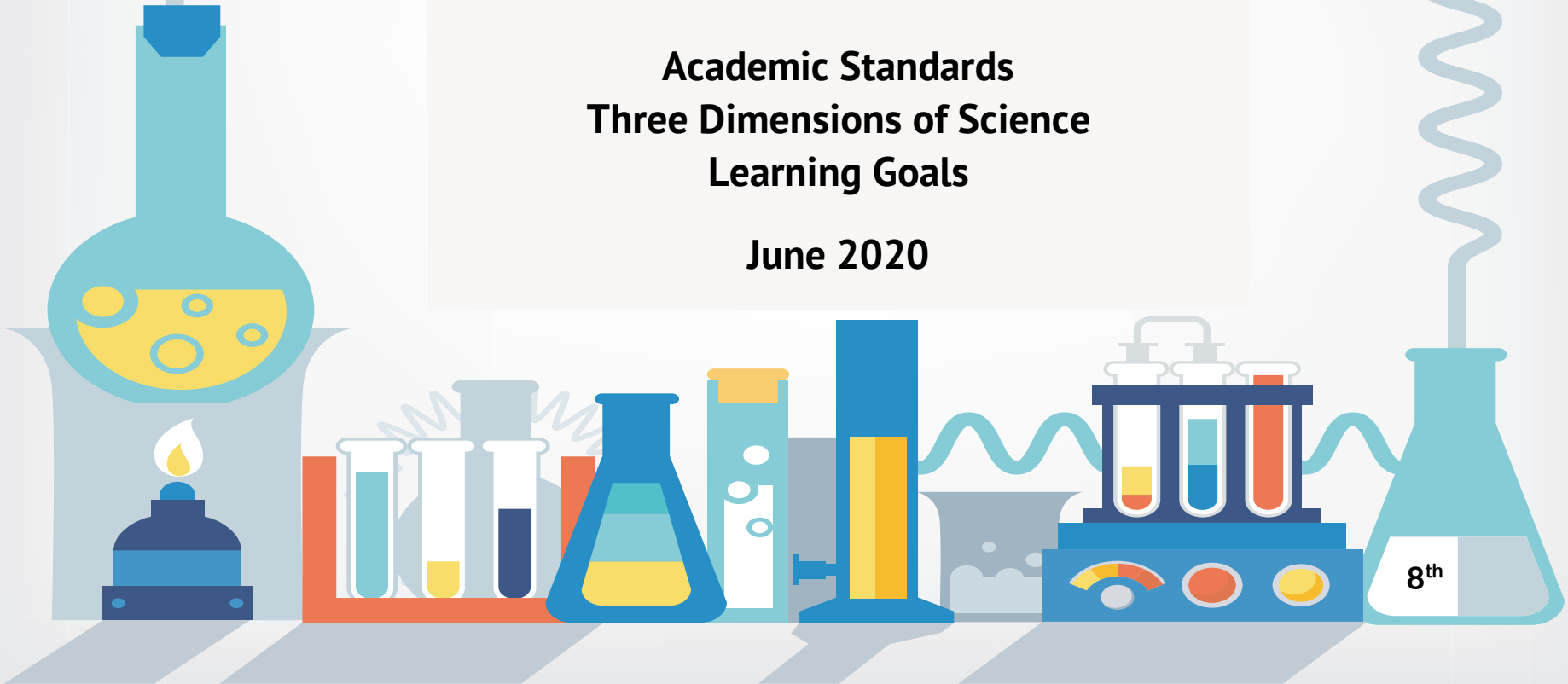
ENVISION 21

DEEP LEARNING • CFSD

SCIENCE

Academic Standards
Three Dimensions of Science
Learning Goals

June 2020



GRADE 8

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8 OVERVIEW

By the end of **eighth grade**, students will describe how stability and change and the process of cause and effect influence changes in the natural world. Students will apply energy principles to chemical reactions, explore changes within Earth and understand how genetic information is passed down to produce variation among the populations. Student investigations focus on collecting and making sense of observational data and simple measurements using the science and engineering practices. While individual lessons may include connections to any of the crosscutting concepts, the standards in eighth grade focus on helping students understand phenomena through the concepts of *cause and effect, energy and matter,* and *stability and change.*

The eighth grade standards are grouped by area of science and topic. They are a *progression* of disciplinary core ideas. Some of the sub-ideas within the disciplinary core ideas (background information) overlap; there is not always a clear division between those ideas. Instead of focusing on distinctly different content or processes at each grade level, the standards engage students in similar topics to develop a progressively deeper understanding of each of the three science dimensions. Students continually build on and revise their knowledge and skills over time. In addition, there is a focus on a limited number of core ideas (content) both within and across the science disciplines. This was done intentionally to avoid the shallow coverage of a large number of topics, and to allow more time for teachers and students to explore each idea in greater depth.

The eighth grade standards have been organized by area of science and suggested topics. However, this does not indicate the instructional sequence or how the standards will be organized for instruction. Educators will make decisions about instructional sequence and how standards will be grouped by units for classroom instruction and assessment to best meet student needs.

	Area of Science	Title	Content
1	Physical Science	Energy Transfer Through Matter	Students apply stability and change to explore chemical properties of matter and chemical reactions to further understand energy and matter.
2	Earth and Space Sciences	Geological Processes Over Time	Students explore natural and human-induced cause-and-effect changes in Earth systems over time.
3	Life Science	Genetics and Traits	Students develop an understanding of patterns and how genetic information is passed from generation to generation. They also develop the understanding of how traits within populations change over time.
4	Computer Science	Computational Thinking & Data and Analysis	Students develop a foundation of computer science knowledge and new approaches to problem solving that capture the power of computational thinking to become both users and creators of computing technology.

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Navigating the Science Standards: Abbreviated Version

The standards serve as the basis for the design of instruction and assessment of the district's science curriculum.

