

AGRICULTURAL SCIENCE

Curriculum Standard: The student will investigate the geological and biological processes that form the soil. Plate tectonics, and volcanism build new land and replenish the soil. Erosion and weathering break down rocks into the small pieces that make up the mineral content of soil. Decomposition of plant and animal remains make up the organic content of the soil. Plants require specific soil types in order to grow.

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>1. The student will understand that the earth is divided into layers that successively get hot towards the center.</p> <p>The earth is heated by pressure from gravity, radiation energy left over from accretion, and radioactive materials inside the earth.</p> <p>2. The student will understand that the earth's crust is broken into plates. Convection currents in the mantle cause them to move. As plates move, in relation to each other, new crust is built and land is uplifted to form mountains, valleys, and other geologic features.</p>	<p>A. Can the student describe how gravity affects us? Can the student identify the parts of the atom? Can the student identify the 3 states of matter?</p> <p>A. Can the student identify the crust and mantle and describe the conditions in those layers?</p>	<ul style="list-style-type: none"> • The student will diagram the layers of the earth and include information on temperature change, physical state, and composition. The student will explain the source of the earth's heat. • The student will compare the convection currents in a pot of boiling water to the mantle. The student will illustrate how the crust undergoes transformation due to plate motion.

AGRICULTURAL SCIENCE

Applied Natural Science

SOIL FORMATION

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>3. The student will understand that the earth’s geologic features are further shaped through erosion and weathering.</p> <p>Erosion and weathering break down rock into small particles that compose the largest portion of soil.</p>	<p>A. Can the student name some erosional forces, such as wind, rain, rivers, etc.? Can the student name some of the basic components of soil?</p>	<ul style="list-style-type: none"> • The student will illustrate some of the changes erosional and weathering forces make to the earth’s surface and explain where the mineral content of soil comes from.
<p>4. The student will understand that minerals are composed of elements. Plants use minerals for their life processes. The amount of useful minerals can deplete over time and soil used for planting needs to be replenished using fertilizers and soil amendments. Volcanism replenishes the soil as well. Volcanic soil is rich in minerals that plants need.</p>	<p>A. Can the student tell what an element is and explain the general information given on the periodic table? Can the student name some familiar elements? Can the student name some minerals his/her bodies need, such as calcium and iron?</p>	<ul style="list-style-type: none"> • The student will diagram the atom and explain how elements differ or share certain characteristics. • The student will explain what information is given on the periodic table. • The student will analyze the elements in an all purpose fertilizer and explain how plants use them. The student will report what mineral sources can supply elements.
<p>5. The student will understand that plant and animal remains decompose and become part of the soil.</p> <p>Animal decomposers eat dead organic material and excrete nutrient rich castings into the soil that help plants grow.</p>	<p>A. Can the student explain the food chain?</p>	<ul style="list-style-type: none"> • The student will illustrate the decomposers part in the food chain explaining how plants need and use organic rich soil. The student will help maintain the school garden compost pile and vermicompost bin. The student will diagram the nitrogen cycle.

AGRICULTURAL SCIENCE

Applied Natural Science

SOIL FORMATION

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>Decomposed organic matter helps the soil retain moisture, provide air space necessary for root aeration, and helps retain warmth.</p> <p>Composting is a way people can add decomposed organic material to their garden's soil.</p> <p>6. The student will understand that soils in different areas contain different types of minerals and have different ratios of particle sizes and amounts of organic matter.</p> <p>Testing can determine soil type and the possible need for amendment.</p>	<p>A. Can the student explain what a plant needs in a soil in order to grow?</p>	<ul style="list-style-type: none"> • The student will test school garden soil, determine its type, and whether it needs amendment. The student will also describe the characteristics of typical San Joaquin soil type.

AGRICULTURAL SCIENCE

Curriculum Standard: The student will investigate how oceans and the water cycle affect weather and climate. The student will explore the ocean ecosystem and lifeforms and effects of human interaction through pollution and fishing industry.

