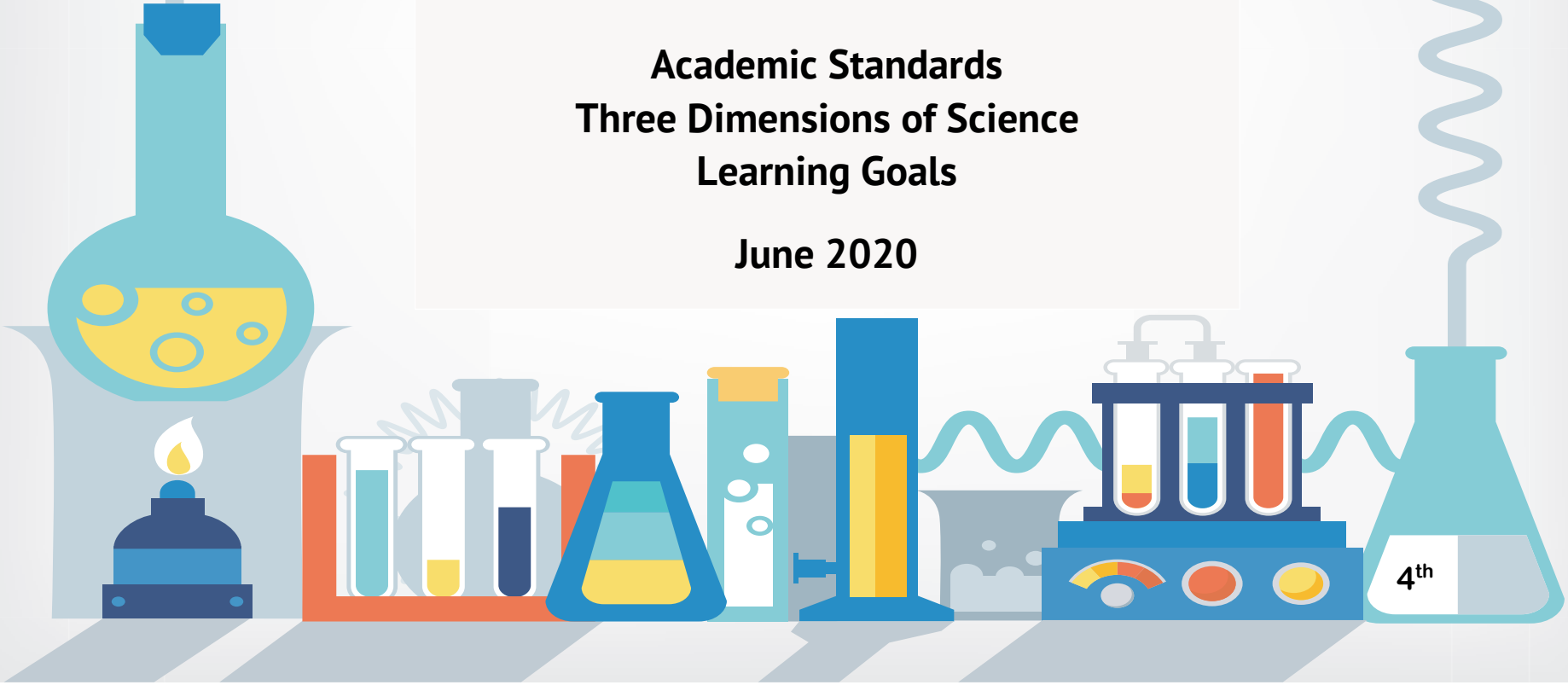
ENVISION 21

DEEP LEARNING • CFSD

SCIENCE

Academic Standards
Three Dimensions of Science
Learning Goals

June 2020



GRADE 4

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 4 OVERVIEW

By the end of **fourth grade**, students expand on the idea that energy from the Sun interacts with Earth systems and explore other forms of energy we use in everyday life. Students apply their understanding of the various Earth systems (geosphere, hydrosphere, atmosphere, biosphere) and how they interact with each other and heat from the Sun. Students learn how geological systems change and shape the planet and provide resources. They also develop an understanding of how Earth processes and human interactions positively and negatively can change environments impacting the ability for organisms to survive. 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 fourth grade focus on helping students understand phenomena through the crosscutting concepts of *systems and system models*, *energy and matter*, and *stability and change*.