- **Standards** are what a student needs to know, understand, and be able to do by the end of each grade or course. They build across grade levels in a progression of increasing understanding and through a range of cognitive demand levels.
- **Curriculum** refers to the resources used for teaching and learning the standards (units, lessons, texts, materials, tech apps, assessments, etc.).
- **Instruction** refers to the methods or methodologies used by teachers to teach their students. Instructional techniques are employed by individual teachers in response to the needs of students in their classes to help them progress through the curriculum to achieve the standards.

Grade Level or Course and **Topic Area** for standard.

Standard – What is Assessed
Describes what students should be able to do at the end of instruction to show what they have learned. Combines Science and Engineering Practices, Core Ideas, and Crosscutting Concepts.

Learning Goals
Indicators or evidence of learning at the end of a lesson or unit as aligned to the standard.

Core Ideas for Knowing and Using Science
"Understandings" or big ideas for physical, earth and space, and life sciences that build in complexity across grade levels and students develop over time.

Background Information (Content) is provided under each Core Idea

Science and Engineering Practices
Skills and knowledge that scientists and engineers engage in to either understand the world or solve a problem.

KINDERGARTEN

LIFE SCIENCE: LIVING AND NON-LIVING THINGS

Life Science
Description of what students will learn for the area of science under study (K-8 only.

Students develop an understanding that the world is comprised of living and non-living things. They investigate the relationship between structure and function in living things; plants and animals use specialized parts to help them meet their needs and survive.

Science Standard: K.L2U1.8 **Observe, ask questions, and explain the differences between the characteristics of living and non-living things.**

Learning Goals

I can:

- Based on prior experiences, ask questions about living and non-living things.
- Make direct or indirect observations about living and non-living things:
  - Identify traits of living and non-living things.
  - Record observations (*e.g., through pictures and/or words*).
  - Make inferences about the characteristics of living and non-living things.
- List the characteristics of living things (*i.e., move, reproduce, react to stimuli*).
- Use evidence to explain how the characteristics of living things differ from the characteristics of non-living things.

Core Ideas

Knowing Science

L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.

- There is a wide variety of living things (organisms), including plants and animals. They are distinguished from non-living things by their ability to move, reproduce, and react to certain stimuli.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students ask questions to frame their exploration of living and non-living things.
- Students make observations about living and non-living things.
- Students use the evidence from their observations to make inferences about the characteristics of living and non-living things.

Science and Engineering Practices

Asking Questions and Defining Problems

- Ask questions based on observations of the natural and/or designed world.

Constructing Explanations and Designing Solutions

- Use information from direct or indirect observations to construct explanations.
- Distinguish between opinions and evidence in one's own explanations.

Crosscutting Concepts

Patterns

- Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

Systems and System Models

- Objects and organisms can be described in terms of their parts.

Three Dimensions (3-D) of Science:
The Practices, Core Ideas, and Crosscutting Concepts that were used to create the standards.

Crosscutting Concepts
Concepts that cut across all disciplines and help students deepen their understanding of core ideas.

PHYSICAL SCIENCE

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

PHYSICAL SCIENCE: ENERGY TRANSFER THROUGH MATTER

Students apply stability and change to explore chemical properties of matter and chemical reactions to further understand energy and matter.

Science Standard: 8.P1U1.1 Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved.

Learning Goals

I can:

- Develop a model *(e.g., diagram, drawing, physical replica, mathematical representation, analogy, and/or computer simulation)* that represents the conservation of mass in chemical reactions:
  - Represent conservation of mass in chemical reactions.
  - Represent the unobservable mechanism that happens when molecules rearrange to form new compounds.
  - Represent the relevant components for a given chemical reaction.
  - Identify limitations of the model.
  - Modify the model, based on the limitations, to improve its representation of chemical reactions, compounds, and conservation of mass.
- Use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved:
  - Use a model to demonstrate what happens when molecules rearrange in a chemical reaction with the total number of each type of atom conserved.
  - Use a model to describe the relationships between the reactants and products within the chemical reaction.
  - Use a model to describe how the atoms that make up the reactants rearrange and come together in different arrangements to form the products of a reaction.

Core Ideas

Knowing Science

P1: All matter in the Universe is made of very small particles.

- All materials, anywhere in the universe, living and non-living, are made of a very large number of basic 'building blocks' called atoms, of which there are about 100 different kinds. Substances made of only one kind of atom are called elements. Atoms of different elements can combine together to form a very large number of compounds. A chemical reaction involves a rearrangement of the atoms in the reacting substances to form new substances, while the total amount of matter remains the same.
- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. The total number of each type of atom is conserved, and thus the mass does not change.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students use models to make sense of the chemical properties of matter. Students' observations and modeling help them develop understanding of the law of conservation of mass.

Science and Engineering Practices	Crosscutting Concepts
Developing and Using Models • Use and/or develop models to predict, describe, support explanations, and/or collect	**Energy and Matter: Flows, Cycles, and Conservation**

data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. • Develop models to describe unobservable mechanisms. • Modify models—based on their limitations—to increase detail or clarity, or to explore what will happen if a component is changed. • Use and develop models of simple systems with uncertain and less predictable factors.	• Matter is conserved because atoms are conserved in physical and chemical processes. • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. • The transfer of energy can be tracked as energy flows through a designed or natural system. **Scale, Proportion, and Quantity** • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

PHYSICAL SCIENCE: ENERGY TRANSFER THROUGH MATTER

Students apply stability and change to explore chemical properties of matter and chemical reactions to further understand energy and matter.

Science Standard: 8.P1U1.2 Obtain and evaluate information regarding how scientists identify substances based on unique physical and chemical properties.

