EL DORADO UNION HIGH SCHOOL DISTRICT
EDUCATIONAL SERVICES

Course of Study Information Page

COURSE TITLE **CA Natural Resources Chemistry**	
DISTRICT COURSE NUMBER 0338	4-DIGIT STATE COURSE CODE (COMPLETED BY SILT) 9325
Rationale:	Natural Resources Chemistry is a place-based, lab course in physical science focused on developing knowledge, skills, and application of NGSS and CTE standards. It is offered at El Dorado High School as the second course in the 4-year vertically aligned Natural Resources pathway.This course fulfills graduation requirements and is a d lab science.
Course Description that will be in the Course Directory:	Natural Resources Chemistry applies chemistry principles to inquiry, investigation, and application involving real-world environmental issues as they relate to renewable and nonrenewable resources. This place-based curriculum utilizes EDHS's East Campus to study the chemistry of soil, vegetation, water, wildlife, minerals, and energy resources in the context of human use, sustainability, and resilience. Application, teacher recommendation and interview are required to be considered for the Natural Resources Program.
How Does this Course align with or meet State and District content standards?	This course meets district and state standards in the area of physical science.
Core Subjects:	*Select up to two that apply:* ☐ Arts ☐ Civics and Government ☐ Not Core Subject ☐ Economics ☐ History ☐ English ☐ Mathematics ☐ Foreign Language ☐ Reading / Language Arts ☐ Geography X Science
CDE CALPADS Course Descriptors: (See Page 2 for Definitions)	CTE TECH PREP COURSE INDICATORS ☐ Tech Prep (32) (Higher Ed) ☐ Tech Prep & ROP(33) (Higher Ed) ☐ ROP (30) X N/A CTE COURSE CONTENT CODE X CTE Introductory (01) ☐ CTE Concentrator (02) ☐ CTE Completer (03) ☐ Voc Subject ____ ☐ N/A INSTRUCTIONAL LEVEL CODE ☐ Remedial (35) ☐ Honors UC-Certified (39) ☐ Honors Non UC-Certified (34) ☐ College (40) X N/A
Length of Course:	X Year ☐ Semester
Grade Level(s):	☐ 9 X 10 X 11 X 12
Credit:	X Number of credits <u>10 credits</u> X Meets graduation requirements (subject **<u>Physical science</u>**) X Request for UC "a–g" requirements CSU/UC requirement <u>d lab science</u> X College Prep
Prerequisites:	Completion of Algebra I and Biology with C or better.
Department(s):	Science department
District Sites:	El Dorado High School

Board of Trustees COS Adoption Date:	05/09/2023
Textbooks / Instructional Materials:	
Funding Source:	General Fund
Board of Trustees Textbook Adoption Date:	

Definitions

CALPADS	California Longitudinal Pupil Achievement Data System
CTE Technical Prep	A course within a CTE technical career pathway or program that has been articulated with a postsecondary education or through an apprenticeship program of at least 2 years following secondary instruction.
Instructional Level Code	Represents a nonstandard instructional level at which the content of a specific course is either above or below a 'standard' course instructional level. These levels may be identified by the actual level of instruction or identified by equating the course content and level of instruction with a state or nationally recognized advanced course of study, such as IB or AP.
Instructional Level Honors, UC Certified	Includes all AP courses.
Instructional Level Honors, non UC Certified	Requires Board approval.
Instructional Level College	Includes ACE courses. Equivalent to college course and content, but not an AP course. Not related to section, but to course.

EL DORADO UNION HIGH SCHOOL DISTRICT

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Course Title:

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EDUCATIONAL SERVICES

Department: **Science Department**

Course Title: **Natural Resources Chemistry** Course Number:

Unit Title: **I. Scientific Methods, Measurement, & Communications**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

Next Generation Science Standards: High School Physical Science
HS.Engineering Design

- HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

California Career Technical Education Model Curriculum Standards
2.0 Communication

- 2.2 Identify barriers to accurate and appropriate communication.
- 2.3 Interpret verbal and nonverbal communications and respond appropriately.
- 2.4 Demonstrate elements of written and electronic communication, such as accurate spelling, grammar, and format.
- 2.5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
- 2.6 Advocate and practice safe, legal, and responsible use of digital media information and communications technologies.

3.0 Career Planning and Management

- 3.1 Identify personal interests, aptitudes, information, and skills necessary for informed career decision making.
- 3.2 Evaluate personal character traits, such as trust, respect, and responsibility, and understand the impact they can have on career success.