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>1. The student will understand that evaporation from the oceans is the principle source of clouds that form precipitation. Rotation of the earth, and heat from the sun create and circulate air masses.</p> <p>Air over polar regions get less heat energy from the sun and forms cold air masses. Air over the tropical regions receives more and forms warm air masses. Heated air rises and cooled air drops causing circular currents. Heat energy is spread through the atmosphere through convection, conduction, and radiation.</p> <p>Clouds are formed when water vapor in warm air cools and condenses. As moisture laden air rises and cools, it reaches its dew point. The cloud can no longer hold the water droplets and they unite and fall as precipitation.</p>	<p>A. Can the student diagram the water cycle and explain how the sun causes the equatorial regions to be warmer and polar regions to be colder? Can the student explain the density of cold vs. warm air and that warmer, less dense things rise? Can the student give examples of how heat can be transferred?</p>	<ul style="list-style-type: none"> • The student will illustrate the amount of heat energy from the sun that reaches the various parts of the globe. • The student will explain the relationship of heat to density at the molecular level and show how heat energy is transferred. • The student will demonstrate how water evaporates to form water vapor. As the vapor laden air cools, the water condenses to form clouds. • The student will explain relative dew point and how various forms of precipitation occur. • The student will measure humidity using a sling psychrometer or wet/dry thermometers over a period of time.

AGRICULTURAL SCIENCE

Applied Natural Science

WEATHER, OCEANS, AND FISHING INDUSTRY

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>2. The student will understand that air pressure and the weight of the air above can differ around the globe. Areas of high pressure move into areas of low pressure causing winds. The direction of the wind is curved due to the rotation of the earth (coriolis effect).</p> <p>Low atmospheric pressure allows warm air to rise, whereas high does not. If the rising air is moist, clouds will develop which can lead to precipitation. Therefore, bad weather is generally linked to low pressure areas and fair weather to high.</p>	<p>A. Can the student define gravity? Can the student describe the movements of molecules in areas of more density into areas of less density (pressure)?</p>	<ul style="list-style-type: none"> • The student will build and use a barometer. The student will track barometric pressure over a period of time. • The student will describe the conditions that affect air pressure. • Using weather maps, the student will track current pressure patterns and analyze weather conditions. • The student will diagram the Coriolis effect on global wind direction.
<p>3. The student will understand that air travels in masses. The air in the mass is of a fairly uniform temperature. Cold air masses push under warm air masses because they are denser. Where warm and cold masses meet, clouds and precipitation can form.</p>	<p>A. Can the student describe the reason air masses of various temperatures form. Can the student compare the density of warm vs. cold air masses.</p>	<ul style="list-style-type: none"> • Using weather maps, the student will track air mass movement, warm and cold fronts, and analyze weather conditions. The student will describe areas and conditions where storms are likely to form .

AGRICULTURAL SCIENCE

Applied Natural Science

WEATHER, OCEANS, AND FISHING INDUSTRY

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>4. The student will understand that climate is the average weather each season in a particular area. Climate affects what kinds of crops can be grown.</p>	<p>A. Can the student describe the characteristics of the major climate zones?</p>	<ul style="list-style-type: none"> • The student will describe conditions that cause climates. The student will compare and contrast climate conditions in the major climate zones. The student will analyze data to determine average temperature, precipitation, etc. of the Sacramento area during the seasons. • The student will create a Sacramento area planting calendar.
<p>5. The student will understand that ocean currents and water masses which influence air masses and humidity also influence climate.</p>	<p>A. Can the student explain how humidity and air mass temperature are influenced by ocean temperature?</p>	<ul style="list-style-type: none"> • The student will compare locations of similar latitude and explain climate differences.
<p>6. The student will understand that ocean currents are caused by wind patterns and the differences in density due to temperature and salinity.</p> <p>Waves are caused primarily by wind and occasionally earthquakes. They have a measurable wave length, height, and period.</p>	<p>A. Can the student explain how sailing ships traveled before the advent of the engine? Can the student describe how liquids and gases of different densities interact?</p>	<ul style="list-style-type: none"> • The student will map the major ocean currents. • The student will demonstrate the behavior of water masses with different temperature and salinity levels. • The student will diagram the parts of a wave and calculate wavelength and period given a set of data. • The student will graph the major ocean elements and explain the causes of varied salinity levels.

