



Chemistry of the Earth System

Board Approval Date: April 15, 2021	Course Length: 2 Semesters
Grading: A-F	Credits: 5 Credits per Semester
Proposed Grade Level(s): 10, 11	Subject Area: Physical Science Elective Area (if applicable):
Prerequisite(s): N/A	Corequisite(s): Integrated Math 1
CTE Sector/Pathway:	
Intent to Pursue ‘A-G’ College Prep Status: Yes	
A-G Course Identifier: (d) Laboratory Science	
Graduation Requirement: Yes	
Course Intent: District Course Program (if applicable):	
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COURSE DESCRIPTION:

Chemistry of the Earth System is a course in the California Next Generation Science Standards (CA NGSS) three course model and includes disciplinary core ideas related to Physical Science and integrates a selection of the Earth and Space Science concepts. This course also incorporates the eight Science and Engineering Practices and seven Crosscutting Concepts related to the NGSS. In this course, students will explore the structure and properties of matter, conservation and transfer of energy, chemical reactions and processes in everyday life, and chemical changes in Earth systems. Engineering Core Ideas are used to explore applications of chemistry concepts. Students apply algebraic processes to describe and predict phenomena. This course is taught using an online platform.

DETAILED UNITS OF INSTRUCTION:

Unit Number/Title	Unit Essential Questions	Examples of Formative Assessments	Examples of Summative Assessment
1. Matter	How can we use calculations to predict the gravitational force between two objects? What are the properties of electric and magnetic fields and how do they interact? How is energy conserved between systems?	*Practice: Gravitational Force *Practice: Electric and Magnetic Force *Journal: Energy and Change	*Lab: Conservation of Energy *Unit Test
2. Atoms	What is the structure of an atom? How is the periodic table organized?	*Journal: Simplifying Your View of Chemistry *Practice: Atomic Structure	*Lab: Mass, Volume, and Density *Unit Test
3. Bonding in Matter	What is the outcome of a chemical reaction based on the outermost electrons of the atoms involved? How do melting point and boiling point affect the strength of electrical forces between particles?	*Journal: Intermolecular Forces and You *Practice: Bonding in Matter	*Lab: Periodic Properties *Unit Test
4. Chemical Reactions and Stoichiometry	Which relationships can be derived from a balanced chemical equation? What is the sequence of steps used in solving stoichiometric problems? In a chemical reaction, how much energy is released or absorbed? How do you calculate the mass of a product when the amounts of more than one reactant are given? How does changing the amount of reactants or products affect a balanced equation?	*Journal: Reactions Around You *Practice: Stoichiometry	*Lab: Stoichiometry and Conservation of Matter *Lab: Precipitation Reactions *Unit Test

5. Phases, Equilibrium, and Kinetics	<p>How can a knowledge of kinetics and equilibrium help to understand the process of chemical reactions?</p> <p>How is dynamic equilibrium represented?</p> <p>How does a reaction or process at equilibrium react to an external perturbation?</p> <p>How are acid and bases affected by equilibrium shift?</p>	<p>*Practice: Equilibrium</p> <p>*Practice: Kinetics</p>	<p>*Lab: Freezing Point Depression</p> <p>*Lab: Disturbing Equilibrium</p> <p>*Unit Test</p>
6. Transferring Energy	<p>How does the flow and storage of energy affect the motion of objects in the world?</p> <p>What happens to the energy in a system – where does this energy come from, how is it changed within the system, and where does it ultimately go?</p> <p>How does the flow of energy affect the materials in the system?</p>	<p>*Journal: Heat Transfer Around You</p> <p>*Practice: Transferring Energy</p>	<p>*Lab: Heats of Reaction</p> <p>*Unit Test</p>
7. Earth's Physical Systems	<p>How do Earth's major systems interact?</p> <p>Why do the continents move, and what causes earthquakes and volcanoes?</p> <p>How do the properties and movements of water shape Earth's surface and affect its systems?</p> <p>What regulates weather and climate?</p>	<p>*Practice: Earth's Atmosphere</p>	<p>*Lab: Thermodynamics and Earth's Systems</p> <p>*Unit Test</p>
8. Matter and Energy in the Biosphere	<p>How can one explain the structure, properties and interactions of matter?</p> <p>How can one explain and predict interactions between objects and within systems of objects?</p> <p>How do organisms interact</p>	<p>*Practice: Natural Systems</p> <p>*Practice: Structures and Cycles of the Biosphere</p> <p>*Explore: The Importance of Coral Reefs</p>	<p>*Lab: Investigate Cycling of O₂ and CO₂</p> <p>*Unit Test</p>