Learning Goals

I can:

- Select relevant information regarding the scientific identification of substances from multiple appropriate sources (*e.g., scientific texts, media, models, investigations, demonstrations, etc.*).
- Select relevant information from multiple sources about the physical properties (*i.e., phase changing, solubility, density, electronegativity*) and chemical properties (*i.e., pH, reactivity*) of substances.
- Assess the credibility, accuracy, and possible bias of each publication and methods used.
- Read critically using scientific knowledge and reasoning to evaluate data, hypotheses, and conclusions that appear in scientific or technical texts in light competing information or accounts.
- Provide an accurate summary of a scientific text distinct from prior knowledge or opinions.

Core Ideas

Knowing Science

P1: All matter in the Universe is made of very small particles.

- The properties of different materials can be explained in terms of the behavior of the atoms and groups of atoms of which they are made.
- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. The total number of each type of atom is conserved, and thus the mass does not change.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students examine scientific texts to develop their understanding of how scientists use physical and chemical properties to identify substances.

Science and Engineering Practices

Obtaining, Evaluating and Communicating Information

- Gather, read, and communicate information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used.
- Read critically using scientific knowledge and reasoning to evaluate data, hypotheses, conclusions that appear in scientific and technical texts in light of competing information or accounts; provide an accurate summary of the text distinct from prior knowledge or opinions.

Crosscutting Concepts

Patterns

- Macroscopic patterns are related to the nature of microscopic and atomic-level structure.

Structure and Function

- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

PHYSICAL SCIENCE: ENERGY TRANSFER THROUGH MATTER

Students apply stability and change to explore chemical properties of matter and chemical reactions to further understand energy and matter.

Science Standard: 8.P4U1.3 Construct an explanation on how energy can be transferred from one energy store to another.

Learning Goals

I can:

- Apply scientific knowledge and evidence to explain how energy is stored.
- Apply scientific knowledge and evidence to explain how energy can be transferred from one energy store to another (*i.e., motion, position, temperature, electric current, radiation, waves*).
- Base explanations on scientific evidence from texts, experiments, demonstrations, investigations, representations, and/or models.

Core Ideas

Knowing Science

P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event.

- Energy can be stored by lifting an object higher above the ground. When it is released and falls, this energy is stored in its motion. When an object is heated it has more energy than when it is cold. An object at a higher temperature heats the surroundings or cooler objects in contact with it until they are all at the same temperature.
- The chemicals in the cells of a battery store energy which is released when the battery is connected so that an electric current flows, transferring energy to other components in the circuit and on to the environment.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students develop explanations of how energy is stored and transferred by examining scientific evidence.

Science and Engineering Practices

Constructing Explanations and Designing Solutions

- Construct explanations for either qualitative or quantitative relationships between variables.
- Apply scientific reasoning to show why the data are adequate for the explanation or conclusion.
- Apply scientific knowledge and evidence to explain real-world phenomena, examples, or events.

Crosscutting Concepts

Energy and Matter: Flows, Cycles, and Conservation

- Matter is conserved because atoms are conserved in physical and chemical processes.
- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.
- Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).
- The transfer of energy can be tracked as energy flows through a designed or natural system.

Stability and Change

	• Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. • Small changes in one part of a system might cause large changes in another part. • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

PHYSICAL SCIENCE: ENERGY TRANSFER THROUGH MATTER

Students apply stability and change to explore chemical properties of matter and chemical reactions to further understand energy and matter.

Science Standard: 8.P4U1.4 Develop and use mathematical models to explain wave characteristics and interactions.

Learning Goals

I can:

- Develop mathematical models that represent wave characteristics and interactions:
  - Represent patterns in wave movements mathematically.
  - Represent mathematical relationships between wave characteristics, such as wavelength, amplitude, frequency, period, and speed.
  - Develop a model that allows for manipulation and testing to mathematically explain wave characteristics.
  - Identify limitations of the models.
  - Modify the models, based on the limitations, to improve its representation of wave characteristics and interactions.
- Use mathematical models to explain wave characteristics and interactions:
  - Use models to describe wave characteristics.
  - Use models to explain reflection, refraction, and defraction.
  - Use models to explain mathematical relationships between wave properties.

Core Ideas

Knowing Science

P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event.

- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students use models to better understand the abstract and typically invisible phenomenon of waves.

Science and Engineering Practices

Using Mathematics and Computational Thinking

- Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends.
- Apply concepts of ratio, rate, percent, basic operations, and simple algebra to scientific and engineering questions and problems.

Developing and Using Models

- Use and/or develop models to predict, describe, support explanations, and/or collect data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.

Crosscutting Concepts

Patterns

- Macroscopic patterns are related to the nature of microscopic and atomic-level structure.
- Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems.

Proportion, Quantity, and Scale

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

• Develop models to describe unobservable mechanisms. • Modify models—based on their limitations—to increase detail or clarity, or to explore what will happen if a component is changed.	• Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. **Systems and System Models** • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. • Models are limited in that they only represent certain aspects of the system under study.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

PHYSICAL SCIENCE: ENERGY TRANSFER THROUGH MATTER

Students apply stability and change to explore chemical properties of matter and chemical reactions to further understand energy and matter.

Science Standard: 8.P4U2.5 Develop a solution to increase efficiency when transferring energy from one source to another.

Learning Goals

I can:

- Engage in the design cycle to construct a solution that meets specific design criteria and constraints:
  - Ask questions to clarify (an) engineering problem(s) pertaining to efficiency in energy transfer.
  - Define the design problem such that it can be solved through the development of an object, tool, process or system.
  - Determine multiple relevant criteria and constraints, including scientific knowledge about energy transfer that may limit possible solutions.
  - Test and retest designs *(e.g., using simulations and/or criteria).*
  - Revise designs to optimize performance based on tests and in response to tradeoffs and/or priorities in criteria.
  - Communicate the design for the solution through a sketch, drawing, or physical model.
  - Develop a solution that describes different types of materials used in the solution and their properties, and how these materials will be used to minimize or maximize energy transfer.