4.0 Technology

- 4.1 Use electronic reference materials to gather information and produce products and services.
- 4.2 Employ Web-based communications responsibly and effectively to explore complex systems
- and issues.
- 4.3 Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources
- 4.4 Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources.

5.0 Problem Solving and Critical Thinking

- 5.1 Identify and ask significant questions that clarify various points of view to solve problems.
- 5.3 Use systems thinking to analyze how various components interact with each other to
- produce outcomes in a complex work environment.
- 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed
- decisions.

7.0 Responsibility and Flexibility

- 7.2 Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
- 7.4 Practice time management and efficiency to fulfill responsibilities.
- 7.5 Apply high-quality techniques to product or presentation design and development.
- 7.7 Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession.
- 7.8 Explore issues of global significance and document the impact on the Agriculture and Natural Resources sector.

8.0 Ethics and Legal Responsibilities
- 8.3 Demonstrate ethical and legal practices consistent with Agriculture and Natural Resources sector workplace standards.
- 8.4 Explain the importance of personal integrity, confidentiality, and ethical behavior in the workplace.
- 8.6 Adhere to copyright and intellectual property laws and regulations, and use and appropriately cite proprietary information.

9.0 Leadership and Teamwork
- 9.1 Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.
- 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills, as applied in groups, teams, and career technical student organization activities.
- 9.3 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting.
- 9.5 Understand that the modern world is an international community and requires an expanded global view
- 9.6 Respect individual and cultural differences and recognize the importance of diversity in the workplace.
- 9.7 Participate in interactive teamwork to solve real Agriculture and Natural Resources sector issues and problems.
- 9.8 Define the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace settings.
- 9.10 Understand how to organize and structure work, individually and in teams, for effective performance and the attainment of goals.
- 9.12 Demonstrate how to interact with others in ways that demonstrate respect for individual and cultural differences and for the attitudes and feelings of others.
- 9.13 Participate in group or team activities, including those offered by the student organization, that develop skills in leadership, cooperation, collaboration, and effective decision making.

11.0 Demonstration and Application
- 11.1 Utilize work-based/workplace learning experiences to demonstrate and expand upon knowledge and skills gained during classroom instruction and laboratory practices specific to the Agriculture and Natural Resources sector program of study.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

A. Scientific Method: The students will identify the different elements of scientific inquiry including variables, constants, and controls. In addition, they will differentiate between theories and hypotheses. These concepts are introduced during this unit and reinforced throughout the year.
B. Chemistry lab equipment and measurements: Students will be introduced to specific lab equipment and measurement tools. Students will be able to use the equipment and tools with excellent accuracy and precision. Accuracy and precision as well as proper use of lab equipment will be reinforced throughout the year.
C. Scientific calculations: Students will learn to identify the precision of measurements in metric units. They will then learn to properly identify significant figures and use a calculator to report data to the degree of precision necessary to communicate accurate scientific data.
D. Communicating Scientific Ideas: Students will communicate experimental results by creating graphs and figures. They will draw conclusions and share their findings in written form as well as through oral presentations. These concepts are introduced during this unit and reinforced throughout the year.
E. Leadership and teamwork: Students will develop and demonstrate accountability, responsibility, cooperation, and respect while carrying out long term scientific inquiry studies.

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

Direct instruction of the core curriculum will include lectures, either in person or digitally provided, guided note taking, hands-on lab activities, class discussion questions, and connections made to relevant current events.

Independent practice and enrichment in the form of scientific articles, digital videos, and standards-based assignments will increase student understanding of core curriculum as well as build academic vocabulary and

introduce students to the nature of scientific writing.

- *Natural Connections Day Scientific Article Review (NR Chemistry and Natural Resources 2)*
- *Natural Resources & Me Poster- to help gain an understanding of students interests and what they would like to gain from their experience in NR*

Labs, activities, and projects engage students in the process of scientific inquiry and develop critical thinking and problem solving skills. Students will apply these skills with increasing depth and complexity in each successive course in the Natural Resources Pathway. Lab activities will include

- *Animal Personality Types and Group Dynamics (NR Chemistry and Natural Resources 2)*
- *Natural Connections Day Presentation (NR Chemistry and Natural Resources 2)*
- *Mimicking Volcanic Eruptions with Chemical Reactions*
- *Investigating Fire Production Methods and Applications*
- *Herbicide Development and Application Project*
- *Investigation of Aquatic Dead Zones Study*
- *Pond Chemistry Longitudinal Study (NR Chemistry and Natural Resources 1)*
- *Study and Senior Project Presentations (NR Chemistry and Natural Resources 2)*
- *Applying Chemical Principles to Make the World A Better Place- spring Final Project*

*Assessments that involve vertical alignment of curricula in the Natural Resources Pathway, collaboration between different classes in the pathway and place-based curriculum that requires resources available at East Campus are italicized.