AGRICULTURAL SCIENCE

Applied Natural Science

WEATHER, OCEANS, AND FISHING INDUSTRY

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>7. The student will understand that the ocean floor has been mapped using remote sensing. It has a variety of geologic features.</p>	<p>A. Can the student name land geologic features?</p>	<ul style="list-style-type: none"> • The student will map a model sea floor using “remote sensing” data. • The student will illustrate the various geologic features of the sea floor and their effects on ocean depth. • The student will explain how volcanism and plate tectonics affects the geology of the sea floor.
<p>8. The student will understand that conditions in the ocean vary widely and affect the types of plants and animals that grow there. There are 3 major environmental or life zones--intertidal, neritic, and open sea.</p>	<p>A. Can the student describe some temperature, light, and salinity differences between the shore and open sea and between climate zones?</p>	<ul style="list-style-type: none"> • The student will describe the conditions and types of plant and animal life found at the various life zones. The student will explain how the life forms are adapted to those conditions. • The student will chart where species important to the fishing industry are located.
<p>9. The student will understand that the fishing industry is important to world economy and food supply. Humans have an impact on the ocean ecology and must take care to protect it and use it wisely.</p>	<p>A. Can the student list some products and foods that come from the ocean? Can the student describe some ways man has impact on the ocean ecology?</p>	<ul style="list-style-type: none"> • The student will explain the steps in catching, processing, marketing and sales, and distribution of ocean products. • The student will research how fishermen and scientists work together to manage our ocean resources.

AGRICULTURAL SCIENCE

Curriculum Standard: The student will investigate energy and energy transformations and how these can be harnessed to do work in the internal combustion engine. Key concepts will include an understanding of the combustion reaction, the nature of heat and heat transfer, its relationship to force and motion, and how energy, force, and motion can be transferred.

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>1. The student will understand that energy cannot be created or destroyed, only changed from one form to another.</p> <p>2. The student will understand that heat energy released during the combustion reaction can be changed to motion energy in the internal combustion engine. There is, however, a loss of energy through heat exchange and friction caused when metals expand.</p> <p>3. The student will understand that combustion is a chemical reaction where fuel is combined with O₂ to produce, CO₂, H₂O, carbon, and other by products plus heat and light energy.</p>	<p>A. Can the student:</p> <ol style="list-style-type: none"> 1. Name some forms of energy? 2. Explain how one type of energy can be changed to another? <p>A. Can the student:</p> <ol style="list-style-type: none"> 1. Name some machines that run on an internal combustion engine and explain their uses? 2. Explain the basic characteristics of fire? 3. Define friction and explain that friction causes heat? <p>A. Can the student:</p> <ol style="list-style-type: none"> 1. Describe what a fuel looks like before and after combustion? 2. Explain how heat and light are a part of combustion? 	<ul style="list-style-type: none"> • The student will create a cartoon strip around one form of energy changing to another and another and then back to the first in a Rube Goldberg cycle. • The student will diagram the operation of a 2 and 4 cycle engine including where waste affects efficiency. • The student will research the oil fires in Kuwait during the Gulf War and explain how the oil fires are a chemical reaction and how the firefighters used this knowledge and the fire triangle to extinguish the flames.

