High School Range Achievement Level Descriptors for the California Science Test

California Assessment of
Student Performance and Progress

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Measuring the Power of Learning.™

Three-Dimensional (3-D) Earth and Space Sciences

Earth and Space Sciences: DCI Strands	Nearly Met Standard Students at level 2 **consistently** apply their knowledge and skills of the CA NGSS to problems of **low complexity**, demonstrating a **partial understanding** of the earth and space sciences.	Met Standard Students at level 3 **consistently** apply their knowledge and skills of the CA NGSS to problems of **medium complexity**, demonstrating an **adequate understanding** of the earth and space sciences.	Exceeded Standard Students at level 4 **consistently** apply their knowledge and skills of the CA NGSS to problems of **high complexity**, demonstrating a **thorough understanding** of the earth and space sciences.
Earth's Place in the Universe (ESS1)	Students can **use a model** to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation; **identify evidence** that supports the Big Bang theory; **describe** how stars, over their life cycle, produce elements; **identify** the components of a mathematical representation of orbital motion; **identify evidence** of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks; and **identify** evidence from ancient Earth materials, meteorites, and other planetary surfaces to describe Earth's formation and early history.	Students can **develop a model** based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation; **construct an explanation** of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and/or composition of matter in the universe; **communicate scientific ideas** about the way stars, over their life cycle, produce elements; **use mathematical or computational representations to explain** the motion of orbiting objects in the solar system; **evaluate evidence** of the past and current movements of continental and oceanic crust and use the theory of plate tectonics to explain the ages of crustal rocks; and **apply scientific reasoning and evidence** from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.	Students can **develop and use a model** based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation; **construct an explanation** of the Big Bang theory based on multiple sources of detailed astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe; **communicate scientific ideas** about the way stars, over their life cycle, produce elements; **use mathematical or computational representations to predict** the motion of orbiting objects in the solar system; **evaluate evidence** of patterns in the past and current movements of continental and oceanic crust and use the theory of plate tectonics to explain the ages of crustal rocks; and **evaluate evidence** from ancient Earth materials, meteorites, and other planetary surfaces and use multiple sources to construct a detailed account of Earth's formation and early history.

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Earth's Systems (ESS2)	Students can **identify components of a model** which shows how Earth's internal and surface processes form continental and ocean-floor features; **describe how data** shows that one change to Earth's surfaces affects changes to other Earth systems; **identify components of a model** which shows the cycling of matter by thermal convection; **identify** variations in the flow of energy into and out of Earth's systems that result in changes in climate; **use data as evidence to describe** the properties of water and its effects on Earth materials and surface processes; **identify components of a quantitative model** which shows the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere; and **use evidence** to describe the simultaneous coevolution of Earth's systems and life on Earth.	Students can **develop a model to illustrate** how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features; **analyze geoscience data** to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems; **develop a model** based on evidence of Earth's interior processes to describe the cycling of matter by thermal convection; **use a model to describe** how variations in the flow of energy into and out of Earth's systems result in changes in climate; **plan and conduct an investigation** of the properties of water and its effects on Earth materials and surface processes; **develop a quantitative model** to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere; and **construct an argument based on evidence** about the simultaneous coevolution of Earth's systems and life on Earth.	Students can **develop and use a model to explain** how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features; **analyze and use geoscience data** to describe a detailed mechanism for the feedbacks between two of Earth's systems; **develop and use a model** based on evidence of Earth's interior processes to explain the cycling of matter by thermal convection; **develop and use a model to explain** how variations in the flow of energy into and out of Earth's systems result in changes in climate; **plan, conduct, and evaluate an investigation** of the properties of water and its effects on Earth materials and surface processes; **develop and evaluate a quantitative model** that describes the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere; and **construct an argument based on evidence** of the causal links and/or feedback mechanisms between changes in the biosphere and changes in Earth's other systems.

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Earth and Human Activity (ESS3)	Students can **identify evidence** that supports how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity; **evaluate a design solution** for developing, managing, and utilizing energy and mineral resources based on cost-benefit analysis; **describe a connection using data** between the management of natural resources, the sustainability of human populations, and biodiversity; **describe data patterns** from global climate models; and **identify** the components of different Earth systems and describe how the relationships between these components are affected by human activity.	Students can **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; **evaluate competing design solutions** for developing, managing, and utilizing energy and mineral resources based on cost-benefit analysis; **create a computational simulation using provided data to illustrate** the relationships among management of natural resources, the sustainability of human populations, and biodiversity; **evaluate** a technological solution that reduces impacts of human activities on natural systems; **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; and **use a computational representation to illustrate** the relationships among Earth systems and how those relationships are affected by human activity.	Students can **construct an explanation based on evidence** of the cause and effect relationships between the availability of natural resources, occurrence of natural hazards, and changes in climate and human activity; **evaluate competing design solutions** and support one design over the other(s) for developing, managing, and utilizing energy and mineral resources based on cost-benefit analysis; **create a computational simulation using provided data to compare** the factors that affect the management of natural resources, the sustainability of human populations, and biodiversity; **evaluate and refine** a technological solution so that it improves the solution and reduces impacts of human activities on natural systems; **analyze any variation in the geoscience data** and the results from different global climate models to make a detailed evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems; and **use a computational representation to explain** how human activity affects the relationships among Earth's systems under consideration.