The fourth 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 fourth 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	Magnets and Electricity	Students develop an understanding of how Earth's resources can be transformed into different forms of energy. Students develop a better understanding of electricity and magnetism.
2	Earth and Space Sciences	Earth Systems	Students develop an understanding of the different Earth systems and how they interact with each other. They understand how geological systems change and shape Earth and the evidence that is used to understand these changes. They also understand how weather, climate, and human interactions can impact the environment.
3	Life Science	Adaptations	Students develop an understanding of the diversity of past and present organisms, factors impacting organism diversity, and evidence of change of organisms 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.

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

KINDERGARTEN

LIFE SCIENCE: LIVING AND NON-LIVING THINGS

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 4 SCIENCE STANDARD

PHYSICAL SCIENCE: MAGNETS AND ELECTRICITY

Students develop an understanding of how Earth's resources can be transformed into different forms of energy. Students develop a better understanding of electricity and magnetism.

Science Standard: 4.P4U1.1 Develop and use a model to demonstrate how a system transfers energy from one object to another even when the objects are not touching.

Learning Goals

I can:

- Develop a model (*e.g., diagrams, drawings, physical replicas, dioramas, dramatizations, or storyboards*) to show how a system transfers energy from one object to another even when the objects are not touching.
  - Develop models using an analogy, example, or abstract representation to show how a system transfers energy from one object to another.
  - Represent energy transfer from one object to another when the objects are touching (*i.e., collisions*).
  - Represent energy transfer from one object to another when the objects are not touching (*i.e., light, sound, electricity*).
  - Compare models to identify common features and differences.
  - Use criteria to collaboratively revise models to improve their representation of how a system transfers energy from one object to another.
  - Identify limitations of models.
- Use models to demonstrate how a system transfers energy from one object to another.
  - Use models to demonstrate how energy transfers from one object to another when the objects are touching (*i.e., collisions*).
  - Use models to demonstrate how energy transfers from one object to another when the objects are not touching (*i.e., light, sound, electricity*).
  - Use models to demonstrate the relationship between movement and energy.

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 is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. The faster a given object is moving, the more energy it possesses. Light also transfers energy from place to place. For example, energy radiated from the sun is transferred to Earth by light. When this light is absorbed, it warms Earth's land, air, and water and facilitates plant growth.
- The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use—for example, the stored energy of water behind a dam is released so that it flows downhill and drives a turbine generator to produce electricity. Food and fuel also release energy when they are digested or burned. When machines or animals "use" energy (e.g., to move around), most often the energy is transferred to heat the surrounding environment. The energy released by burning fuel or digesting food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).

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 energy transfer by making visible what might be otherwise unseen.

Science and Engineering Practices	Crosscutting Concepts
Developing and Using Models • Develop and revise models collaboratively to measure and explain frequent and regular events. • Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution. • Use simple models to describe or support explanations for phenomena and test cause and effect relationships or interactions concerning the functioning of a natural or designed system. • Identify limitations of models.	**Energy and Matter: Flows, Cycles, and Conservation** • Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. • Energy can be transferred in various ways and between objects. **Systems and System Models** • A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. • A system can be described in terms of its components and their interactions.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 4 SCIENCE STANDARD

PHYSICAL SCIENCE: MAGNETS AND ELECTRICITY

Students develop an understanding of how Earth's resources can be transformed into different forms of energy. Students develop a better understanding of electricity and magnetism.

Science Standard: 4.P4U1.2 Plan and carry out an investigation to explore and explain how energy is moved from place to place through electric currents.

Learning Goals

I can:

- In collaboration with peers, design an investigation (*e.g., a simulation*) to explore how energy is moved from place to place through electric currents:
  - Form scientific (testable) questions based on careful observations of phenomena and information.
  - Formulate a reasonable prediction based on patterns such as cause and effect relationships.
  - Design a procedure that will produce data in response to the testable question(s).
  - Identify controlled variables.
  - Determine an appropriate number of trials for the investigation.
  - Determine how observations and/or measurements will be made in order to answer the investigative question.
- In collaboration with peers, conduct a simple investigation to explore how energy is moved from place to place through electric currents:
  - Follow a procedure with precision.
  - Make observations about energy and electric currents.
  - Collect and record appropriate data from the investigation.
  - Identify patterns to make meaning of the data.
- Explain how energy is moved from place to place through electric currents:
  - Use data from the investigation to explain how energy is moved from place to place through electric currents.

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 also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy (e.g., moving water driving a spinning turbine which generates electric currents).

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 engage in investigations to build their understanding of the flow of energy through electric currents.