AGRICULTURAL SCIENCE

Applied Natural Science

ENERGY TRANSFORMATION

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>4. The student will understand that heat is characterized by the motion of molecules. Heat energy is transferred through matter by conduction, convection, and radiation. Heat causes matter to expand. The expansion of matter exerts force in the form of pressure on surrounding objects.</p>	<p>A. Can the student:</p> <ol style="list-style-type: none"> 1. Define atom, element, molecule? 2. Describe the 3 states of matter? 	<ul style="list-style-type: none"> • The student will draw a graphic analogy explaining the motion and relative space taken by the “molecule” in the 3 states. Example: <u>Solid</u> - Cars jammed at a standstill at rush hour. <u>Liquid</u> - Cars moving freely in lanes, taking up more space. <u>Gas</u> - Cars speeding, crashing, and flying off embankment, taking up the most space.
<p>5. The student will understand that the force from expanding heated gases pushes the piston, creating linear motion. This linear motion is transformed into circular motion by the crank-shaft and used to turn wheels or other machines. Steering and road surface conditions can affect motion in vehicles.</p>	<p>A. Can the student:</p> <ol style="list-style-type: none"> 1. Describe some different types of motion? 2. Name some machines that change one type of motion to another? 	<ul style="list-style-type: none"> • The student will explain how motion is transferred through an automobile from the piston, through the drive train, to the wheels. The student will also describe some other ways the car moves, such as steering and suspension.

AGRICULTURAL SCIENCE

Curriculum Standard: The student will investigate electricity and magnetism and how they apply to farm, business, and household appliances and equipment. Key concepts include separation of charge alternating and direct current, circuits and components, induction, and power generation.

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>1. The student will understand that magnetism is a force that can be observed in the metals iron, cobalt, and nickel. Objects made from these metals and some of their alloys can be permanently, magnetized by bringing them near other strong magnets or an electromagnetic field. They can be demagnetized if heated or dropped.</p> <p>Magnets and pieces of magnets have a north and south pole which interact as such:</p> <ul style="list-style-type: none"> • Like poles repel. • Opposite poles attract. <p>Magnets are also attracted to objects that contain iron.</p> <p>The magnetic field extends beyond the magnet in patterns of force. The stronger the magnet, the further out the magnetic field extends. Fields from two magnets interact in a recognizable pattern.</p>	<p>A. Can the student identify bar and horseshoe magnets, name some objects the magnets will pick up, and describe the forces of attraction and repulsion?</p>	<ul style="list-style-type: none"> • The student will demonstrate how magnets interact with each other and with other objects and be able to draw the field lines of force around a single magnet and between two magnets that are attracting and repelling. The student will explain what metals can be magnetized and how they are permanently magnetized and demagnetized.

AGRICULTURAL SCIENCE

Applied Natural Science

ELECTRICITY AND MAGNETISM

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>2. The student will understand that atoms are made of particles that behave similarly to magnets. Protons have a positive charge, electrons have a negative charge (neutrons have no charge). Like charges repel and opposite charges attract. Electrons can be removed from some atoms and forced to travel from atom to atom. This is called an electric current.</p> <p>3. The student will understand that electrons or negative charges can be stripped from the atoms in some materials by the materials through friction and stored. This is called static electricity. The material storing the electrons has a net negative charge. The material losing the electrons has a net positive charge. Like charged objects repel, opposite charged objects attract.</p> <p>Lightning or static spark is caused when the static charge becomes so great in one object that it can overcome air resistance and travel to another object of opposite or less charge.</p>	<p>A. Can the student explain that all the matter in the universe is composed of building blocks called atoms and that the atoms themselves are composed of building blocks?</p> <p>A. Can the student define friction and identify it as a force in creating static cling or shock in a clothes dryer. Can the student name the 3 parts of the atom, their charges, and how charges interact?</p>	<ul style="list-style-type: none"> • The student will diagram the parts of the atom and label their charge, explain how charges interact, and define electric current as the flow of electrons or negative charges between atoms. • The student will demonstrate the principles of static electricity and behavior of charges using balloons, fur, and/or other electrostatic equipment.