Assessments: Describe the Formative and Summative assessments that will be used to demonstrate learning and mastery of the standards.

Chapter Assignments—These formative assignments help to build the students foundation for the information they will learn during the unit. Weekly assignments serve to assess and give immediate feedback to the students as to how they are progressing in the acquisition of the content knowledge. These assignments inform the instructor as to the progress of the students and allow the instruction of the material to be adjusted, should students need remediation or if they require supplementary instruction.

Projects and Labs—these are the primary foundation for this program and indicate how well a student applies the information covered in the text and lecture with the processes and skills necessary for proper field research. As this is a science based class, it is imperative that students demonstrate application of their knowledge through inquiry and observation. Semester-long projects will incorporate the use of a detailed rubric. Students will receive a copy of the rubric prior to beginning each project. Students will also conduct a self- and peer-evaluation at the end of each project or long-term group assignment. Self-evaluation helps students to learn and grow from their mistakes, group evaluations help hold all students accountable for their participation and contribution to group work.

Quizzes—These short assignments are used as formative assessment to help the instructor understand whether or not the material covered in class is understood by the students. These are primarily used to assess what is understood by a majority of the students and what areas are in need of emphasis or reteaching.

Tests—These longer assessments are the summative portion of the units and will determine whether or not the overarching goals of the units are understood by the students. The information will also help the teacher to redesign learning objectives for the following year and make adjustments to curriculum.

Interventions: Describe methods used to support students who fail to master unit Formative and Summative assessments.

Formative assessments, such as chapter review questions and quizzes, will be followed by immediate reteaching through large group discussion in class and small group review during Intervention..

Many labs will be conducted over the course of several class periods. At the end of each class period, the teacher will scan the parts students have completed to that point, and clarify or correct misconceptions at the opening of the following period.

Semester-long projects will include multiple checkpoints so that the teacher can track students' progress and correct misconceptions. These checkpoints will involve peer evaluation and small-group meetings with the teacher to correct errors and address any challenges that may arise.

Students who miss entire assignments will have the opportunity to complete the work during Intervention with the teacher,where they can receive one-on-one or small group tutoring.

Natural Resources Program offers peer tutoring for students who consistently struggle with curriculum. The tutors have attended training sessions and commit to regular weekly tutoring sessions. Upperclassmen in the Program are mentors to younger students academically and socially.

EDUCATIONAL SERVICES

Department: **Science Department**

Course Title: **Natural Resources Chemistry** Course Number:

Unit Title: **II. Raw Materials of Natural Resources**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

Next Generation Science Standards: High School Physical Science
HS.Structure and Properties of Matter

- 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.
- HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

California Career Technical Education Model Curriculum Standards
E. Forestry and Natural Resources Pathway
E3.0 Explore soil composition and soil management.

- E3.2 Explain the reasons for, and importance of, soil conservation.
- E3.3 Analyze soils found in the different natural resource management areas.
- E3.4 Develop and implement a soil management plan for a natural resource management area.
- E3.5 Understand how to analyze existing soil surveys to develop effective management plans.

E8.0 Explore basic plant physiology, anatomy, and taxonomy.

- E8.4 Recognize and explain the factors that influence plant growth, such as respiration, temperature, nutrients, and photosynthesis.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

A. History of the Atom: Students will learn the history of the atom and its evolution through. Students will be able to identify early models of the Atom and their significance and role in expanding scientific knowledge through the scientific process.
B. Atomic Structure: Students will be able to identify pieces of the atom and its unique properties such as the importance of atomic numbers, protons, neutrons, electrons, ions, atomic mass, and atomic weight.
C. Organization of the Periodic Table: Students will understand how the periodic table is organized and its significance and use. Students will know periodic table families, relative reactivities and how each element's electron configurations contribute to the atom's specific properties. Students will learn how these properties of elements contribute to atoms use in the natural resource and agricultural sectors.
D. Bonding: Students will learn how valence electron structure impacts the type of bond formed by atoms to create compounds. Students will know the difference between ionic and covalent bonds and their impacts in the natural resource and agricultural sectors, with specific emphasis on fertilizers.
E. Defining the mole: Students will understand the importance of the chemistry unit of the mole. Students will be able to compute molar mass, percent composition, and use stoichiometry to convert between mole units and molecules, atoms, grams, and liters. Specific conversion will be applied to industrial and agricultural applications.

