

CALEXICO UNIFIED SCHOOL DISTRICT NEW COURSE PROPOSAL

Proposed Course Title: Agricultural Integrated Science

Department: Science

Content Area: Physical Science/Agriculture (CTE)

Grade Level: 9

Graduation Requirement Fulfilled: Physical Science

Prerequisites: None

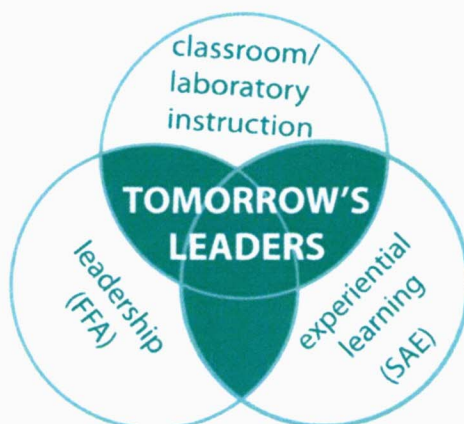
Financial Impacts: TBD

Material Costs: TBD

Funding Source: General Fund and/or Perkins

1. COURSE DESCRIPTION:

Agricultural Integrated Science is a one-year physical science course which emphasizes agriculture skills and knowledge via the teaching of introductory physical science concepts. This course is offered to first year agriculture students who are interested in the agricultural industry, Future Farmers of America (FFA), and/or are planning to major in agriculture in a college or university. The goal of this course is to give students the opportunity to explore the different aspects of the agricultural industry. Supervised Agricultural Experience (SAE) projects and FFA are integral parts of the class. Students are required to participate in various FFA activities per semester, which may include leadership training experiences and competitions offered by the FFA. Students must maintain a record of their FFA activities through the Agricultural Experience Tracker (AET) national website. The course focus will be on implementing the Next Generation Science Standards (NGSS) and the CTE Model Curriculum Standards for Agriculture and Natural Resources (MCS/ANR); specifically, the science practice strand while supporting Common Core. The course content includes standards from three branches (physical, life, and earth) of science delineated by NGSS and from three branches (plant and soil science, animal science and agriscience) delineated by the MCS/ANR. As an agriculture course, lessons in this class will be implemented through the three-ring model of agriculture education which includes: leadership; laboratory and supervised agricultural experience projects (SAE); and FFA participation. Each of these three components serve to further prepare students for career readiness through hands-on learning experiences.



2. PROPOSED INSTRUCTIONAL MATERIALS:

Primary Textbook Title: Principles of Agriculture, Food, and Natural Resources

By: John S. Rayfield, Kasee L. Smith, Travis D. Park, and D. Barry Croom. Publisher: The Goodheart-Willcox Company, Inc. Tinley Park, IL. Copyright 2017 ISBN: 978-1-63126-235-7.

Standard materials commonly associated with the teaching of introductory concepts related to physical science, life science and earth science will be required.

3. KEY STANDARDS ADDRESSED BY COURSE:

Next Generation Science Standards (NGSS) & CTE Model Curriculum Standards Agriculture and Natural Resources (MCS/ANR).

First Quarter Key Standards:

NGSS:

Nature of Science: Understanding how science works to distinguish between science and non-science.

Science & Engineering Practices (SEP)

SEP3: Planning and carrying out investigations (Grades 6-8)

- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.
- Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.

SEP3: Planning and carrying out investigations (Grades 9-12)

- Plan an investigation or test a design individually and collaboratively to produce data to serve the basis for evidence as part of building and revising models, supporting explanations of phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data, and refine the design accordingly.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

SEP4: Analyzing and interpreting data (Grades 6-8)

- Use graphical displays of large data sets to identify temporal and spatial relationships.
- Distinguish between causal and correlational relationships in data.
- Analyze and interpret data to provide evidence for phenomena.

SEP4: Analyzing and interpreting data (Grades 9-12)

- Consider limitations of data analysis when analyzing and interpreting data.
- Compare and contrast various types of data sets to examine consistency of measurements and observations.

MCSANR

Knowledge & Performance Anchor Standards (K&PAS)

- 5.0. Conduct short as well as more sustained research to create alternative solutions to answer a question or solve a problem unique to the Agriculture and Natural Resources sector, using critical and creative thinking, logical reasoning, analysis, inquiry, and problem solving techniques. (Direct alignment with WS 1112.7)
- 5.1 Identify and ask significant questions that clarify various points of view to solve problems.
- 5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive and deductive) as appropriate.
- 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.

K& PAS

- 6.0 Health and Safety: Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain specific words and phrases as related to the Agriculture and Natural Resources sector workplace environment. (Direct alignment with RSTS 910, 1112. 4)
- 6.1 Locate and adhere to Material Safety Data Sheet (MSDS) instructions.
- 6.2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.
- 6.3 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies.
- 6.4 Practice personal safety when lifting, bending, or moving equipment and supplies.
- 6.5 Demonstrate how to prevent and respond to work-related accidents or injuries; this includes demonstrating an understanding of ergonomics.
- 6.6 Maintain a safe and healthful working environment.
- 6.7 Be informed of laws/acts pertaining to the Occupational Safety and Health Administration (OSHA)

Agriscience

- C1.0 Evaluate the role of agriculture in the California economy.
- C13.0 Design agricultural experiments using the scientific method.
- C13.1 State the steps of the scientific method.
- C13.2 Analyze an agricultural problem and devise a solution based on the scientific method.