Core Ideas

Knowing Science

P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event.

- When an object is heated it has more energy than when it is cold. An object at a higher temperature heats the surroundings or cooler objects in contact with it until they are all at the same temperature. How quickly this happens depends on the kind of material which is heated and on the material between them (the extent to which they are thermal insulators or conductors).
- The transfer of energy in making things happen almost always results in some energy being shared more widely, heating more atoms and molecules and spreading out by conduction or radiation. The process cannot be reversed and the energy of the random movement of particles cannot as easily be used. Thus, some energy is dissipated.
- The chemicals in the cells of a battery store energy which is released when the battery is connected so that an electric current flows, transferring energy to other components in the circuit and on to the environment. Energy can be transferred by radiation, as sound in air or light in air or a vacuum.

Using Science

U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products.

- Students apply their scientific understanding of energy transfer to design a solution to increase energy efficiency in the transfer of energy.

Science and Engineering Practices	Crosscutting Concepts
Constructing Explanations and Designing Solutions • Undertake design projects, engaging in the design cycle, to construct and implement a solution that meets specific design criteria and constraints. • Apply scientific knowledge and evidence to explain real-world phenomena, examples, or events.	**Energy and Matter: Flows, Cycles, and Conservation** • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. • Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).

• Construct explanations from models or representations. • Apply scientific knowledge to design, construct, and test a design of an object, tool, process or system. • Optimize performance of a design by prioritizing criteria, making tradeoffs, testing, revising, and retesting.	• The transfer of energy can be tracked as energy flows through a designed or natural system. **Systems and System Models** • Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.

EARTH AND SPACE SCIENCES

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

EARTH AND SPACE SCIENCES: GEOLOGIC PROCESSES OVER TIME

Students explore natural and human-induced cause-and-effect changes in Earth systems over time.

Science Standard: 8.E1U1.6 Analyze and interpret data about the Earth's geological column to communicate relative ages of rock layers and fossils.

Learning Goals

I can:

- Use tools to analyze and interpret data (*e.g., from investigations, demonstrations, texts, data sets, simulations, etc.*) about Earth's geological column:
  - Ask questions about geologic time to frame the analysis and interpretation of data.
  - Construct a graphical representation to display temporal and spatial relationships of relative ages of rock layers and fossils.
  - Analyze data from graphical displays to identify anomalies and/or trends in rock layers and fossils.
  - Analyze graphical displays to identify temporal and spatial relationships of the relative ages of rock layers and fossils.
  - Interpret patterns and trends in rock layers and fossils to identify cause and effect relationships.
  - Analyze and interpret valid and reliable sources of data to predict fossil age by the superposition of the rock layer.
  - Analyze and interpret data to compare rock layers and fossils in different locations.
  - Consider limitations of data analysis *(e.g., measurement error),* and seek to improve precision and accuracy of data with better technological tools and methods *(e.g., multiple trials).*
- Use data to communicate relative ages of rock layers and fossils:
  - Use different formats (*e.g., verbally, graphically, textually, and mathematically*) to communicate evidence about the relative ages of rock layers and fossils.
  - Apply scientific knowledge and data to explain different geologic time frames and patterns of geologic events.
  - Use analyses of rock formations and the fossils they contain to establish relative ages of major events in Earth's history.
  - Apply scientific reasoning to show why the data are adequate for the explanation.

Core Ideas

Knowing Science

E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate.

- Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geological history. Plate movements are responsible for most continental and ocean floor features and for the distribution of most rocks and minerals within Earth's crust.
- Evolution is shaped by Earth's varying geological conditions. Sudden changes in conditions (e.g., meteor impacts, major volcanic eruptions) have caused mass extinctions, but these changes, as well as more gradual ones, have ultimately allowed other life forms to flourish.
- The evolution and proliferation of living things over geological time have in turn changed the rates of weathering and erosion of land surfaces, altered the composition of Earth's soils and atmosphere, and affected the distribution of water in the hydrosphere.
- Analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Geologic time is a complex concept that students examine through various data sources. Students identify patterns in data and determine what these patterns suggest about relative ages of rock layers and fossils.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, or unexpected results. • Ask questions to clarify or identify evidence and the premise(s) of an argument. **Analyzing and Interpreting Data** • Construct, analyze, and interpret graphical displays of data to identify linear and nonlinear relationships. • Consider limitations of data analysis (e.g., measurement error), and seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials). • Analyze and interpret data in order to determine similarities and differences in findings. • Distinguish between causal and correlational relationships. • Use graphical displays (e.g., maps) of large data sets to identify temporal and spatial relationships. **Obtaining, Evaluating, and Communicating Information** • Communicate scientific information and/or technical information (e.g. about a proposed object, tool, process, system) in different formats (e.g., verbally, graphically, textually, and mathematically).	**Patterns** • Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. • Patterns can be used to identify cause and effect relationships. • Graphs, charts, and images can be used to identify patterns in data. **Cause and Effect: Mechanism and Prediction** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. **Stability and Change** • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. • Small changes in one part of a system might cause large changes in another part. • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

EARTH AND SPACE SCIENCES: GEOLOGIC PROCESSES OVER TIME

Students develop an understanding of the patterns of energy flow along with matter cycling within and among Earth's systems.

Science Standard: 7.E1U1.6 Construct a model to explain how the distribution of fossils and rocks, continental shapes, and seafloor structures provides evidence of the past plate motions.