Science and Engineering Practices	Crosscutting Concepts
Planning and Carrying Out Investigations • Design and conduct investigations collaboratively, using fair tests in which variables are controlled and the number of trials considered. • Evaluate appropriate methods and tools for collecting data.	**Cause and Effect: Mechanism and Prediction** • Cause and effect relationships are routinely identified, tested, and used to explain change.

• Make observations and/or measurements, collect appropriate data, and identify patterns that provide evidence for an explanation of a phenomenon or test a design solution. • Make measurements of two different models of the same proposed object, tool or process to determine which better meets criteria for success.	• Events that occur together with regularity might or might not be a cause and effect relationship. **Energy and Matter: Flows, Cycles, and Conservation** • Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems. • Energy can be transferred in various ways and between objects.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 4 SCIENCE STANDARD

PHYSICAL SCIENCE: MAGNETS AND ELECTRICITY

Students develop an understanding of how Earth's resources can be transformed into different forms of energy. Students develop a better understanding of electricity and magnetism.

Science Standard: 4.P2U1.3 Develop and use a model to demonstrate magnetic forces.

Learning Goals

I can:

- Develop a model (*e.g., diagrams, drawings, physical replicas, dioramas, dramatizations, or storyboards*) to demonstrate magnetic forces:
  - Develop models using an analogy, example, or abstract representation to demonstrate magnetic forces.
  - Represent how magnetism increases/decreases based on the distance of the magnet.
  - Represent how magnetism increases/decreases based on the orientation of the magnet(s) and/or objects.
  - Represent how magnetism increases/decreases based on the properties of the objects.
  - Represent how magnetism can be used to produce motion and electric current.
  - Compare models to identify common features and differences.
  - Use criteria to collaboratively revise models to improve their representation of how a system transfers energy from one object to another.
  - Identify limitations of models.
- Use models to demonstrate magnetic forces.
  - Use evidence from models to explain magnetic forces.
  - Use evidence from models to explain how magnetism increases/decreases based on the distance of the magnet.
  - Use evidence from models to explain how magnetism increases/decreases based on the orientation of the magnet(s) and/or objects.
  - Use evidence from models to explain how magnetism increases/decreases based on the properties of the objects.
  - Use evidence from models to explain how magnetism produces motion and electric current.
  - Identify the evidence from the model that supports particular points in the explanation.

Core Ideas

Knowing Science

P2: Objects can affect other objects at a distance.

- Magnetic forces between two objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to 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.

- Because forces are essentially invisible, students use models to make sense of magnetic forces.

Science and Engineering Practices	Crosscutting Concepts
Developing and Using Models • Develop and revise models collaboratively to measure and explain frequent and regular events. • Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution. • Use simple models to describe or support explanations for phenomena and test cause and effect relationships or interactions concerning the functioning of a natural or designed system. • Identify limitations of models.	**Energy and Matter: Flows, Cycles, and Conservation** • Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems. • Energy can be transferred in various ways and between objects. **Stability and Change** • Change is measured in terms of differences over time and may occur at different rates. • Some systems appear stable, but over long periods of time will eventually change. **Cause and Effect: Mechanism and Prediction** • Cause and effect relationships are routinely identified, tested, and used to explain change. • Events that occur together with regularity might or might not be a cause and effect relationship.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 4 SCIENCE STANDARD

PHYSICAL SCIENCE: MAGNETS AND ELECTRICITY

Students develop an understanding of how Earth's resources can be transformed into different forms of energy. Students develop a better understanding of electricity and magnetism.

Science Standard: 4.P4U3.4 Engage with perspectives on the use and impact of renewable and nonrenewable resources to generate electricity.

Learning Goals

I can:

- Evaluate perspectives regarding the use and impact of renewable resources to generate electricity:
  - Respectfully provide and receive critiques on opinions with peers by citing relevant scientific evidence and posing specific questions.
  - Cite relevant evidence and pose specific questions to peers regarding the use and impact of renewable and nonrenewable resources to generate electricity.
  - Identify and explain different perspectives regarding the use and impact of renewable and nonrenewable resources to generate electricity.
- Construct, use, and present oral and written opinions regarding the use and impact of renewable and nonrenewable resources to generate electricity:
  - State and defend an opinion regarding the use and impact of renewable and nonrenewable resources to generate electricity.
  - Construct and/or support opinions with scientific evidence, data, and/or a model.
  - Compare and refine opinions based on the strengths and weaknesses of the evidence presented.
  - Compare natural resources, their sources, and ways they are used to generate electricity.
  - Use data to justify uses of renewable and nonrenewable resources to generate electricity.