AGRICULTURAL SCIENCE

Applied Natural Science

ELECTRICITY AND MAGNETISM

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>4. The student will understand that charges can be separated in some materials (potential difference) through chemical reaction and exposure to light, heat, and pressure so that one end will have a negative charge and the opposite a positive charge. This is how batteries, solar and piezoelectric cells, and thermopiles work.</p> <p>5. The student will understand that when there is a potential difference and electrons are given a material or path to flow through, they will in order to achieve equilibrium. This is called electric current. Current can be harnessed to operate devices, such as a light bulb or buzzer.</p> <p>Potential difference is measured with a unit called the volt, current the ampere, and resistance to current the ohm. These operate under a set of mathematical ratios called Ohm’s Law where: voltage = current x resistance</p>	<p>A. Can the student explain how a battery is used in common devices and name the symbols on the battery?</p> <p>A. Can the student explain the concept of equilibrium, potential, kinetic energy? Can the student solve basic algebraic equations?</p>	<ul style="list-style-type: none"> • The student will build a wet cell battery, explain how it works, and test it with a meter. The student will discuss how charge is separated in a solar cell, piezoelectric device, and thermopile. • The student will build simple DC circuits and explain electron flow. The student will name the measuring units of current, potential difference, and resistance. The student will solve simple Ohm’s Law equations from meter measurements.

AGRICULTURAL SCIENCE

Applied Natural Science

ELECTRICITY AND MAGNETISM

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>6. The student will understand that an electric current creates a magnetic field and that the field can be concentrated by coiling the wire to create an electromagnet.</p> <p style="padding-left: 20px;">A motor is a device that uses electromagnetism to change electricity to mechanical motion. Motors are found in many farm and household devices.</p>	<p>A. Can the student state the ways magnets interact with each other? Can the student name some devices with motors?</p>	<ul style="list-style-type: none"> • The student will build and operate an electromagnet and a simple motor using common materials and a battery. The student will explain how these operate. The student will also name key parts in an industrial motor and give several applications around the farm.
<p>7. The student will understand that when a closed wire is passed through a magnetic field, it induces a current in the wire (electromagnetic induction).</p> <p style="padding-left: 20px;">A generator is a device that uses motion and electromagnetic induction to generate electricity for households, farms, and businesses. It creates an alternating current, however.</p>	<p>A. Can the student explain where his/her household current comes from? Can the student explain that electric current has a magnetic field (have a relationship)?</p>	<ul style="list-style-type: none"> • The student will diagram a generating system that uses a combustion engine, steam, or hydroelectric, or wind energy to turn the generator plus describe the principles of induction.

AGRICULTURAL SCIENCE

Curriculum Standard: The student will explore the properties of light, how light enables us to see, and how life depends on light for its life processes. Key concepts include electromagnetic radiation and characteristics of waves.

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>1. The student will understand that light is a form of subatomic particle energy that travels in a wave.</p> <p style="padding-left: 20px;">Visible light is a small part of the electromagnetic spectrum.</p>	<p>A. Can the student name some other forms of electromagnetic energy, such as x-rays or radiowaves?</p>	<ul style="list-style-type: none"> • The student will illustrate the electromagnetic spectrum. The student will explain how wave frequency and amplitude determine the type and amount of electromagnetic radiation.
<p>2. The student will understand that light waves can be refracted, reflected, or absorbed when they strike objects. Transparent or translucent objects let some or all light through, opaque objects absorb or reflect all light.</p>	<p>A. Can the student recognize transparent, translucent, and opaque objects?</p>	<ul style="list-style-type: none"> • The student will describe how light waves interact with transparent, translucent and opaque objects. • The student will diagram reflected light rays from flat, concave, and convex mirrors. • The student will diagram angle of refraction in water and various lenses.
<p>3. The student will understand that frequency determines color and that white light is made up of all of the colors.</p> <p style="padding-left: 20px;">Surface colors of an object are determined by which colors are absorbed and which are reflected into the viewer's eye.</p>	<p>A. Can the student name the colors in the rainbow and explain what a prism does to white light?</p>	<ul style="list-style-type: none"> • The student will show how a prism diffracts white light. • The student will construct color charts to show pigment blends and light blends. • The student will explain how light can be absorbed or reflected and how this determines the color of an object.