	with the living and nonliving environments to obtain matter and energy? How do the water and carbon cycles interact within the biosphere?		
9. Earth's Resources	How do the Earth's surface processes and human activities affect each other? How do humans depend on Earth's resources? How do natural hazards affect individuals and societies? How do humans change the planet? Which human activities minimize impacts to Earth's resources?	*Practice: Resource Availability	*Lab: Generating a Biofuel *Unit Test
10. Environmental Challenges	How are human activities affecting Earth Systems? How do people model and predict the effects of human activities on Earth's climate?	*Explore: Reading Graphs in Scientific Literature	*Lab: Acid Rain and Brine Shrimp *Unit Test

APEX Units 6&12: Review and Exams

ESSENTIAL STANDARDS:

HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedback that causes changes to other Earth systems. (ELA/Literacy CCSS: RST.11-12.1, RST.11-12.2 and Math CCSS: MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.3)

HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. (Math CCSS: MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3)

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. (ELA/Literacy CCSS: RST.9-10.7)

HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. (ELA/Literacy CCSS: RST.11-12.2, RST.11-12.5 and Math CCSS: HSN-Q.A.1, HSN-Q.A.3)

HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. (ELA/Literacy

CCSS: RST.11-12.1, RST.11-12.2 and Math CCSS: MP.2, HSN-Q.A.1, HSN-Q.A.3)

HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.* (ELA/Literacy CCSS: RST.11-12.7)

HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. (Math CCSS: MP.2, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3)

RELEVANT STANDARDS AND FRAMEWORKS, CONTENT/PROGRAM SPECIFIC STANDARDS:

Link to Common Core Standards (if applicable):

Educational standards describe what students should know and be able to do in each subject in each grade. In California, the State Board of Education decides on the standards for all students, from kindergarten through high school.

<http://www.corestandards.org/ELA-Literacy/RST/9-10/>

<http://www.corestandards.org/ELA-Literacy/RST/11-12/>

Link to Framework (if applicable):

Curriculum frameworks provide guidance for implementing the content standards adopted by the State Board of Education (SBE). Frameworks are developed by the Instructional Quality Commission, formerly known as the Curriculum Development and Supplemental Materials Commission, which also reviews and recommends textbooks and other instructional materials to be adopted by the SBE.

<https://www.cde.ca.gov/ci/sc/cf/documents/scifwchapter7.pdf>

Link to Subject Area Content Standards (if applicable):

Content standards were designed to encourage the highest achievement of every student, by defining the knowledge, concepts, and skills that students should acquire at each grade level.

<https://www.nextgenscience.org/>

Link to Program Content Area Standards (if applicable):

Program Content Area Standards applies to programs such as International Baccalaureate, Advanced Placement, Career and Technical Education, etc.

TEXTBOOKS AND RESOURCE MATERIALS:

Textbooks

Board Approved	Pilot Completion Date (If applicable)	Textbook Title	Author(s)	Publisher	Edition	Date
<i>Yes</i>		<i>APEX: Chemistry in the Earth System</i>		APEX Online Courses		<i>2019</i>

Other Resource Materials

Supplemental Materials

Board approved supplemental materials (Including but not limited to: Film Clips, Digital Resources, Supplemental texts, DVDs, Programs (Pebble Creek, DBQ, etc.):