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

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Independent practice and enrichment in the form of scientific articles, digital videos, and standards-based assignments will increase student understanding of core curriculum as well as build academic vocabulary and introduce students to the nature of scientific writing.

- *Natural Resources Superhero & Villians Project- students choose an element specifically related to the Natural Resources industry such as Nitrogen in fertilizers and they develop a superhero or villain based on the chemical and physical properties of the chosen element.*

Labs, activities, and projects engage students in the process of scientific inquiry and develop critical thinking and problem solving skills. Students will apply these skills with increasing depth and complexity in each successive course in the Natural Resources Pathway. Lab activities will include

- Cadmium Lab
- Rutherford Activity
- Chemically Speaking What is a Plant
- *Herbicide Project- Students apply scientific method in a longitudinal study at East Campus. Results are presented to the class to develop communication skills.*
- *Career exploration-Field trip to glass blowing studio to see artists manipulation matter.*

*Assessments that involve vertical alignment of curricula in the Natural Resources Pathway, collaboration between different classes in the pathway and place-based curriculum that requires resources available at East Campus are italicized.

Assessments: Describe the Formative and Summative assessments that will be used to demonstrate learning and mastery of the standards.

Chapter Assignments—These formative assignments help to build the students foundation for the information they will learn during the unit. Weekly assignments serve to assess and give immediate feedback to the students as to how they are progressing in the acquisition of the content knowledge. These assignments inform the instructor as to the progress of the students and allow the instruction of the material to be adjusted, should students need remediation or if they require supplementary instruction.

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Quizzes—These short assignments are used as formative assessment to help the instructor understand whether or not the material covered in class is understood by the students. These are primarily used to assess what is understood by a majority of the students and what areas are in need of emphasis or reteaching.

Tests—These longer assessments are the summative portion of the units and will determine whether or not the overarching goals of the units are understood by the students. The information will also help the teacher to redesign learning objectives for the following year and make adjustments to curriculum.

Interventions: Describe methods used to support students who fail to master unit Formative and Summative assessments.

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EDUCATIONAL SERVICES

Department: **Science Department**

Course Title: **Natural Resources Chemistry** Course Number:

Unit Title: **III. Nuclear Processes and Environmental Impacts**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

Next Generation Science Standards: High School Physical and Earth Science
HS. Structure and Properties of Matter
- HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

HS.Waves and Electromagnetic Radiation
- HS-PS4-3. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.
- HS-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

HS.Human Sustainability
- HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

California Career Technical Education Model Curriculum Standards
E. Forestry and Natural Resources Pathway
E1.0 Understand the importance of energy and energy cycles.
- E1.1 Diagram the oxygen, carbon, nitrogen, and water cycles.
- E1.2 Differentiate between renewable and nonrenewable energy sources
- E1.5 Analyze the way in which human activities influence energy cycles and natural resource management.

E2.0 Understand air and water use, their management practices, and conservation strategies.
- E2.1 Explain the government's role in regulating air, soil, and water use management practices and conservation strategies.

E10.0 Implement forest management practices.
- E10.1 Describe how social, political, and economic factors can affect the use of forests.

E12.0 Produce, harvest, process, and market products from natural resource industries.
- E12.1 Explain the marketing processes and manufacturing standards for a variety of natural resource products, including mining, quarrying, and drilling.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

A. Types of nuclear radiation: Students will know the products of alpha, beta & gamma, radiation. Students will be able to evaluate the societal and environmental impacts of each type of radiation.
B. Half-life: Students will understand the impacts of half-life on the nuclear process. They will be able to calculate the half-life of various elements and conceptually understand their environmental impacts.
C. Nuclear Fusion & Fission: Students will know the difference both quantitatively and qualitatively between fusion and fission reactions. Students will learn new technological advances in both fission and fusion energies and critically evaluate their impacts on the environment and human society at large.
D. Environmental Nuclear impacts: Students will evaluate the applications of nuclear technologies through the lens of natural resources. They will critically analyze nuclear applications as a sustainable and renewable or nonrenewable resource. Students will learn about nuclear applications to a wide variety of fields such as agriculture, transportation, and alternative energy. Students will communicate their nuclear findings in an organized, respectful and persuasive manner.

