
11-12	**Science and Technology** 1. Know how science enables technology but also constrains it, and recognize the difference between real technology and science fiction (e.g., rockets vs. antigravity machines; nuclear reactors vs. perpetual-motion machines; medical X-rays vs. Star-Trek tricorders). 2. Understand how advances in technology enable further advances in science (e.g., microscopes and cellular structure; telescopes and understanding of the universe). 3. Evaluate the influences of technology on society (e.g., communications, petroleum, transportation, nuclear energy, computers, medicine, genetic	Students will create a timeline of the development of chemistry from Democritus to the present. In a paper and seminar: Students will pick a twenty-year time period prior to 1900. Students will: • Indicate why they would have liked to have lived in this time period from the perspective of a scientist. • Indicate where they would have liked to have lived and why. • Explain why the society of the time ripe for the technological advances?

GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS
	engineering) including both desired and undesired effects, and including some historical examples (e.g., the wheel, the plow, the printing press, the lightning rod). 4. Understand the scientific foundations of common technologies (e.g., kitchen appliances, radio, television, aircraft, rockets, computers, medical X-rays, selective breeding, fertilizers and pesticides, agricultural equipment). 5. Understand that applications of genetics can meet human needs and can create new problems (e.g., agriculture, medicine, cloning). 6. Analyze the impact of digital technologies on the availability, creation, and dissemination of information. 7. Describe how human activities have affected ozone in the upper atmosphere and how it affects health and the environment. 8. Describe uses of radioactivity (e.g., nuclear power, nuclear medicine, radiometric dating).	• Describe how they would have influenced experimentation in order to increase the rate at which technology might have advanced? • Take into account the ability to pursue this line from the point of view of limitations of existing equipment and sociological influences. • Suppose that they could take back to the time period a single piece of technology; what would the student select and why? • Indicate how an individual from that time period might react to that piece of technology. • Assume they were able to communicate by letter with two persons of that time period - one from the arts, one from the science - which two people would the student choose and why? • Compose a letter that to either of these people. • Upon returning, students describe the moral/ethical principles of that time do the student understands better from this experience?