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 and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time and others are not.

Using Science

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

- Electricity is a human need, and there are various perspectives regarding the use of different types of resources to generate electricity. Students engage with different perspectives as they explore the implications of various sources of energy.

Science and Engineering Practices

Engaging in Argument from Evidence

- Construct and/or support scientific arguments with evidence, data, and/or a model.
- Compare and refine arguments based on the strengths and weaknesses of the evidence presented.
- Respectfully provide and receive critiques on scientific arguments with peers by citing relevant evidence and posing specific questions.

Crosscutting Concepts

Energy and Matter: Flows, Cycles, and Conservation

- Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems.
- Energy can be transferred in various ways and between objects.

Systems and System Models

	• A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. • A system can be described in terms of its components and their interactions.

EARTH AND SPACE SCIENCES

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 4 SCIENCE STANDARD

EARTH AND SPACE SCIENCES: EARTH SYSTEMS

Students develop an understanding of the different Earth systems and how they interact with each other. They understand how geological systems change and shape Earth and the evidence that is used to understand these changes. They also understand how weather, climate, and human interactions can impact the environment.

Science Standard 4.E1U1.5 Use models to explain seismic waves and their effect on the Earth.

Learning Goals

I can:

- Use evidence from models (*e.g., diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations*) to explain seismic waves and their effect on the Earth:
  - Explain how energy from earthquakes produces seismic waves.
  - Describe the wavelength and amplitude of seismic waves.
  - Explain how seismic waves travel through the Earth.
  - Explain how seismic waves affect the Earth (*e.g., landslides, ground rupture, tsunamis, liquefaction, etc.*).
  - Describe the effects of earthquakes of varying magnitude and intensity.

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.

- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). Waves can add or cancel one another as they cross, depending on their relative phase (i.e., relative position of peaks and troughs of the waves), but they emerge unaffected by each other. Earthquakes cause seismic waves, which are waves of motion in Earth's crust.

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.

- Because seismic waves are unseen phenomena, modeling helps students explore cause and effect relationships between these waves and the Earth.

Science and Engineering Practices

Developing and Using Models

- Develop and revise models collaboratively to measure and explain frequent and regular events.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
- Use simple models to describe or support explanations for phenomena and test cause and effect relationships or interactions concerning the functioning of a natural or designed system.
- Identify limitations of models.

Crosscutting Concepts

Cause and Effect: Mechanism and Prediction

- Cause and effect relationships are routinely identified, tested, and used to explain change.
- Events that occur together with regularity might or might not be a cause and effect relationship.

Systems and System Models

- A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.
- A system can be described in terms of its components and their interactions.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 4 SCIENCE STANDARD

EARTH AND SPACE SCIENCES: EARTH SYSTEMS

Students develop an understanding of the different Earth systems and how they interact with each other. They understand how geological systems change and shape Earth and the evidence that is used to understand these changes. They also understand how weather, climate, and human interactions can impact the environment.

Science Standard 4.E1U1.6 Plan and carry out an investigation to explore and explain the interactions between Earth's major systems and the impact on Earth's surface materials and processes.

Learning Goals

I can:

- In collaboration with peers, design an investigation (*e.g., a simulation*) to explore the interactions between Earth's major systems:
  - Form scientific (testable) questions based on careful observations of phenomena and information.
  - Formulate a reasonable prediction based on patterns such as cause and effect relationships.
  - Design a procedure that will produce data in response to the testable question(s).
  - Identify controlled variables.
  - Determine an appropriate number of trials for the investigation.
  - Determine how observations and/or measurements will be made in order to answer the investigative question.
- In collaboration with peers, conduct a simple investigation to explore the interactions between Earth's major systems:
  - Follow a procedure with precision.
  - Make observations about interactions between Earth's major systems.
  - Collect and record appropriate data from the investigation.
  - Identify patterns to make meaning of the data.
- Explain the interactions between Earth's major systems and the impact on Earth's surface materials and processes:
  - Use data from the investigation to explain relationships between the geosphere, hydrosphere, atmosphere, and biosphere.
  - Explain how Earth's major systems affect Earth's surface materials and processes (*i.e., the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere*).

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.

- Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and / organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. Rainfall helps shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. Human activities affect Earth's systems and their interactions at its surface.