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

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Labs, activities, and projects engage students in the process of scientific inquiry and develop critical thinking and problem solving skills. Students will apply these skills with increasing depth and complexity in each successive course in the Natural Resources Pathway. Lab activities will include

- *Natural Resources Nuclear Mini-project- students research and present on nuclear phenomena related to natural resources industries such as food irradiation.*
- *Nuclear Nature- Geiger Counter activity challenging students to find the most "nuclear" object at East Campus.*
- *Nuclear Debate- students critically evaluate the use and application of nuclear energy. They discuss its sustainability, impacts on the environment and evaluate how it should be categorized as a renewable or non-renewable resource. The winning side will persuade the class to use or not to use nuclear energy as an alternative to current energy sources.*

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EDUCATIONAL SERVICES

Department: **Science Department**

Course Title: **Natural Resources Chemistry** Course Number:

Unit Title: **IV. Renewable and Nonrenewable Energy Resources**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

Next Generation Science Standards: High School Physical and Earth Science
HS.Chemical Reactions
- HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- 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.

HS.Structure and Properties of Matter
- HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of materials such as long chained molecules.

HS.Energy
- HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).

HS.Human Sustainability
- HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
- HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
- HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
- HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
- HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

California Career Technical Education Model Curriculum Standards
10.0 Technical Knowledge and Skills
- 10.1 Interpret and explain terminology and practices specific to the Agriculture and Natural Resources sector.
- 10.2 Comply with the rules, regulations, and expectations of all aspects of the Agriculture and Natural Resources sector.
- 10.3 Construct projects and products specific to the Agriculture and Natural Resources sector requirements and expectations.
- 10.4 Collaborate with industry experts for specific technical knowledge and skills.

E Forest and Natural Resource Pathway
E1.0 Understand the importance of energy and energy cycles.
- E1.1 Diagram the oxygen, carbon, nitrogen, and water cycles
- E1.2 Differentiate between renewable and nonrenewable energy sources
- E1.4 Compare the effects on air and water quality of using different forms of energy.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

A. Renewable vs. nonrenewable resources: Students will learn to distinguish between renewable and nonrenewable resources. Students will be able to evaluate current energy resources and future energy sources as either renewable or renewable. In addition, they will evaluate the sustainability of each type of energy resource and evaluate its environmental and societal impacts.
B. Petroleum: Students will understand petroleum, its combustion and relation to climate change. Students will know the specific chemical byproducts of burning fossil fuels. Students will evaluate human contributions and naturally occurring contributions to global climate change.
C. Naming Hydrocarbons: Students will understand the importance of naming various hydrocarbons (alkanes, alkenes, alkynes) in a systematic way. Students will be able to name hydrocarbons with up to ten carbons in the parent chain. Students will understand the contribution of molecular geometries of valence shell electrons on not only a molecule's shape but also how that shape goes on to affect function.
D. Fuels impact on society and our environment: Students will evaluate their individual dependance on fuel. Students will explore and discuss alternative energies and their benefits and/or detriments to society and the environment. Students will evaluate many energy forms and its contribution to global climate change.

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

Direct instruction of the core curriculum will include lectures, either in person or digitally provided, guided note taking, hands-on lab activities, class discussion questions, and connections made to relevant current events such as human impact on natural resource availability and climate change.

Independent practice and enrichment in the form of scientific articles, digital videos, and standards-based assignments will increase student understanding of core curriculum as well as build academic vocabulary and introduce students to the nature of scientific writing.

Labs, activities, and projects engage students in the process of scientific inquiry and develop critical thinking and problem solving skills. Students will apply these skills with increasing depth and complexity in each successive course in the Natural Resources Pathway. Lab activities will include

- *Preserving a Piece of East Campus- Epoxy resin lab*
- *Career exploration- Guest speaker from the fire department to discuss and demonstrate fire suppression techniques.*

*Assessments that involve vertical alignment of curricula in the Natural Resources Pathway, collaboration between different classes in the pathway and place-based curriculum that requires resources available at East Campus are italicized.

Assessments: Describe the Formative and Summative assessments that will be used to demonstrate learning and mastery of the standards.

Chapter Assignments—These formative assignments help to build the students foundation for the information they will learn during the unit. Weekly assignments serve to assess and give immediate feedback to the students as to how they are progressing in the acquisition of the content knowledge. These assignments inform the instructor as to the progress of the students and allow the instruction of the material to be adjusted, should students need remediation or if they require supplementary instruction.

