Science Standard
Catalina Foothills School District
High School: Chemistry

Chemistry is an inquiry based laboratory course that emphasizes essential concepts with real world applications. Students will explore topics such as structure of matter, molar relationships, gas laws, chemical reactions, qualitative analysis, acid/base reactions, and periodicity. Laboratory experiments are enhanced by application of critical thinking, scientific inquiry, and data analysis skills. A combination of guided instruction and collaborative learning will enrich the learning experience of students with varied learning styles.

SCIENTIFIC INQUIRY

SCIENTIFIC INQUIRY: GENERATING SCIENTIFIC QUESTIONS

CHEM.1a.1 Frames testable questions showing evidence of observations and connections to prior knowledge.

CHEM.1a.2 Develops a testable question appropriate to the scientific domain being investigated.

SCIENTIFIC INQUIRY: FORMULATING HYPOTHESES

CHEM.1b.1 Develops a testable hypothesis based upon evidence of scientific principles, probability and/or modeling.

CHEM.1b.2 Clearly distinguishes relationships between variables (required: cause and effect or correlation) within a testable hypothesis).

SCIENTIFIC INQUIRY: DESIGNING INVESTIGATIONS

CHEM.1c.1 Specifies the parameters of measurement.

CHEM.1c.2 Describes suitable controls for the investigation.

CHEM.1c.3 Designs procedures that appropriately address the hypothesis.

SCIENTIFIC INQUIRY: DATA COLLECTION

CHEM.1d.1 Creates and demonstrates safe and ethical procedures.

CHEM.1d.2 Uses units of measurement with appropriate degree of accuracy.

CHEM.1d.3 Creates procedures that appropriately and adequately address the hypothesis (for example: adequate sample size, multiple trials).

CHEM.1d.4 Creates a suitable method of recording data.

SCIENTIFIC INQUIRY: ANALYSIS

CHEM.1e.1 Interprets data to describe relationships between variables (for example: positive, negative, no relationship).

CHEM.1e.2 Incorporates mathematical analysis, where appropriate.

CHEM.1e.3 Critiques the investigation for possible sources of error and suggests corrections.

CONCLUSIONS AND EXTENSIONS

CHEM.1f.1 Makes evidence-based predictions (for example: extrapolations and interpolations).

CHEM.1f.2 Evaluates whether the data support the hypothesis.

COMMUNICATION

CHEM.1g.1 Uses suitable media to inform an audience about an investigation.

CHEM.1g.2 Applies appropriate ethics (for example: language, style, citations).

INTERACTION OF SCIENCE AND SOCIETY

CHEM.2.1 Describes the interaction of science, human curiosity and societal needs (for example: the positive and negative impact of controversial chemistry: nuclear power, hydrogen bomb).

CHEM.2.2 Critically analyzes the science concepts behind societal issues (for example: nanotechnology, environmental issues).

SYSTEMS THINKING (CFSD Deep Learning Proficiency – DLP)

SYSTEMS THINKING: CHANGE OVER TIME

CHEM.3a.1 Explains how a system's components change over time (for example: radioactive decay).

SYSTEMS THINKING: INTERDEPENDENCIES

BIO.3b.1 Explains the causal relationships in a system as being either positive or negative feedback relationships (for example: equilibrium reactions).

SYSTEMS THINKING: SYSTEM-AS-CAUSE

CHEM.3c.1 Explains reasons why specific behaviors result from the organization of a system (for example: phases of matter related to the kinetic theory).

STRUCTURE OF MATTER

CHEM.4.1 Explains the identity and structure of an atom, using the relationships between sub-atomic particles.

CHEM.4.2 Describes the historical development of the atom (required: Dalton, Rutherford, Bohr; for example: Democritus, Quantum Model).

CHEM.4.3 Explains the details of the atomic structure (required: orbitals, Valence electrons, Lewis-dot diagrams; for example: electron configuration, energy levels).

PROPERTIES OF MATTER

CHEM.5.1 Differentiates substances based on their physical and chemical properties.

CHEM.5.2 Predicts and explains properties of elements and compounds using trends of the Periodic Table (for example: EN, atomic radius, ionization energy, and reactivity).

CHEM.5.3 Compares the properties of solutions (required: level of saturation, solubility, conductivity of electricity/dissociation).

THERMOCHEMISTRY

CHEM.6.1 Describes different types of energy (required: potential, kinetic, thermal).

CHEM.6.2 Interprets the molecular motion relationship within phase changes.

CHEM.6.3 Explains the energy transfers within chemical reactions (for example: endothermic, exothermic, catalyst-energy diagram).

CHEMICAL REACTIONS - QUANTITATIVE

CHEM.7.1 Utilizes the law of conservation of mass to explain and balance chemical equations.

CHEM.7.2 Solves abstract problems with consideration to significant figures using mole conversions (required: mass$\Leftrightarrow$mole$\Leftrightarrow$particles, molarity, $M_1V_1=M_2V_2$, stoichiometry, ideal gas law, $M_aV_a=M_bV_b$).

CHEM.7.3 Quantifies the relationships between reactants and products in chemical reactions (required: stoichiometry, % yield; for example: equilibrium, energy transfers).

CHEM.7.4 Compares the concentration, pH and pOH of acids and bases (required: calculate pH, pOH, $[H^+]$, $[OH^-]$).

CHEMICAL REACTIONS - QUALITATIVE

CHEM.8.1 Describes properties of the types of bonds (required: ionic, covalent, metallic).

CHEM.8.2 Compares the nature and behavior of acids and bases.

CHEM.8.3 Determines if a change is physical or chemical using the indicators of chemical change (required: release or absorption of heat energy, formation of a precipitate or gas, color change, and odor change).

CHEMICAL BONDING

CHEM.9.1 Predicts the type of bond based on the positions of the elements in the Periodic Table (required: ionic, covalent, metallic).

CHEM.9.2 Applies the properties of electric charge and the conservation of electric charge (required: naming compounds, writing formulas, electrical conductivity and thermal conductivity, % composition).

CHEM.9.3 Predicts molecular shape and polarity utilizing Lewis dot structures.

INTERACTIONS OF ENERGY AND MATTER

CHEM.10.1 Applies the kinetic molecular theory (KMT) to explain how reaction rate is affected by temperature, concentration, particle size, and agitation.

CHEM.10.2 Applies the kinetic molecular theory (KMT) to explain the behavior of matter (required: Boyle's Law, Charles' Law, Combined Gas Law, Ideal Gas Law).

ENVIRONMENTAL CHEMISTRY

CHEM.11.1 Evaluates the effects of human activities on the environment (for example: urban development and consumer demands).

CHEM.11.2 Analyzes the cost, benefits and risks of energy sources (required: nuclear power, solar power, wind power, hydrological power, fossil fuels).

CHEM.11.3 Assesses factors that impact current and future water quality and quantity (for example: acid rain and pollution).