FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

Agriculture and Soil Chemistry

DATE: MARCH 2015 **SUBJECT AREA: SCIENCE**

PROPOSED GRADE LEVEL(S): 11TH – 12TH GRADE **COURSE LENGTH: ONE YEAR**

GRADING: A-F **NUMBER OF CREDITS: 5 PER SEMESTER**

PREREQUISITES: PASSING GRADE IN AG. BIOLOGY OR BIOLOGY, GEOMETRY OR CONCURRENT ENROLLMENT

COURSE DESCRIPTION:

This course explores the physical and chemical nature of soil as well as the relationships between soil, plants, animals and agricultural practices. Students will examine properties of soil and land and their connections to plant and animal production. Using knowledge of scientific protocols as well as course content, students will develop an Agriscience research program to be conducted throughout the first semester of the course. To complete that whole project each student will investigate and test an Agriscience research question by formulating a scientific question related to the course content, formulating a hypothesis based on related research, conducting an experiment to test the hypothesis, collecting quantitative data, and forming a conclusion based on analysis of the data. The result of this research program will be an in depth research and experimentation paper that is technically written, based on scientific protocol, and cited using APA formatting. Additionally, students will develop and present a capstone soil management plan for agricultural producers, using the content learned throughout the course. Throughout the course, students will be graded on participation in intracurricular FFA activities as well as the development and maintenance of an ongoing Supervised Agricultural Experience (SAE) program.

GENERAL GOALS/ESSENTIAL PURPOSES:

1) The introductory unit will focus on proper methods of agriscience inquiry. Through a series of mini-lab experiences based on the course content, students will learn to ask questions and define problems, conduct research to form a hypothesis, determine the experimental design and conduct experimentation, analyze and interpret data, develop conclusions and then communicate their findings in lab reports.
2) Students will use the methods of scientific inquiry, developed in the previous unit, to investigate the composition of the physical world, and discover how matter and energy change forms through biogeochemical cycles. Students will understand where soil originates by investigating the role of the rock cycle in soil formation. Students will learn how the electron configurations of different elements, present in the parent material, give them unique physical and chemical properties, and will further investigate how these properties impact soil characteristics.
3) Using knowledge accessed from previous units on the physical and chemical properties of soil, students will analyze how the water cycle impacts soil based on its soil type (sand, silt, clay) soil location (geographic and topographic), vegetative state and natural slope of land. In order to understand how water becomes available for plant growth, students will explain the movement of water through soil with respect to how intermolecular forces impact percolation, capillary action, pore size, cohesion and adhesion.
4) Building on knowledge acquired from the previous units on the physical and chemical properties of water and soil, students will begin to determine the effects of plant, soil and water interactions with respect to maintaining or restoring environmental health and structure. Students will model how nutrients cycle through the environment, analyze how pH affects nutrient availability by changing chemical equilibrium,

determine water holding capacity with respect to water availability for plant growth, and identify possible nutrient deficiencies based on plant observations.

5) Using knowledge from previous units about soil nutrient content, students will identify the key macro minerals and micro minerals necessary for normal livestock growth and reproduction. The students will correlate the minerals present in soil with the nutrient content of typical livestock concentrate and roughage feeds. Using local resources, the students will identify mineral deficiencies or toxicities in the soil and relate the deficiencies or toxicities to livestock health.
6) Based on the accumulation of knowledge, examples and research conclusions from throughout the year, students will develop an understanding of sustainable agriculture by employing a Sustainability evaluation tool, "The 3-Pillars of Sustainability, economic, environmental and social impacts" of agriculture.

CCSS READING COMPONENT:

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.

HS-ETS1.3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

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.

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

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.Matter and Energy in Organisms and Ecosystems

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

HS Interdependent Relationships in Ecosystems

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

CCSS WRITING COMPONENT:

HS.Engineering Design

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.

HS Interdependent Relationships in Ecosystems

WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.9-12.7 Conduct short, as well as, more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

HS.Matter and Energy in Organisms and Ecosystems

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WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research**.**

HS Chemical Reactions

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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

WHST.9-12.7 Conduct short, as well as, more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task,

purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.

CCSS SPEAKING & LISTENING COMPONENT:

Chemical Reactions

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

DETAILED UNITS OF INSTRUCTION:

Unit of Instruction/Objectives	CCSS Standards	Key Assignments
Unit 1: Agriscience Practices **Unit Description** This introductory unit will focus on proper methods of agriscience inquiry. Through a series of mini-lab experiences based on the course content, students will learn to ask questions and define problems, conduct research to form a hypothesis, determine the experimental design and conduct experimentation, analyze and interpret data, develop conclusions and then communicate their findings in lab reports.	HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 RST.11-12.7 RST.11-12.8 RST.11-12.9	• Soil Structure and Composition Mini-Lab - Calgon Testing • Animal and Soil Management Mini-Lab - Animal Manure Amendment • Technology Mini-Lab - Soil Moisture Testing • Agriscience Research Project Proposal
Unit II: The Nature of Soil **Unit Description** Students will use the methods of scientific inquiry, developed in the previous unit, to investigate the composition of the physical world, and discover how matter and energy change forms through biogeochemical cycles.	HS-PS1-1 HS-PS1-3 HS-PS1-8 HS-ESS2-5 HS-ESS2-7 HS-ESS2-2 RST.9-10.7 RST.11-12.1 WHST.9-12.7 WHST.11-12.8 WHST.9-12.9 MP.4 HSN-Q.A.1 - 3	• Sedimentary Rock Lab • Collect and Test Soil Samples: Physical Properties (figure out what elements might be in them based on chemical properties) • Background Scholarly Research and Forming a Hypothesis • Test Soil Samples: Chemical Properties • Experimental Design and Conducting Experimentation • Creating Soil Maps • Soil Management Project