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.

- Students explore Earth's major systems through scientific investigations. They use the evidence obtained in the investigation to develop explanations of these interrelated systems.

Science and Engineering Practices	Crosscutting Concepts
Planning and Carrying Out Investigations • Design and conduct investigations collaboratively, using fair tests in which variables are controlled and the number of trials considered. • Evaluate appropriate methods and tools for collecting data. • Make observations and/or measurements, collect appropriate data, and identify patterns that provide evidence for an explanation of a phenomenon or test a design solution.	**Cause and Effect: Mechanism and Prediction** • Cause and effect relationships are routinely identified, tested, and used to explain change. • Events that occur together with regularity might or might not be a cause and effect relationship. **Systems and System Models** • A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. • A system can be described in terms of its components and their interactions.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 4 SCIENCE STANDARD

EARTH AND SPACE SCIENCES: EARTH SYSTEMS

Students develop an understanding of the different Earth systems and how they interact with each other. They understand how geological systems change and shape Earth and the evidence that is used to understand these changes. They also understand how weather, climate, and human interactions can impact the environment.

Science Standard: 4.E1U1.7 Develop and/or revise a model using various rock types, fossils location, and landforms to show evidence that Earth's surface has changed over time.

Learning Goals

I can:

- Develop and/or revise a model (*e.g., diagrams, drawings, physical replicas, dioramas, dramatizations, or storyboards*) to show evidence that Earth's surface has changed over time.
  - Develop and/or revise models using an analogy, example, or abstract representation to show evidence that Earth's surface has changed over time.
  - Develop and/or revise models using various rock types (*e.g., sedentary, metamorphic, igneous*), fossil locations (*e.g., above or below rock layers, in particular geographic locations*), and landforms (*e.g., rivers, glaciers, faulting/fractures*) to show how the Earth's surface has changed over time.
  - Compare models to identify common features and differences.
  - Use criteria to collaboratively revise models to improve their representation of how the Earth's surface has changed over time.
  - Identify limitations of models.

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.

- Earth has changed over time. Understanding how landforms develop, are weathered (broken down into smaller pieces), and erode (get transported elsewhere) can help infer the history of the current landscape. Local, regional, and global patterns of rock formations reveal changes over time due to Earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.

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.

- Students explore changes to the Earth's surface through modeling. They revise models in response to feedback or additional scientific evidence.

Science and Engineering Practices

Developing and Using Models

- Develop and revise models collaboratively to measure and explain frequent and regular events.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
- Use simple models to describe or support explanations for phenomena and test cause and effect relationships or interactions concerning the functioning of a natural or designed system.
- Identify limitations of models.

Crosscutting Concepts

Systems and System Models

- A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.
- A system can be described in terms of its components and their interactions.

Stability and Change

- Change is measured in terms of differences over time and may occur at different rates.
- Some systems appear stable, but over long periods of time will eventually change.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 4 SCIENCE STANDARD

EARTH AND SPACE SCIENCES: EARTH SYSTEMS

Students develop an understanding of the different Earth systems and how they interact with each other. They understand how geological systems change and shape Earth and the evidence that is used to understand these changes. They also understand how weather, climate, and human interactions can impact the environment.

Science Standard: 4.E1U1.8 Collect, analyze, and interpret data to explain weather and climate patterns.

Learning Goals

I can:

- Collect weather and climate data:
  - Formulate scientific questions about weather and climate patterns.
  - Collect (*e.g., through data centers, and/or investigations*) and record data in response to the investigative questions.
  - Select and record data across different times and locations.
- Analyze and interpret data to explain weather and climate patterns:
  - Organize data using categories.
  - Display weather and climate data in tables and graphs, using digital tools when feasible, to reveal patterns that indicate relationships.
  - Use weather and climate data to evaluate cause and effect relationships.
  - Compare data collected by different groups in order to discuss similarities and differences in their findings.
  - Interpret data to make sense of and explain weather and climate phenomena, using logical reasoning, mathematics, and/or computation.

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.

- Weather is the minute-by-minute to day-by-day variation of the atmosphere's condition on a local scale. Scientists record the patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. Climate describes the ranges of an area's typical weather conditions and the extent to which those conditions vary over years to centuries.

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.

- Students make sense of weather and climate phenomena by analyzing and interpreting data collected in response to a scientific question.