Learning Goals

I can:

- Develop a model *(e.g., diagram, drawing, physical replica, mathematical representation, analogy, and/or computer simulation)* that shows evidence of past plate motions:
  - Represent the distribution of fossils and rocks as evidence of the past plate motions.
  - Represent seafloor structures as evidence of past plate motions.
  - Represent the shapes of continents as evidence of the past plate motions.
  - Evaluate limitations of models in representing evidence of the past plate motions.
- Use evidence from models to support the theory of plate tectonics:
  - Explain how the distribution of fossils and rocks provides evidence of the past plate motions.
  - Explain how seafloor structures provide evidence of past plate motions.
  - Explain how the shapes of continents provide evidence of the past plate motions.
  - Explain the relationship between plate motion; the locations of fossils, rocks, and seafloor structures; and Earth's geological history.

Core Ideas

Knowing Science

E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate.

- Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geological history. Plate movements are responsible for most continental and ocean floor features and for the distribution of most rocks and minerals within Earth's crust.
- Plate movements are responsible for most continental and ocean floor features and for the distribution of most rocks and minerals within Earth's crust.
- Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Modeling helps students make sense of several phenomena that provide evidence of the Earth's past plate movements. Using models, students develop an explanation in support of the theory of plate tectonics.

Science and Engineering Practices

Asking Questions and Defining Problems

- Ask questions that arise from careful observation of phenomena, models, or unexpected results.
- Ask questions to clarify or identify evidence and the premise(s) of an argument.

Crosscutting Concepts

Patterns

- Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems.
- Patterns can be used to identify cause and effect relationships.

Analyzing and Interpreting Data • Construct, analyze, and interpret graphical displays of data to identify linear and nonlinear relationships. • Consider limitations of data analysis (e.g., measurement error), and seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials). • Analyze and interpret data in order to determine similarities and differences in findings. • Distinguish between causal and correlational relationships. • Use graphical displays (e.g., maps) of large data sets to identify temporal and spatial relationships. **Obtaining, Evaluating, and Communicating Information** • Communicate scientific information and/or technical information (e.g. about a proposed object, tool, process, system) in different formats (e.g., verbally, graphically, textually, and mathematically).	• Graphs, charts, and images can be used to identify patterns in data. **Cause and Effect: Mechanism and Prediction** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. **Stability and Change** • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. • Small changes in one part of a system might cause large changes in another part. • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

EARTH AND SPACE SCIENCES: GEOLOGIC PROCESSES OVER TIME

Students explore natural and human-induced cause-and-effect changes in Earth systems over time.

Science Standard: 8.E1U3.7 Obtain, evaluate, and communicate information about data and historical patterns to predict natural hazards and other geological events.

Learning Goals

I can:

- Obtain and evaluate evidence about data and historical patterns in natural hazards and other geological events:
  - Select relevant evidence *(i.e., data and historical patterns)* from multiple appropriate *sources (e.g., scientific texts, media, models, investigations, demonstrations, etc.*) about natural hazards and other geological events over time.
  - Assess the credibility, accuracy, and possible bias of each publication and methods used.
  - Read critically using scientific knowledge and reasoning to evaluate data, hypotheses, and conclusions that appear in scientific or technical texts in light competing information or accounts.
  - Ask questions that challenge the interpretation of a data set.
  - Provide an accurate summary of a scientific text distinct from prior knowledge or opinions.
- Communicate scientific information about data and historical patterns in natural hazards and other geological events:
  - Use different formats *(e.g., verbally, graphically, textually, and mathematically)* to communicate information about data and historical patterns regarding natural hazards and other geological events.
  - Use patterns in the data *(e.g., upward movement of magma in volcanoes, mapping fault lines of earthquakes*) to forecast the potential for a natural hazard to affect an area in the future.
  - Compare, integrate, and evaluate multiple sources of information presented in different media or formats *(e.g., visually, quantitatively)* to support data and historical patterns regarding natural hazards and geologic events.
- Use data and historical patterns to predict natural hazards and other geological events:
  - Evaluate data to make predictions about natural hazards and other geological events.
  - Use patterns of evidence from previous geological events *(e.g., volcanic eruptions, earthquakes, landslides, floods, erosion, etc.)* to predict future events.
  - Justify predictions with evidence and scientific reasoning.
- Describe examples of technology that engineers have developed to mitigate the effects of natural *hazards (e.g., satellite monitoring of weather patterns, designs of buildings and bridges to resist earthquakes, warning signs for tsunamis, storm shelters for tornadoes, levees to prevent flooding, etc.).*

Core Ideas

Knowing Science

E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate.

- By tracking the upward movement of magma, for example, volcanic eruptions can often be predicted with enough advance warning to allow neighboring regions to be evacuated.
- Earthquakes, in contrast, occur suddenly; the specific time, day, or year cannot be predicted. However, the history of earthquakes in a region and the mapping of fault lines can help forecast the likelihood of future events.
- Finally, satellite monitoring of weather patterns, along with measurements from land, sea, and air, usually can identify developing severe weather and lead to its reliable forecast. Some natural hazards are preceded by geological activities that allow for reliable predictions; others occur suddenly, with no notice, and are not yet predictable.

Using Science

U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.

- Students evaluate data to explore how patterns enable us to make predictions about future geological events. Predictive technology is an application of science that has various implications, as human decisions about preparedness must rely on these imperfect tools and methods.

Science and Engineering Practices	Crosscutting Concepts
Obtain, Evaluate, and Communicate Information • Communicate scientific information and/or technical information (e.g. about a proposed object, tool, process, system) in different formats (e.g., verbally, graphically, textually, and mathematically). • Gather, read, and communicate information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used. • Read critically using scientific knowledge and reasoning to evaluate data, hypotheses, conclusions that appear in scientific and technical texts in light of competing information or accounts; provide an accurate summary of the text distinct from prior knowledge or opinions.	**Patterns** • Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. • Patterns can be used to identify cause and effect relationships. • Graphs, charts, and images can be used to identify patterns in data. **Cause and Effect: Mechanism and Prediction** • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. • Cause and effect relationships may be used to predict phenomena in natural or designed systems. • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. **Stability and Change** • Small changes in one part of a system might cause large changes in another part. • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

LIFE SCIENCE

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

LIFE SCIENCE: GENETICS AND TRAITS

Students develop an understanding of patterns and how genetic information is passed from generation to generation. They also develop the understanding of how traits within populations change over time.