Unit III: Water and Soil Management **<u>Unit Description</u>** Using knowledge accessed from previous units on the physical and chemical properties of soil, students will analyze how the water cycle impacts soil based on its soil type (sand, silt, clay) soil location (geographic and topographic), vegetative state and natural slope of land. In order to understand how water becomes available for plant growth, students will explain the movement of water through soil with respect to how intermolecular forces impact percolation, capillary action, pore size, cohesion and adhesion.	HS-PS1-1 - 4 HS-ESS3-3 WHST.9-12.2 WHST.9-12.5 WHST.9-12.7 SL.11-12.5 MP.2 MP.4 HSN-Q.A.1 HSN-Q.A.2 HSN-Q.A.3	• Soil Erosion and Runoff Lab • Water Quality Testing • Analyzing data, interpreting data and forming conclusions • Tillage Practices and the Impact they have on Runoff, Erosion and Soil Chemistry • Ground Water Contamination and Aquifer Lab • Irrigation Practices in Agriculture • Semester One Capstone Project
Unit IV: Plants and Soil Management **<u>Unit Description</u>** Building on knowledge acquired from the previous units on the physical and chemical properties of water and soil, students will begin to determine the effects of plant, soil and water interactions with respect to maintaining or restoring environmental health and structure.	HS-PS1-1-7 HS-ESS3-3 WHST.9-12.2 WHST.9-12.5 WHST.9-12.7 SL.11-12.5 MP.2 MP.4 HSN-Q.A.1-Q.A.3	• Plant Requirements from Soil Lab • Soil Management Project • Plant and Soil Interactions
Unit V: Animals and Soil Management Using knowledge from previous units about soil nutrient content, students will identify the key macro minerals and micro minerals necessary for normal livestock growth and reproduction.	HS-PS1-3 HS-PS1-4 HS-PS1-6 HSPS1-2 RST.11-12.1 WHST.9-12.2 – 12.9 MP.4 HSN-Q.A.1-3 SL.11-12.5	• Nutrient Deficiencies in Livestock • Livestock and Water Quality • Livestock Waste Management • Soil Management Project
Unit VI: Soil and Agricultural Technology **<u>Unit Description</u>** Based on the accumulation of knowledge, examples and research conclusions from throughout the year, students will develop an understanding of sustainable agriculture by employing a Sustainability evaluation tool, "The 3-Pillars of Sustainability, economic, environmental and social impacts" of agriculture.	HS-LS2-4 HS-LS1-6 HS-LS4-6 HS-LS-6 HS-LS2-7 HS-LS2-2 HS-ET1-2 HS-ETS1-1, HS-ETS1-4 RST.11-12.1 WHST.9-12.2 WHST.9-12.5	• Phytoremediation Lab • Tillage Protocols: Impact on Soil Structure and Soil Sustainability Lab • Land Use Planning Model • Agriculture Issue Debate and Policy Proposal • Soil Management Project

	WHST.9-12.9 RST.11-12.7- 12.9 MP.2, MP.4 HSN-Q.A.1-A.3	
Unit VII: Capstone Project and Portfolio **1.Soil Management Capstone Project** As the final course capstone project, students will be given a scenario and soil sample designed around their local agriculture industry. **2. Course Portfolio** The course portfolio will provide evidence of real-world agriculture application of scientific research done throughout this course.		

TEXTBOOK AND RESOURCE MATERIALS:

Primary Text:
Plant & Soil Science Fundamentals and Applications by Rick Parker,
Principles of Soil Chemistry 4th edition by Kim Tan,
Laboratory experiments are done throughout the course.

COMMON CORE STANDARDS TO BE ADDRESSED:

*** See middle column titled "CCSS Standards" above under Units of Instruction.**

DISTRICT ESLRs TO BE ADDRESSED:

Students will be:

- **Self-Directed Learner:** Students will be required to work independently, monitor their progress and meet assignment requirements at stated intervals. This class will prepare students to be self-directed lifelong learners.
- **Effective Communicator:** Students will communicate their understanding of agriculture and floral design concepts through written, visual and oral expression.
- **Quality Producer/Performer:** Students will demonstrate successful performance through instructor assessments, completed FFA Record Book, and floral arrangements.
- **Constructive Thinkers:** Reading and analysis of text provided case studies and opposing points of view will develop students' problem solving/critical thinking skills.
- **Collaborative Workers:** Students will need to identify and gather resources and information from outside the school and home to complete assignments in class. Students will need to work together to produce floral arrangements to meet the consumers needs.
- **Responsible Citizens:** Students will become more knowledgeable of floral design skills needed and workplace expectations on a regional and global scale.

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