Science and Engineering Practices

Analyzing and Interpreting Data

- Display data in tables and graphs, using digital tools when feasible, to reveal patterns that indicate relationships.
- Use data to evaluate claims about cause and effect.
- Compare data collected by different groups in order to discuss similarities and differences in their findings.
- Use data to evaluate and refine design solutions.

Crosscutting Concepts

Patterns

- Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products.
- Patterns of change can be used to make predictions.
- Patterns can be used as evidence to support an explanation.

Stability and Change

• Interpret data to make sense of and explain phenomena, using logical reasoning, mathematics, and/or computation.	• Change is measured in terms of differences over time and may occur at different rates. • Some systems appear stable, but over long periods of time will eventually change. **Cause and Effect: Mechanism and Prediction** • Cause and effect relationships are routinely identified, tested, and used to explain change. • Events that occur together with regularity might or might not be a cause and effect relationship.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 4 SCIENCE STANDARD

EARTH AND SPACE SCIENCES: EARTH SYSTEMS

Students develop an understanding of the different Earth systems and how they interact with each other. They understand how geological systems change and shape Earth and the evidence that is used to understand these changes. They also understand how weather, climate, and human interactions can impact the environment.

Science Standard: 4.E1U3.9 Construct and support an evidence-based argument about the availability of water and its impact on life.

Learning Goals

I can:

- Construct, use, and present oral and written opinions regarding the availability of water and its impact on life:
  - State and defend an opinion regarding water availability and its impact on life.
  - Construct and/or support opinions with scientific evidence, data, and/or a model.
  - Compare and refine opinions based on the strengths and weaknesses of the evidence presented.
  - Use data to describe the implications of water scarcity.

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.

- Water is found almost everywhere on Earth: as vapor; as fog or clouds in the atmosphere; as rain or snow falling from clouds; as ice, snow, and running water on land and in the ocean; and as groundwater beneath the surface. The downhill movement of water as it flows to the ocean shapes the appearance of the land. Nearly all of Earth's available water is in the ocean. Most freshwater is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.

Using Science

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

- Water availability is a significant issue that has various positive and negative ethical, social, economic, and/or political implications. Students explore the impact of water on life on Earth.

Science and Engineering Practices

Engaging in Argument from Evidence

- Construct and/or support scientific arguments with evidence, data, and/or a model.
- Compare and refine arguments based on the strengths and weaknesses of the evidence presented.
- Respectfully provide and receive critiques on scientific arguments with peers by citing relevant evidence and posing specific questions.

Crosscutting Concepts

Cause and Effect: Mechanism and Prediction

- Cause and effect relationships are routinely identified, tested, and used to explain change.
- Events that occur together with regularity might or might not be a cause and effect relationship.

Systems and System Models

- A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.
- A system can be described in terms of its components and their interactions.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 4 SCIENCE STANDARD

EARTH AND SPACE SCIENCES: EARTH SYSTEMS

Students develop an understanding of the different Earth systems and how they interact with each other. They understand how geological systems change and shape Earth and the evidence that is used to understand these changes. They also understand how weather, climate, and human interactions can impact the environment.

Science Standard: 4.E1U2.10 Define problem(s) and design solution(s) to minimize the effects of natural hazards.

Learning Goals

I can:

- Define the problem(s) presented by natural hazards:
  - Describe the problems presented by natural hazards.
  - Ask questions to clarify the constraints of solutions to a problem.
  - Define the design problem by establishing several criteria for success and constraints on materials, time, or cost.
- Design solution(s) to minimize the effects of natural hazards:
  - Use tools and materials to develop multiple designs that meet the established criteria and constraints.
  - Communicate designs through sketches, drawings, and/or physical models.
  - Apply scientific knowledge about weather and climate to design solution(s).
  - Generate and compare multiple solutions to the problem based on how well they meet the criteria and constraints of the problem.

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.

- A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions, severe weather, floods, coastal erosion). Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

Using Science

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

- Students use their understanding of Earth's systems and weather and climate patterns to address the problem of natural hazards. Students ask questions to frame problems and develop solutions.

Science and Engineering Practices

Asking Questions and Defining Problems

- Ask questions to clarify the constraints of solutions to a problem.
- Use prior knowledge to describe problems that can be solved.
- Define a simple design problem that can be solved through the development of an object, tool or process and includes several criteria for success and constraints on materials, time, or cost.
- Formulate questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.

Crosscutting Concepts

Cause and Effect: Mechanism and Prediction

- Cause and effect relationships are routinely identified, tested, and used to explain change.
- Events that occur together with regularity might or might not be a cause and effect relationship.