Science Standard: 8.L3U1.9 Construct an explanation of how genetic variations occur in offspring through the inheritance of traits or through mutations.

Learning Goals

I can:

- Describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.
- Use scientific evidence (*e.g., from texts, demonstrations, models, media, etc.*) to explain how traits are inherited by offspring.
- Explain how a genetic mutation to a protein can lead to genetic variation (positive, negative, neutral).
- Explain how sexual reproduction produces genetic variation.

Core Ideas

Knowing Science

L3: Genetic information is passed down from one generation of organisms to another.

- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of a specific protein, which in turn affects the traits of the individual (e.g., human skin color results from the actions of proteins that control the production of the pigment melanin). Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. Sexual reproduction provides for transmission of genetic information to offspring through egg and sperm cells. These cells, which contain only one chromosome of each parent's chromosome pair, unite to form a new individual (offspring). Thus offspring possess one instance of each parent's chromosome pair (forming a new chromosome pair). Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited or (more rarely) from mutations.
- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students examine evidence from various sources to develop their understanding of genetic variation. They then select evidence to construct scientific explanations about how genetic variations occur.

Science and Engineering Practices	Crosscutting Concepts
Constructing Explanations and Designing Solutions • Apply scientific reasoning to show why the data are adequate for the explanation or conclusion. • Base explanations on evidence obtained from sources (including their own experiments) and the assumption that natural laws operate today as they did in the past and will continue to do so in the future.	**Patterns** • Macroscopic patterns are related to the nature of microscopic and atomic-level structure. • Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. • Patterns can be used to identify cause and effect relationships.

• Apply scientific knowledge and evidence to explain real-world phenomena, examples, or events. • Construct explanations from models or representations.	• Graphs, charts, and images can be used to identify patterns in data. **Cause and Effect: Mechanism and Prediction** • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. • Cause and effect relationships may be used to predict phenomena in natural or designed systems. • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. **Stability and Change** • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. • Small changes in one part of a system might cause large changes in another part. • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

LIFE SCIENCE: GENETICS AND TRAITS

Students develop an understanding of patterns and how genetic information is passed from generation to generation. They also develop the understanding of how traits within populations change over time.

Science Standard: 8.L3U3.10 Communicate how advancements in technology have furthered the field of genetic research and use evidence to support an argument about the positive and negative effects of genetic research on human lives.

Learning Goals

I can:

- Use data to communicate how advancements in technology have furthered the field of genetic research:
  - Use different formats *(e.g., verbally, graphically, textually, and mathematically)* to communicate evidence about the impact of advancements in genetic research technology.
  - Synthesize information from reliable sources about the impact of genetic technologies on society.
- Construct, use, and present an oral and/or written argument about the positive and negative effects of genetic research on human lives:
  - Make an evidence-based claim that evaluates the impact of genetic research on human lives (or support an argument with evidence that technology in the field of genetics affects society both positively and negatively).
  - Compare multiple viewpoints to evaluate the positive and negative effects of genetic research.
  - Support and refute claims with empirical evidence and scientific reasoning.
  - Respectfully provide and receive critiques on scientific arguments by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail.

Core Ideas

Knowing Science

L3: Genetic information is passed down from one generation of organisms to another.

- Note: There is no other background information or research in *A Framework For K-12 Science Education* or *Working With Big Ideas in Science Education* to support this standard.
- Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism.

Using Science

U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.

- Genetic research is a controversial topic, since the processes involved in generating the technology as well as the applications of the technology itself can have various consequences for human lives. Students explore how technology has advanced over time, and they examine the implications of genetic research.

Science and Engineering Practices	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information • Communicate scientific information and/or technical information (e.g. about a proposed object, tool, process, system) in different formats (e.g., verbally, graphically, textually, and mathematically). **Engaging in Argument from Evidence**	**Cause and Effect: Mechanism and Prediction** • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. • Cause and effect relationships may be used to predict phenomena in natural or designed systems.

• Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation for a phenomenon or a solution to a problem. • Respectfully provide and receive critiques on scientific arguments by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail. • Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system, based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints.	• Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. **Stability and Change** • Small changes in one part of a system might cause large changes in another part. • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

LIFE SCIENCE: GENETICS AND TRAITS

Students develop an understanding of patterns and how genetic information is passed from generation to generation. They also develop the understanding of how traits within populations change over time.

Science Standard: 8.L4U1.11 Develop and use a model to explain how natural selection may lead to increases and decreases of specific traits in populations over time.

Learning Goals

I can:

- Develop a model *(e.g., diagram, drawing, physical replica, mathematical representation, analogy, and/or computer simulation)* that represents the relationship between natural selection and increases and decreases of specific traits in populations over time:
  - Represent the predominance and suppression of traits in a population.
  - Represent the relationship between changes to environmental conditions and changes to species over time.
  - Represent changes to the distribution of traits in a population.
  - Evaluate the limitations of natural selection models in predicting population changes over time.
  - Modify the model, based on the limitations, to improve its representation of specific traits in populations over time.
- Use a model to explain how natural selection may influence trait distribution in populations over time:
  - Use evidence from a model to explain how environmental changes may affect specific traits of populations over time.
  - Use a model to describe the relationship between natural selection and adaptation.
  - Use a model to predict a specific trait outcome of a population over time.
  - Use a model to explain how some traits become predominant while others become suppressed.

Core Ideas

Knowing Science

L4: The unity and diversity of organisms, living and extinct, is the result of evolution.