Projects and Labs—these are the primary foundation for this program and indicate how well a student applies the information covered in the text and lecture with the processes and skills necessary for proper field research. As this is a science based class, it is imperative that students demonstrate application of their knowledge through inquiry and observation. Semester-long projects will incorporate the use of a detailed rubric. Students will receive a copy of the rubric prior to beginning each project. Students will also conduct a self- and peer-evaluation at the end of each project or long-term group assignment. Self-evaluation helps students to learn and grow from their mistakes, group evaluations help hold all students accountable for their participation and contribution to group work.

Quizzes—These short assignments are used as formative assessment to help the instructor understand whether

or not the material covered in class is understood by the students. These are primarily used to assess what is understood by a majority of the students and what areas are in need of emphasis or reteaching.

Tests—These longer assessments are the summative portion of the units and will determine whether or not the overarching goals of the units are understood by the students. The information will also help the teacher to redesign learning objectives for the following year and make adjustments to curriculum.

Interventions: Describe methods used to support students who fail to master unit Formative and Summative assessments.

Formative assessments, such as chapter review questions and quizzes, will be followed by immediate reteaching through large group discussion in class and small group review during Intervention..

Many labs will be conducted over the course of several class periods. At the end of each class period, the teacher will scan the parts students have completed to that point, and clarify or correct misconceptions at the opening of the following period.

Semester-long projects will include multiple checkpoints so that the teacher can track students' progress and correct misconceptions. These checkpoints will involve peer evaluation and small-group meetings with the teacher to correct errors and address any challenges that may arise.

Students who miss entire assignments will have the opportunity to complete the work during Intervention with the teacher,where they can receive one-on-one or small group tutoring.

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EDUCATIONAL SERVICES

Department: **Science Department**

Course Title: **Natural Resources Chemistry** Course Number:

Unit Title: **V. Societal and Environmental Cost of Water Quality**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

Next Generation Science Standards: High School Physical and Earth Science
HS.Structure and Properties of Matter
- 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.
- HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

HS.Chemical Reactions
- 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.

HS.Human Sustainability
- HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

California Career Technical Education Model Curriculum Standards
10.0 Technical Knowledge and Skills
- 10.2 Comply with the rules, regulations, and expectations of all aspects of the Agriculture and Natural Resources sector.
- 10.3 Construct projects and products specific to the Agriculture and Natural Resources sector requirements and expectations.
- 10.4 Collaborate with industry experts for specific technical knowledge and skills.

E. Forestry and Natural Resources Pathway
E2.0 Understand air and water use, their management practices, and conservation strategies.
- E2.2 Research and discuss air and water conservation issues.
- E2.3 Define appropriate water conservation measures.
- E2.4 Interpret the component of a plan that monitors water quality.
- E2.6 Analyze the way in which water management affects the environment and human needs.

E6.0 Understand aquatic resource use and management.
- E6.4 Analyze the relationship between water quality and aquatic species habitat.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

A. Properties of Water: Students will explore the chemical composition of water and its structure that contributes to its polar properties. Students will investigate non-polar molecules and understand what makes each type of molecule different. Students will understand the implications of polarity on solubility and learn how polarity affects pollution of water.
B. Water quality and availability: Students will learn about human and industry sources of water contamination such as petroleum, heavy metals, and agricultural run-off. Students will evaluate industrial laws and management that may lead to the contribution or reduction of water pollution. Students will learn to

evaluate water quality based on various water testing, such as conductivity, ion concentration, molarity, and pH concentration. Students will examine the impact water quality has on the quality of life of humans as well as the impacts on the environment.

C. Solutions: Students will understand the difference between homogeneous and heterogeneous mixtures. Students will be able to calculate the concentration of various solutions using molarity, parts per million and parts per billion quantifiers.

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

Direct instruction of the core curriculum will include lectures, either in person or digitally provided, guided note taking, hands-on lab activities, class discussion questions, and connections made to relevant current events.

Independent practice and enrichment in the form of scientific articles, digital videos, and standards-based assignments will increase student understanding of core curriculum as well as build academic vocabulary and introduce students to the nature of scientific writing.

Labs, activities, and projects engage students in the process of scientific inquiry and develop critical thinking and problem solving skills. Students will apply these skills with increasing depth and complexity in each successive course in the Natural Resources Pathway. Lab activities will include

- Foul Water Project
- *Investigating Aquatic Dead Zones utilizing East Campus aquaponics and hydroponics systems*
- *East Campus Pond Health Longitudinal Study (NR Chemistry and Natural Resources 1)*
- *Career exploration- Field trip to wastewater treatment facility*
- *Career exploration- Guest speaker Delta Conveyance Water Project or other water management agency*

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Assessments: Describe the Formative and Summative assessments that will be used to demonstrate learning and mastery of the standards.