Stability and Change

- Change is measured in terms of differences over time and may occur at different rates.

Constructing Explanations and Designing Solutions • Use evidence (e.g., measurements, observations, patterns) to construct a scientific explanation or design a solution to a problem. • Apply scientific knowledge to solve design problems. • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the problem.	• Some systems appear stable, but over long periods of time will eventually change.

LIFE SCIENCE

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 4 SCIENCE STANDARD

LIFE SCIENCE: ADAPTATIONS

Students develop an understanding of the diversity of past and present organisms, factors impacting organism diversity, and evidence of change of organisms over time.

Science Standard: 4.L4U1.11 Analyze and interpret environmental data to demonstrate that species either adapt and survive, or go extinct over time.

Learning Goals

I can:

- Formulate scientific questions to frame environmental data analysis and interpretation.
- Organize data (*e.g., from data centers, and/or investigations*) into meaningful categories based on the investigative questions.
- Display environmental data in tables and graphs, using digital tools when feasible, to reveal patterns that indicate relationships.
- Use environmental data to evaluate cause and effect relationships with regard to adaptation, survival, and extinction.
- Compare data collected by different groups in order to discuss similarities and differences in their findings.
- Compare fossils with one another and to living organisms to make inferences about organisms that lived long ago and about the nature of their environments.
- Interpret data to make sense of and explain environmental data, using logical reasoning, mathematics, and/or computation.

Core Ideas

Knowing Science

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

- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. Fossils provide evidence about the types of organisms (both visible and microscopic) that lived long ago and also about the nature of their environments. Fossils can be compared with one another and to living organisms according to their similarities and differences.
- Changes in an organism's habitat are sometimes beneficial to it and sometimes harmful. For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

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 analyze and interpret data in order to better understand factors that contribute to a species' survival or extinction.

Science and Engineering Practices

Asking Questions and Defining Problems

- Ask questions based on careful observations of phenomena and information.
- Ask questions to clarify ideas or request evidence.

Analyzing and Interpreting Data

- Display data in tables and graphs, using digital tools when feasible, to reveal patterns that indicate relationships.
- Use data to evaluate claims about cause and effect.

Crosscutting Concepts

Patterns

- Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products.
- Patterns of change can be used to make predictions.
- Patterns can be used as evidence to support an explanation.

Cause and Effect: Mechanism and Prediction

- Cause and effect relationships are routinely identified, tested, and used to explain change.

• Compare data collected by different groups in order to discuss similarities and differences in their findings. • Use data to evaluate and refine design solutions. • Interpret data to make sense of and explain phenomena, using logical reasoning, mathematics, and/or computation.	• Events that occur together with regularity might or might not be a cause and effect relationship. **Stability and Change** • Change is measured in terms of differences over time and may occur at different rates. • Some systems appear stable, but over long periods of time will eventually change.

COMPUTER SCIENCE

(Note: The Computer Science Standards will be taught by the STEM Integration Specialist in collaboration with the classroom teachers.)

CATALINA FOOTHILLS SCHOOL DISTRICT

COMPUTER SCIENCE STANDARDS FOR GRADES 3-5

CONCEPT: COMPUTATIONAL THINKING

Concept: Computational Thinking (Algorithms and Programming)

Subconcepts:

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

Computer Science Standard: 3-5.AP.A.1 Compare, test, and refine algorithms for the same task and determine which is the most efficient.

Learning Goals

I can:

- Select the most efficient algorithm to accomplish a task.
- Accomplish a programming task using the most efficient algorithm(s).

Computer Science Standard: 3-5.AP.V.1 Identify variables in applications where data is stored and modified to accomplish a task.

Learning Goals

I can:

- Identify a count or score as variables that can be programmed to change in a digital game.

Computer Science Standard: 3-5.AP.C.1 Create programs that include sequences, loops, and conditionals to express ideas or solve a problem.

Learning Goals

I can:

- Create a program to accomplish a task that requires a repeated sequence of commands *(i.e., loop).*
- Create a program to accomplish a task that requires execution of a portion of code when a specific condition *(i.e., sensor)* is true.

Computer Science Standard: 3-5.AP.M.1 Decompose problems into smaller, manageable subproblems to facilitate the program development process.

Learning Goals

I can:

- Identify the steps required to solve a problem.
- Code the multiple small steps to solve a problem in order one by one.
- Create command sequences *(i.e., subroutines)* that can be reused or combined to accomplish a complex task.