- Genetic variations among individuals in a population give some individuals an advantage in surviving and reproducing in their environment. This is known as natural selection. It leads to the predominance of certain traits in a population and the suppression of others.
- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students use models to explore and explain how traits in populations change over time in response to natural selection.

Science and Engineering Practices	Crosscutting Concepts
Developing and Using Models • Use and/or develop models to predict, describe, support explanations, and/or collect data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. • Develop models to describe unobservable mechanisms. • Modify models—based on their limitations—to increase detail or clarity, or to explore what will happen if a component is changed. • Use and develop models of simple systems with uncertain and less predictable factors.	**Cause and Effect: Mechanism and Prediction** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. **Stability and Change** • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. • Small changes in one part of a system might cause large changes in another part. • Stability might be disturbed either by sudden events or gradual changes that accumulate over time. **Structure and Function** • Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 8

LIFE SCIENCE: GENETICS AND TRAITS

Students develop an understanding of patterns and how genetic information is passed from generation to generation. They also develop the understanding of how traits within populations change over time.

Science Standard: 8.L4U1.12 Gather and communicate evidence on how the process of natural selection provides an explanation of how new species can evolve.

Learning Goals

I can:

- Obtain evidence about how natural selection provides an explanation of how new species can evolve:
  - Ask questions about natural selection and evolution to frame the collection of evidence.
  - Select relevant evidence (*i.e., data and historical patterns*) from multiple appropriate sources (*e.g., scientific texts, media, models, investigations, demonstrations, etc.*) about how new species evolve through natural selection.
  - Identify evidence of separated populations with different conditions that have evolved to become different species.
  - Select relevant evidence about artificial selection and its effect on changes in populations over time *(e.g., selecting traits in dog breeding and modern produce).*
  - Assess the credibility, accuracy, and possible bias of each publication and methods used.
  - Read critically using scientific knowledge and reasoning to evaluate data, hypotheses, and conclusions that appear in scientific or technical texts in light competing information or accounts.
  - Ask questions that challenge the interpretation of a data set.
  - Provide an accurate summary of a scientific text distinct from prior knowledge or opinions.
- Communicate evidence about how new species can evolve through natural selection:
  - Use different formats (*e.g., verbally, graphically, textually, and mathematically*) to communicate evidence about how the process of natural selection can cause new species to evolve.
  - Compare, integrate, and evaluate multiple sources of evidence presented in different media or formats *(e.g., visually, quantitatively*) in order to explain how natural selection can cause new species to evolve.
  - Use evidence to explain how human interaction and natural selection will lead to a decrease in biodiversity and resources over time.
  - Use evidence to explain how separated populations with different conditions can evolve to become two different species.
  - Use evidence to explain how artificial selection causes populations to change over time in designed ways.

Core Ideas

Knowing Science

L4: The unity and diversity of organisms, living and extinct, is the result of evolution.

- In separated populations with different conditions, the changes can be large enough that the populations, provided they remain separated (a process called reproductive isolation), evolve to become separate species.
- Biodiversity is the wide range of existing life forms that have adapted to the variety of conditions on Earth, from terrestrial to marine ecosystems. Biodiversity includes genetic variation within a species, in addition to species variation in different habitats and ecosystem types (e.g., forests, grasslands, wetlands).
- Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students examine evidence to explore phenomena pertaining to biodiversity. They explore explanations for the evolution of new species.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, or unexpected results. • Ask questions to clarify or identify evidence and the premise(s) of an argument. **Obtaining, Evaluating, and Communicating Information** • Communicate scientific information and/or technical information (e.g. about a proposed object, tool, process, system) in different formats (e.g., verbally, graphically, textually, and mathematically). • Gather, read, and communicate information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used. • Read critically using scientific knowledge and reasoning to evaluate data, hypotheses, conclusions that appear in scientific and technical texts in light of competing information or accounts; provide an accurate summary of the text distinct from prior knowledge or opinions.	**Patterns** • Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. • Patterns can be used to identify cause and effect relationships. • Graphs, charts, and images can be used to identify patterns in data. **Cause and Effect: Mechanism and Prediction** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. **Stability and Change** • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. • Small changes in one part of a system might cause large changes in another part. • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

GRADE 8

COMPUTER SCIENCE

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADES 6-8

COMPUTER SCIENCE STANDARDS: COMPUTATIONAL THINKING

Concept: Computational Thinking (Algorithms and Programming)

Subconcepts:

- **Algorithms (A)**
- **Variables (V)**
- **Control (C)**
- **Modularity (M)**
- **Program Development (PD)**

Computer Science Standards:

6-8.AP.A.1 Develop planning strategies, such as flowcharts or pseudocode, to develop algorithms to address complex problems.

Learning Goals

I can:

- Sequence and organize an algorithm (e.g., flowchart, pseudocode).
- Independently create a pseudocode to solve a problem and model a solution.

6-8.AP.V.1 Create named variables that represent different data types and perform operations on their values.

Learning Goals

I can:

- Differentiate between various variable data types (i.e., numeric, text, or boolean variables).
- Use naming conventions for program readability, consistency and clarity (i.e., camelCase).
- Perform operations on variables as needed to accomplish a task.

6-8.AP.C.1 Create programs that combine control structures, including nested loops and compound conditionals.

Learning Goals

I can:

- Write a text-based code for a loop and/or conditional statement.
- Use block code or text-based code to create a program with multiple loops.
- Include nested loops and/or compound conditionals in a program to accomplish a specific task.

6-8.AP.M.1 Decompose problems into manageable subproblems to facilitate the design, implementation, and review of programs.

Learning Goals

I can:

- Identify the manageable and logical subproblems involved in accomplishing a task in order to develop and review code for a program.
- Define command sequences that can be repeated in a program or reused in other programs.

6-8.AP.M.2 Create procedures with parameters (e.g., functions) to make the code reusable and more efficient.