Chapter Assignments—These formative assignments help to build the students foundation for the information they will learn during the unit. Weekly assignments serve to assess and give immediate feedback to the students as to how they are progressing in the acquisition of the content knowledge. These assignments inform the instructor as to the progress of the students and allow the instruction of the material to be adjusted, should students need remediation or if they require supplementary instruction.

Projects and Labs—these are the primary foundation for this program and indicate how well a student applies the information covered in the text and lecture with the processes and skills necessary for proper field research. As this is a science based class, it is imperative that students demonstrate application of their knowledge through inquiry and observation. Semester-long projects will incorporate the use of a detailed rubric. Students will receive a copy of the rubric prior to beginning each project. Students will also conduct a self- and peer-evaluation at the end of each project or long-term group assignment. Self-evaluation helps students to learn and grow from their mistakes, group evaluations help hold all students accountable for their participation and contribution to group work.

Quizzes—These short assignments are used as formative assessment to help the instructor understand whether or not the material covered in class is understood by the students. These are primarily used to assess what is understood by a majority of the students and what areas are in need of emphasis or reteaching.

Tests—These longer assessments are the summative portion of the units and will determine whether or not the overarching goals of the units are understood by the students. The information will also help the teacher to redesign learning objectives for the following year and make adjustments to curriculum.

Interventions: Describe methods used to support students who fail to master unit Formative and Summative assessments.

Formative assessments, such as chapter review questions and quizzes, will be followed by immediate reteaching through large group discussion in class and small group review during Intervention..

Many labs will be conducted over the course of several class periods. At the end of each class period, the teacher will scan the parts students have completed to that point, and clarify or correct misconceptions at the opening of the following period.

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EDUCATIONAL SERVICES

Department: **Science Department**

Course Title: **Natural Resources Chemistry** Course Number:

Unit Title: **VI. Industrial Chemical Reactions**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

Next Generation Science Standards: High School Physical and Earth Science
HS.Chemical Reactions

- 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.
- HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- 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.

HS.Structure and Properties of Matter

- 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.
- HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

HS. Energy

- HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
- HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).
- HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

HS.Human Sustainability

- HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
- HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

California Career Technical Education Model Curriculum Standards
10.0 Technical Knowledge and Skills

- 10.1 Interpret and explain terminology and practices specific to the Agriculture and Natural Resources sector.
- 10.2 Comply with the rules, regulations, and expectations of all aspects of the Agriculture and Natural Resources sector.
- 10.3 Construct projects and products specific to the Agriculture and Natural Resources sector requirements and expectations.
- 10.4 Collaborate with industry experts for specific technical knowledge and skills.

E. Forestry and Natural Resources Pathway
E1.0 Understand the importance of energy and energy cycles.

- E1.2 Differentiate between renewable and nonrenewable energy sources
- E1.4 Compare the effects on air and water quality of using different forms of energy.

- E1.5 Analyze the way in which human activities influence energy cycles and natural resource management.

E2.0 Understand air and water use, their management practices, and conservation strategies.

- E2.1 Explain the government's role in regulating air, soil, and water use management practices and conservation strategies.

E9.0 Explore the role of fire in natural resource management.

- E9.2 Explain the significance of each of the components of the "fire triangle."

E12.0 Produce, harvest, process, and market products from natural resource industries.

- E12.1 Explain the marketing processes and manufacturing standards for a variety of natural resource products, including mining, quarrying, and drilling.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

A. Chemical and Physical Properties: Students will understand the difference between chemical and physical properties. They will distinguish how these properties may influence a substance's usefulness in an industrial setting.
B. Chemical Compounds and reactivities: Students will learn to name ionic, and molecular compounds. Students will learn the properties of ionic and molecular compounds and how that contributes to their chemical reactivities. Students will know how to balance single-replacement, double replacement, acid/base, combustion and elimination types of reactions. Students will understand the conservation of matter and energy and how it applies to chemical reactions. Students will know real-world examples of each type of reaction and how they relate to industrial and agricultural fields.
C. Environmental impacts of chemical reactions: Students will learn specific reactivities of metals and how it relates to the mining industry. Students will also learn about the Haber-Bosch Process and it's impacts on the agricultural industry and our world. Students will discuss these various chemical processes and how they have impacted society, our environment and the future of the world.