Plant & Soil Science

- G10.0 Apply local crop management and production practices.
- G7.0 Integrate effective tillage and soil conservation management practices.

Second Quarter Key Standards:

NGSS:

High School Physical Science (HSPS)

- HSPS11. 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. [Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [Assessment Boundary: Assessment is limited to main group elements.]

- HSPS12. 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. [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.]
- HSPS13. 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. [Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.]

MCSANR

Agriscience

- C10.0 Explain soil science principles.
- C10.1 Recognize the major soil components and types.
- C10.2 Summarize how soil texture, structure, pH, and salinity affect plant growth.

Third Quarter Key Standards:

NGSS:

(HSL16) Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. [Clarification Statement: Emphasis is on using evidence from model and simulations to support explanations.]

- Identify the structure and function of the four types of organic macromolecules.
- Compare and contrast covalent and ionic bonds.
- Evaluate why the structure of water makes it a good solvent (polar molecule).
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The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells.

(HSL16) As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HSL16), (HSL17)

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MCSANR

Agriscience

- C11.0 Analyze plant growth and development.
- C11.1 Understand the anatomy and functions of plant systems and structures.

- C11.2 Identify plant growth requirements.
- C11.5 Understand photosynthesis and the roles of the sun, chlorophyll, sugar, oxygen, carbon dioxide and water in the process.
- C11.6 Summarize the respiration process in the breakdown of food and organic matter.
Plant & Soil Science
- G3.1 Investigate plant systems, nutrient transportation, and energy storage.
- G3.3 Discern how primary, secondary, and trace elements are used in plant growth.
- G3.4 Research the factors that influence plant growth, including water, nutrients, light, soil, air, and climate.
- G3.6 Conduct experiments testing the factors that affect plant growth and predict plant response.

Fourth Quarter Key Standards:

NGSS:

High School Life Science:

- HSLS23. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
- HSLS15. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
- HSLS17. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
- LS1.A: Structure and Function All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MSLS11) Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MSLS12) In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MSLS13)

High School Earth and Space Science

- HSESS22. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
- HSESS24. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

High School Engineering, Technology, and Applications of Science

- HSETS11. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HSETS12. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HSETS13. Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

MCS-ANR

Animal Science

- D3.0 Apply principles of comparative anatomy and physiology to uses within various animal systems.
- D3.1 Compare and contrast animal cells, tissues, organs, and body systems.
- D3.3 Relate the importance of animal organs to the health, growth, and reproduction of animals.

Plant & Soil Science

- G2.0 Explore cell biology.
- G2.1 Compare differences between prokaryotic cells and plant and animal eukaryotic cells and how viruses differ from them in complexity and general structure.
- G2.2 Test plant cellular function reactions when plants are grown under different conditions.
- G2.3 Explain functions organelles play in the health of the cell.
- G2.4 Recognize the part of the cell that is responsible for the genetic information that controls plant growth and development.
- G2.6 List which organelles in plant cells carry out photosynthesis.
- G8.1 Summarize California water history, current issues, water rights, water law, and water transfer through different distribution projects throughout the state.
- G8.2 Research and describe the local, state, and federal agencies that regulate water quality and availability in California.

4. COURSE SEQUENCE AND PACING GUIDE

First Quarter:

1. Agriculture and Society
2. Leadership in Agriculture
3. Agriculture as a Career
4. Agricultural Safety
5. Metric System and Applied Measurements
6. Models and Microscopes (use and care)
7. Scientific Method
8. Graphing
9. Scales and Models of Garden

Second Quarter:

10. Agriculture Science
11. Production, Gardening and Vegetable Production
12. Atomic Structure & Covalent and Ionic Bonding
13. Periodic Table
14. Water and Properties of Water
15. pH
16. Soil and Water Management
17. Soils and Fertilizer
18. Essential Plant Nutrients

Third Quarter:

19. Atmosphere, Weather and Climate
20. Biomes
21. Importance of Food
22. World Food Supply and World Wide Production Zones
23. Large-Animal Production
24. Small-Animal Production
25. Plant Production
26. Environmental Systems Impacting Agriculture

Fourth Quarter:

27. Imperial Valley Water Quality and Water Supply (History of Water)
28. Irrigation Management
29. Agriscience and California
30. California Geology
31. Agricultural Technology
32. Agricultural Power and Engineering
33. Agricultural Mathematics

5. ADDITIONAL ACADEMIC REQUIREMENTS

- **FFA Participation and Leadership:**

The type and number of activities will be determined by the course instructor.



- **Supervised Agricultural Experience Projects (SAE):**

- a. All students are required to have a project of some kind which relates to agriculture.
- b. Students will be required to document their project within the official Agricultural Experience Tracker (time will be given in class).
- c. A minimum of 40 hours is required to be completed for the school year.