Learning Goals

I can:

- Create a function to simplify and reduce the repetition of code.
- Create a function that represents a module or section of code.
- Use a parameter to create a reusable module or section of code.

6-8.AP.PD.1 Seek and incorporate feedback from team members and users to refine a solution that meets user needs.

Learning Goals

I can:

- Design the criteria for a solution defined by the user.
- Evaluate one's own or other solutions based on the criteria.

6-8.AP.PD.2 Incorporate existing code and media into original programs, and give attribution.

Learning Goals

I can:

- Follow copyright and attribution requirements when importing media or code for use or remixing in a program.
- Credit sources when importing media and reusing or remixing code.

6-8.AP.PD.3 Systematically test and refine programs using a range of possible inputs.

Learning Goals

I can:

- Evaluate steps in a program or sections of code (specific command sequences, functions or formulas) before completing the task.
- Anticipate errors and test the program to discover invalid inputs.
- Correct the programs or formulas based on results of testing.

6-8.AP.PD.5 Document programs to make them easier to follow, test, and debug.

Learning Goals

I can:

- Describe the purpose of documenting programs (e.g., process development, summarize sections of code).
- Enter text documentation into code.
- Create clear directions for users to follow a program.

Computer Science Practices

Fostering an Inclusive Computing Culture

- Build an inclusive and diverse computing culture using strategies that incorporate perspectives from people of different genders, ethnicities, and abilities.

Collaborating Around Computing

- Collaborate around computing by working in pairs and on teams to perform a computational task, asking for the contributions and feedback of others to improve outcomes.

Recognizing and Defining Computational Problems

- Recognize and define computational problems, break them down into parts, and evaluate each part to determine whether a computational solution is appropriate.

Developing and Using Abstractions

- Identify patterns and extract common features from specific examples to create generalizations from abstractions.

Creating Computational Artifacts

- Create computational artifacts that embrace both creative expression and the exploration of ideas to create prototypes and solve computational problems. Create artifacts that are personally relevant or beneficial to the community and beyond.

Testing and Refining Computational Artifacts

- Test and refine computational artifacts using a deliberate and iterative process for improving a computational artifact.

Communicating About Computing

- Communicate clearly with others about the use and effects of computation and computational choices, and to exchange ideas with others.

Science and Engineering Practices	Crosscutting Concepts
Ask Questions and Defining Problems • Ask questions to clarify and refine a model, an explanation, or an engineering problem. • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. **Developing and Using Models** • Use and/or develop models to predict, describe, support explanations, and/or collect data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. • Develop a model that allows for manipulation and testing of a proposed object, tool, process or system • Evaluate limitations of a model for a proposed object or tool. **Using Mathematics and Computational Thinking** • Create algorithms (a series of ordered steps) to solve a problem. **Constructing Explanations and Designing Solutions** • Optimize performance of a design by prioritizing criteria, making tradeoffs, testing, revising, and retesting.	**Systems and System Models** • Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. • Models can be used to represent systems and their interactions—such as inputs, processes and outputs. **Stability and Change** • Small changes in one part of a system might cause large changes in another part.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADES 6-8

COMPUTER SCIENCE STANDARDS: DATA AND ANALYSIS

Concept: Data and Analysis

Subconcepts:

- **Collection, Visualization, and Transformation (CVT)**
- **Inference and Models (M)**

Computer Science Standards:

6-8.DA.CVT.1a Assess and analyze data using computational tools.

Learning Goals

I can:

- Organize a data set (i.e., spreadsheet: e.g., Google Sheets, Excel, Numbers).

6-8.DA.CVT.1b Transform data to make it more meaningful and useful.

Learning Goals

I can:

- Manipulate data in order to understand and solve a problem (i.e., sort, graph, consider outliers, remove errors, apply formulas, e.g., spreadsheet).

6-8.DA.IM.1 Evaluate the reliability and validity of data by comparing it to a computational model.

Learning Goals

I can:

- Compare experimental data to simulated data (e.g., looking for outliers, inconsistencies, or errors).
- Determine factors which may affect both the simulated and experimental data which may change results.

Computer Science Practices

Fostering an Inclusive Computing Culture

- Build an inclusive and diverse computing culture using strategies that incorporate perspectives from people of different genders, ethnicities, and abilities.

Collaborating Around Computing

- Collaborate around computing by working in pairs and on teams to perform a computational task, asking for the contributions and feedback of others to improve outcomes.

Recognizing and Defining Computational Problems

- Recognize and define computational problems, break them down into parts, and evaluate each part to determine whether a computational solution is appropriate.

Developing and Using Abstractions

- Identify patterns and extract common features from specific examples to create generalizations from abstractions.

Creating Computational Artifacts

- Create computational artifacts that embrace both creative expression and the exploration of ideas to create prototypes and solve computational problems. Create artifacts that are personally relevant or beneficial to the community and beyond.

Testing and Refining Computational Artifacts

- Test and refine computational artifacts using a deliberate and iterative process for improving a computational artifact.

Communicating About Computing

- Communicate clearly with others about the use and effects of computation and computational choices, and to exchange ideas with others.

Science and Engineering Practices	Crosscutting Concepts
Analyzing and Interpreting Data • Consider limitations of data analysis, and seek to improve precision and accuracy of data with better technological tools and methods. • Distinguish between causal and correlational relationships. • Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success. **Using Mathematics and Computational Thinking** • Use digital tools to analyze very large sets for patterns and trends. • Critically evaluate whether or not technical information on a device, tool or process is relevant to its suitability to solve a specific design problem. **Constructing Explanations and Designing Solutions** • Construct explanations for either qualitative or quantitative relationships between variables.	**Patterns** • Patterns can be used to identify cause and effect relationships. • Graphs, charts, and images can be used to identify patterns in data. **Cause and Effect: Mechanism and Prediction** • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.