Computer Science Standard: 3-5.AP.M.2 Modify, remix, or incorporate portions of an existing program into one's own work to add more advanced features.

Learning Goals

I can:

- Make use of examples and text features on the assignment sheets to develop the subroutines for a multi-step program.
- Reuse programming sequences to accomplish new tasks.

Computer Science Standard: 3-5.AP.PD.1 **Use an iterative process to plan the development of a program (i.e., soliciting feedback, others' perspectives, user preferences).**

Learning Goals

I can:

- Use command cards and diagrams to discuss and plan a program with my partner.
- Review code with partner to check for programming errors before testing.
- Make and test improvements until the program works as intended.

Computer Science Standard: 3-5.AP.PD.2 **Observe intellectual property rights and give attribution when remixing programs or utilizing the work of others.**

Learning Goal

I can:

- Share ideas and programming strategies to facilitate learning.
- Credit others when their ideas and work is utilized.

Computer Science Standard: 3-5.AP.PD.3 **Test and debug (identify and fix errors) a program/app or algorithm to ensure it runs as intended.**

Learning Goal

I can:

- Establish a routine to isolate and analyze errors during testing.
- Evaluate accuracy of input values (parameters).

Computer Science Standard: 3-5.AP.PD.4 **Describe choices made during program development using code comments, presentations, and demonstrations.**

Learning Goal

I can:

- Discuss decisions throughout the process of planning, testing and refining a program with a partner.
- Use comments to document a section of code to identify and explain it to others.
- Reflect on the solutions to problems encountered and the number of trials needed to reach the programming goal.

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
Asking Questions and Defining Problems • Ask questions to clarify the constraints of solutions to a problem. **Developing and Using Models** • Develop a diagram or simple physical prototype to convey a proposed object, tool or process. **Analyzing and Interpreting Data** • Use data to evaluate and refine design solutions. **Obtaining, Evaluating, and Communicating Information** • Critique and/or communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers.	**Cause and Effect: Mechanism and Prediction** • Cause and effect relationships are routinely identified, tested, and used to explain change. **Systems and System Models** • A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. • A system can be described in terms of its components and their interactions.

CATALINA FOOTHILLS SCHOOL DISTRICT

COMPUTER SCIENCE STANDARDS FOR GRADES 3-5

CONCEPT: DATA AND ANALYSIS

Concept: Data and Analysis

Subconcepts:

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

Computer Science Standard: 3-5.DA.CVT.1a Use a digital tool to collect, organize, manipulate data.

Learning Goals

I can:

- Collect data for an investigation using a digital tool (i.e., table, spreadsheet, digital camera, cell phone, iPad app or simulation).
- Create an organizational structure (e.g., table, spreadsheet) to sort and compare the values in a data set.

Computer Science Standard: 3-5.DA.CVT.1b Present data visually through multiple representations to highlight relationships and support a claim.

Learning Goals

I can:

- Create a visual representation of a data set using a digital tool (graph, photo, video, slide show, simulation).
- Use a digital tool to generate a graphical representation (pictograph, bar graph, pie chart, line plot) of a data set.
- Choose a graphical representation (type of graph and scale) to reveal the relationship between two variables.

Computer Science Standard: 3-5.DA.IM.1 Use a computational tool to make predictions, propose cause-and-effect relationships, draw conclusions, and answer questions from the data.

Learning Goals

I can:

- Read a visual or graphical display of data to make a prediction or inference.
- Analyze a graph generated from a data set for evidence to support a claim.
- Evaluate a claim using evidence from a graphical display to draw a conclusion.
- Compare the results of a simulation to a real-world observation.

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.

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- 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.

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

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- 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
Planning and Carrying Out Investigations • Evaluate appropriate methods and tools for collecting data. **Analyzing and Interpreting Data** • Use data to evaluate and refine design solutions. **Using Mathematics and Computational Thinking** • Organize simple data sets to reveal patterns that suggest relationships. **Constructing Explanations and Designing Solutions** • Use evidence (e.g., measurements, observations, patterns) to construct a scientific explanation or design a solution to a problem. • Identify the evidence that supports particular points in an explanation.	**Patterns** • Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products. • Patterns of change can be used to make predictions. • Patterns can be used as evidence to support an explanation **Cause and Effect: Mechanism and Prediction** • Cause and effect relationships are routinely identified, tested, and used to explain change.