3-D Life Sciences

Life Sciences: DCI Strands	Nearly Met Standard Students at level 2 **consistently** apply their knowledge and skills of the CA NGSS to problems of **low complexity**, demonstrating a **partial understanding** of the life sciences.	Met Standard Students at level 3 **consistently** apply their knowledge and skills of the CA NGSS to problems of **medium complexity**, demonstrating an **adequate understanding** of the life sciences.	Exceeded Standard Students at level 4 **consistently** apply their knowledge and skills of the CA NGSS to problems of **high complexity**, demonstrating a **thorough understanding** of the life sciences.
From Molecules to Organisms: Structures and Processes (LS1)	Students can **describe** how the sequence of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells; **use a model to identify** the hierarchical organization of interacting systems that provide specific functions within multicellular organisms; **identify** an example of how a feedback mechanism maintains homeostasis; **identify the components of a model** illustrating the role of mitosis and cell differentiation in producing and maintaining complex organisms; **identify the components of a model to illustrate** how photosynthesis transforms light energy into stored chemical energy; **describe** how carbon, hydrogen, and oxygen from sugar molecules combine with other elements to form amino acids and/or other large carbon-based molecules; and **identify the components of a model** illustrating 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.	Students can **construct an explanation based on evidence** for how the sequence of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells; **develop and use a model to illustrate** the hierarchical organization of interacting systems that provide specific functions within multicellular organisms; **plan and conduct an investigation** to provide evidence that feedback mechanisms maintain homeostasis; **use a model to illustrate** the role of mitosis and cell differentiation in producing and maintaining complex organisms; **use a model to illustrate** how photosynthesis transforms light energy into stored chemical energy; **construct or 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; and **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.	Students can **construct an explanation based on a variety of sources of evidence** for how the sequence of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells; **develop and use a model to illustrate** the hierarchical interactions within and between systems at different scales that provide specific functions within multicellular organisms; **use evidence to plan an investigation** about how feedback mechanisms maintain homeostasis; **use a model to explain** the role of mitosis and cell differentiation in producing and maintaining complex organisms; **use a model to illustrate** how photosynthesis transforms light energy into stored chemical energy, given new evidence or context; **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; and **use a model to explain** 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.

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Ecosystems: Interactions, Energy, and Dynamics (LS2)	Students can **identify** factors that affect carrying capacity of ecosystems at different scales; **identify** factors affecting biodiversity and populations in ecosystems of different scales; **describe** the cycling of matter and flow of energy in aerobic and anaerobic conditions; **describe** the cycling of matter and flow of energy among organisms in an ecosystem; **use a model** to identify the components of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere; **identify a claim** that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem; and **identify** one potential solution for reducing the impacts of human activities on the environment and biodiversity.	Students can **use mathematical and/or computational representations** to support explanations of factors that affect carrying capacity of ecosystems at different scales; **use mathematical and/or computational representations** to support explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales; **construct and revise an explanation** based on evidence for the cycling of matter and/or flow of energy in aerobic and anaerobic conditions**; use mathematical representations to support** claims for the cycling of matter and/or flow of energy among organisms in an ecosystem; **develop a model to illustrate** the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere; **evaluate the claims, evidence, and reasoning** that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem; **design, evaluate, and refine a solution** for reducing the impacts of human activities on the environment and biodiversity; and **evaluate the evidence** for the role of group behavior on individual and species' chances to survive and reproduce.	Students can **use mathematical and/or computational representations** to identify the independence of factors (living and nonliving) and the resulting effect on the carrying capacity of ecosystems at different scales; **use mathematical and/or computational representations** to revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales; **construct and revise an explanation** based on new evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions; **use mathematical representations to explain** the cycling of matter and flow of energy among organisms in an ecosystem; **develop a complex model to explain** the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere; **evaluate the claims, evidence, and reasoning**, that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but the relationship between degree of change and stability in ecosystems can affect its biodiversity; **design, evaluate and refine a solution** by prioritizing the criteria and making tradeoffs to reduce environmental impact and loss of biodiversity while addressing human needs; and **evaluate the evidence** for the role of group behavior and its effects on individual and species' chances to survive and reproduce.