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

Direct instruction of the core curriculum will include lectures, either in person or digitally provided, guided note taking, hands-on lab activities, class discussion questions, and connections made to relevant current events.

Independent practice and enrichment in the form of scientific articles, digital videos, and standards-based assignments will increase student understanding of core curriculum as well as build academic vocabulary and introduce students to the nature of scientific writing.

Labs, activities, and projects engage students in the process of scientific inquiry and develop critical thinking and problem solving skills. Students will apply these skills with increasing depth and complexity in each successive course in the Natural Resources Pathway. Lab activities will include

- *Penny to Gold Lab- Copper plating*
- *Soil Buffer Lab- Using East Campus to identify and analyze different soil types*
- *Titration Lab- Using East Campus grown and harvested cabbage, butterfly pea, or fruit pH indicators*
- *Making Soap Using Locally Sourced Agricultural Products*
- *Career exploration- Field trip to Madrone Winery to explore enology and viticulture*

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Assessments: Describe the Formative and Summative assessments that will be used to demonstrate learning and mastery of the standards.

Chapter Assignments—These formative assignments help to build the students foundation for the information they will learn during the unit. Weekly assignments serve to assess and give immediate feedback to the students as to how they are progressing in the acquisition of the content knowledge. These assignments inform the instructor as to the progress of the students and allow the instruction of the material to be adjusted, should students need remediation or if they require supplementary instruction.

Projects and Labs—these are the primary foundation for this program and indicate how well a student applies the information covered in the text and lecture with the processes and skills necessary for proper field research. As this is a science based class, it is imperative that students demonstrate application of their knowledge through inquiry and observation. Semester-long projects will incorporate the use of a detailed rubric. Students will receive a copy of the rubric prior to beginning each project. Students will also conduct a self- and peer-evaluation at the end of each project or long-term group assignment. Self-evaluation helps students to learn and grow from their mistakes, group evaluations help hold all students accountable for their participation and contribution to group work.

Quizzes—These short assignments are used as formative assessment to help the instructor understand whether or not the material covered in class is understood by the students. These are primarily used to assess what is understood by a majority of the students and what areas are in need of emphasis or reteaching.

Tests—These longer assessments are the summative portion of the units and will determine whether or not the overarching goals of the units are understood by the students. The information will also help the teacher to redesign learning objectives for the following year and make adjustments to curriculum.

Interventions: Describe methods used to support students who fail to master unit Formative and Summative assessments.

Formative assessments, such as chapter review questions and quizzes, will be followed by immediate reteaching through large group discussion in class and small group review during Intervention..

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EDUCATIONAL SERVICES

Department: **Science Department**

Course Title: **Natural Resources Chemistry** Course Number:

Unit Title: **VII. Food and Agricultural Applications**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

Next Generation Science Standards: High School Physical Science
HS.Structure and Properties of Matter
- HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of materials such as long chained molecules, and pharmaceuticals that are designed to interact with specific receptors.

HS.Energy
- HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

HS.Human Sustainability
- HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

California Career Technical Education Model Curriculum Standards
E. Forestry and Natural Resource Pathway
E1.0 Understand the importance of energy and energy cycles.
- E1.2 Differentiate between renewable and nonrenewable energy sources.
- E1.5 Analyze the way in which human activities influence energy cycles and natural resource management.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

A. Chemicals in food: Students will evaluate the chemical components that make-up macromolecules such as carbohydrates, fats, proteins, vitamins, minerals, additives and DNA of food products. Students will learn about the impacts different food products have on the human system and overall well-being of individuals.
B. Calorimetry: Students will learn how we can measure the chemical potential energy in a food product and convert it into useful kinetic energy in our body system.
C. Food Production: Students will evaluate the environmental impact of transporting food from one region to another. Students will engage in local food practices and discuss alternatives to improving the carbon footprint of food production, transportation and delivery within our community and the global community at large.

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

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Labs, activities, and projects engage students in the process of scientific inquiry and develop critical thinking and problem solving skills. Students will apply these skills with increasing depth and complexity in each successive

course in the Natural Resources Pathway. Lab activities will include

- Food as Energy-Calorimetry project
- *Decomposition Study using garden resources at East Campus*
- *Field to Table - investigating the carbon foot-print of various food products*
- *Guest speaker- Folsom Lake College Enology and Viticulture Program professors (NR Chemistry and Natural Resources 2 collaboration)*

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