AGRICULTURAL SCIENCE

Applied Natural Science

LIGHT

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>4. The student will understand that living things need light to carry on their life processes. Light is necessary for photosynthesis. Vitamin D is produced by fatty substances in the skin when struck by ultra violet light.</p> <p>Plants will grow in such a way as to receive optimum light for photosynthesis (photo tropism).</p>	<p>A. Can the student name some reasons why light is important? Can the student explain light’s role in photosynthesis?</p>	<ul style="list-style-type: none"> • The student will explain what a chemical reaction is and how photosynthesis is a chemical reaction. The student will be able to explain what a balanced chemical equation is. • The student will demonstrate how plants need light for photosynthesis and how they grow toward a light source through experimentation with living plants. • The student will research how lack of sunlight affects humans and animals and how some animals adapt to low light conditions.

AGRICULTURAL SCIENCE

Applied Natural Science

SOUND

Curriculum Standard: The student will investigate how sound waves are produced and transmitted. The student will describe the basic characteristics of waves, distinguish between pitch and sound intensity, and explain how wave interaction can change the quality of sound.

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>1. The student will understand that sound is caused by the vibration of molecules. It is transmitted through matter as a periodic series of compressions and rarefactions called a longitudinal wave.</p> <p>Sound waves have a frequency and amplitude. Amplitude is characterized by how far the molecules are moved from their original position and frequency by the number of complete vibrations per second (hertz).</p> <p>2. The student will understand that pitch is determined by frequency and loudness by amplitude.</p> <p>Pitch can appear to change in moving objects due to wave compression (Doppler effect).</p>	<p>A. Can the student describe vibration and give examples of things that vibrate?</p> <p>A. Can the student recognize changes in pitch and amplitude?</p>	<ul style="list-style-type: none"> • The student will describe how sound is transmitted through matter and illustrate its motion. • Using a variety of sound instruments, the student will illustrate how vibrations are produced and how frequency and amplitude can change. • The student will calculate frequency given a set of data. • The student will illustrate the waveforms of sounds with high and low pitch and amplitude. • The student will demonstrate how string length and tension affect pitch. • The student will explain the Doppler effect.

AGRICULTURAL SCIENCE

Applied Natural Science

SOUND

Performance Objective	Critical Attributes	Benchmarks/Assessment
<p>3. The student will understand that sound waves can interfere or combine either constructively or destructively. Waves that are in phase combine and become more intense. Waves that are out of phase cancel each other out.</p>	<p>A. Can the student show wave information using a sine wave?</p>	<ul style="list-style-type: none"> • The student will illustrate types of wave interference and explain the effect on intensity.
<p>4. The student will understand that objects have their own natural frequency. One vibrating object can cause another object with the same natural frequency to vibrate (resonance).</p>	<p>A. Can the student describe frequency and pitch?</p>	<ul style="list-style-type: none"> • The student will demonstrate how one vibrating object can transmit energy to another using pendulums or other vibrating objects.
<p>5. The student will understand that different sounds have their own qualities (timbre) determined by the pitch and number of overtones produced. Overtones are higher frequency vibrations within the fundamental (lowest) tone vibration.</p>	<p>A. Can the student describe the sound quality of different instruments playing a similar fundamental tone?</p>	<ul style="list-style-type: none"> • The student will illustrate fundamental tones and overtones. • The student will explain octaves and scales using a musical instrument.