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Heredity: Inheritance and Variation of Traits (LS3)	Students can **describe** the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring; **describe** that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors; and **use concepts of statistics and probability to identify** that there is variation and distribution of expressed traits in a population.	Students can **ask questions** to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring; **make and defend a claim** based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors; and **apply concepts of statistics and probability to explain** the variation and distribution of expressed traits in a population.	Students can **ask questions** to clarify cause and effect relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring; **make, evaluate, and defend a claim** based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors; and **apply concepts of statistics and probability to predict** changes in trait distribution when environmental variables change.

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Biological Evolution: Unity and Diversity (LS4)	Students can **describe** that common ancestry and biological evolution are supported by multiple lines of evidence; **identify** that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment; **use concepts of statistics and probability to identify** an advantageous inheritable trait; **describe evidence** for how natural selection leads to adaptation of populations; **identify evidence** supporting a claim that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species; and **identify the components** that are modeled by a simulation that tests solutions that mitigate adverse impacts of human activity on biodiversity.	Students can **communicate scientific information** that common ancestry and biological evolution are supported by multiple lines of evidence; **construct an explanation** based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment; **apply concepts of statistics and probability to support** explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait; **construct an explanation based on evidence** for how natural selection leads to changes in a population; **evaluate the evidence** supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species; and **use a simulation to test a solution** that mitigates adverse impacts of human activity on biodiversity.	Students can **communicate complex scientific information** that common ancestry and biological evolution are supported by patterns in DNA sequences, fossil record, and embryological development; **construct an explanation based on evidence to evaluate** the influence on the process of evolution from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment; **apply concepts of statistics and probability to analyze** shifts in the numerical distribution of traits and support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait; **construct an explanation based on evidence** for how living and nonliving factors can cause changes in populations by natural selection; **evaluate the evidence** supporting claims of the cause and effect relationship between changes in environmental conditions and: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species; and **use a simulation to test a solution and analyze the simulation results** to determine whether the simulation provides sufficient information to evaluate the solution.

3-D Physical Sciences

Physical Sciences: DCI Strands	Nearly Met Standard Students at level 2 **consistently** apply their knowledge and skills of the CA NGSS to problems of **low complexity**, demonstrating a **partial understanding** of the physical sciences.	Met Standard Students at level 3 **consistently** apply their knowledge and skills of the CA NGSS to problems of **medium complexity**, demonstrating an **adequate understanding** of the physical sciences.	Exceeded Standard Students at level 4 **consistently** apply their knowledge and skills of the CA NGSS to problems of **high complexity**, demonstrating a **thorough understanding** of the physical sciences.
Matter and Its Interactions (PS1)	Students can **use the periodic table to identify** the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms; **describe** 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; **conduct an investigation to compare** the properties of substances at the bulk scale to infer the strength of electrical forces between particles; **use a model to describe** that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy; **identify how** changing the temperature or concentration of the reacting particles affects the rate at which a reaction occurs; **describe** how a change in experimental conditions could produce increased amounts of products at equilibrium; **use mathematical representations to support the claim** that mass is conserved during a chemical reaction; and **use 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.	Students can **use the periodic table to predict** the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms; **construct an explanation** for the outcome of a simple chemical reaction based on the atom’s outermost electrons, trends in the periodic table, and knowledge of the patterns of chemical properties; **plan and conduct an investigation to gather evidence to compare** the properties of substances at the bulk scale to infer the strength of electrical forces between particles; **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; **use 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; **refine the design** of a chemical system by proposing a change in conditions that would produce increased amounts of products at equilibrium; **use mathematical representations to support the claim that** atoms, and therefore mass, are conserved during a chemical reaction; and **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.	Students can **use the periodic table to predict** the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms and the attraction and repulsion between electrically charged particles; **construct and revise an explanation** that the types of chemical bonds formed during a simple chemical reaction are based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties; **plan and conduct an investigation to gather evidence** from observations to compare the properties of substances at multiple scales to infer the strength of electrical forces between particles; **develop a model to test and predict** the release or absorption of energy from a chemical reaction system when there is a change in total bond energy; **use patterns in the data 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 using collision theory; **evaluate potential refinements of the redesign** of a chemical system with a list of criteria and constraints using Le Châtelier’s principle; **use mathematical representations to describe** how the mass of a substance is conserved during a reaction and that mass can be used to determine the number of atoms using moles and mole relationships; and **develop models to explain** the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

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Motion and Stability: Forces and Interactions (PS2)	Students can **use data to support** how Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration; **identify** that the total momentum of a system of objects is conserved when there is no net force on the system; **design and evaluate a device** that minimizes the force on a macroscopic object during a collision; **compare** the gravitational and electrostatic forces between objects; **describe** how an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current; and **explain** why the molecular-level structure is important in the functioning of designed materials.	Students can **analyze data** to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration; **use mathematical representations to support the claim** that the total momentum of a system of objects is conserved when there is no net force on the system; **design, evaluate, and refine a device** that minimizes the force on a macroscopic object during a collision; **use mathematical representations** of Newton's law of gravitation and Coulomb's law to describe the gravitational and electrostatic forces between objects; **plan and conduct an investigation** to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current; and **communicate scientific and technical information** about the importance of molecular-level structure in the functioning of designed materials.	Students can **analyze data** to support the claim that Newton's second law of motion predicts changes in the motion of objects using the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration; **use mathematical representations to make the claim** that the total momentum of a system of objects is conserved when there is no net force on the system; **design, evaluate, and refine a device** using mathematical reasoning so that the device minimizes the force on an object by extending the time the force is applied to the object during the collision; **use mathematical representations** of Newton's law of gravitation and Coulomb's law to predict the gravitational and electrostatic forces between objects; **evaluate an investigation**, including the accuracy and precision of collected data, as well as the limitations of the investigation on how an electric current can produce a magnetic field or how a changing magnetic field can produce an electric current; and **communicate scientific and technical information** about how the attractive and repulsive forces at the atomic scale result in contact forces on the macroscopic scale.

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Energy (PS3)	Students can **use 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; **use a model** to identify energy at the macroscopic scale as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects)**; test a device** that works within given constraints to convert one form of energy into another form of energy; **describe** how 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); and **use a model** of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.	Students can **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; **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); **design, build, and refine a device** that works within given constraints to convert one form of energy into another form of energy; **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); and **develop and use a model** of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.	Students can **create and explain the meaning of 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; **develop and use models** to illustrate that the total energy is conserved in a closed system, and 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); **evaluate the performance of the device** using both qualitative and quantitative reasoning within given criteria and constraints to convert one form of energy into another form of energy; **use evidence to plan an investigation** about the transfer of thermal energy when two components of different temperature are combined within a closed system; and **develop and use a model** of two objects interacting through electric or magnetic fields to explain the cause and effect relationships between forces produced by electric and magnetic fields and the change of energy of the objects in the system.

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Waves and their Applications in Technologies for Information Transfer (PS4)	Students can **use mathematical representations** to identify and relate the frequency, wavelength, and speed of waves; **ask a question** about the advantages of using digital transmission and storage of information; **describe** the idea that electromagnetic radiation can be described either by a wave model or a particle model; **identify** a claim in published material of the effects that different frequencies of electromagnetic radiation have when absorbed by matter; and **use information** to describe how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.	Students can **use mathematical representations** to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in a particular medium; **evaluate questions** about the advantages of using digital transmission and storage of information; **evaluate the claims, evidence, and reasoning** behind the idea that electromagnetic radiation can be described either by a wave model or a particle model; **evaluate** the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter; and **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/or energy.	Students can **use mathematical representations** to predict the relative change in the wavelength of a wave when it travels through various media; **evaluate the testability of questions** about the advantages of using digital transmission and storage of information; **explain** why for some aspects the wave model is more useful and for other aspects the particle model is more useful to describe electromagnetic radiation**; describe the cause and effect reasoning for** the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter; and **use technical information** to explain how some technological devices depend on the photoelectric effect for their operation.

3-D Engineering Technology and Applications of Science

Engineering, Technology, and Applications of Science: DCI Strand	Nearly Met Standard Students at level 2 **consistently** apply their knowledge and skills of the CA NGSS to problems of **low complexity**, demonstrating a **partial understanding** of engineering, technology, and applications of science.	Met Standard Students at level 3 **consistently** apply their knowledge and skills of the CA NGSS to problems of **medium complexity**, demonstrating an **adequate understanding** of engineering, technology, and applications of science.	Exceeded Standard Students at level 4 **consistently** apply their knowledge and skills of the CA NGSS to problems of **high complexity**, demonstrating a **thorough understanding** of engineering, technology, and applications of science.
Engineering Design (ETS1)	Students can **describe** a major global challenge and identify a solution that accounts for societal needs and wants; **design a solution** to a complex real-world problem through engineering by breaking it down into smaller, more manageable problems that can be solved through engineering; **identify 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; and **use a computer simulation to model** the impact of a proposed solution to a complex real-world problem.	Students can **analyze** a major global challenge to specify criteria and constraints for solutions that account for societal needs and wants; **design a solution** to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering; **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; and **use a computer simulation to model** the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.	Students can **analyze** a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants relative to the problem; **design a solution** to a complex real-world problem by breaking it down into smaller, more manageable problems that can each be tested and refined; **refine a solution** to a complex real-world problem by prioritizing criteria and making trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts; and **use a computer simulation to predict** the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.