ENVISION 21
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SCIENCE

Academic Standards
Three Dimensions of Science
Learning Goals

June 2020

GRADE 6

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 6 OVERVIEW

By the end of **sixth grade**, students apply their understanding of how matter and energy relate to atoms, the solar system, and ecosystems. Students will develop an understanding of the nature of matter and the role of energy transformation. Students will also deepen their understanding of scales, patterns, and properties of matter, the solar system, and ecosystems. 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 sixth grade focus on helping students understand phenomena through the concepts of *patterns; scale, proportion, and quantity, systems and system models,* and *energy and matter.*

The sixth 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 sixth 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 and Matter	Students develop an understanding of forces and energy and how energy can transfer from one object to another or be converted from one form to another. They also develop an understanding of the nature of matter.
2	Earth and Space Sciences	Solar Radiation	Students develop an understanding that the atmosphere is transparent to allow energy from the Sun to pass, keeping the Earth warm.
3	Earth and Space Sciences	Movement in the Solar System	Students develop an understanding of the scale and properties of objects in the solar system and how forces (gravity) and energy cause observable patterns in the Sun-Earth-Moon system.
4	Life Science	Ecosystems	Students develop an understanding of how energy from the Sun is transferred through ecosystems.
5	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.

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.

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

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.

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

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

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 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

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.

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

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

Science and Engineering Practices	Crosscutting Concepts
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.	**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.

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

PHYSICAL SCIENCE

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 6 SCIENCE STANDARD

PHYSICAL SCIENCE: ENERGY AND MATTER

Students develop an understanding of forces and energy and how energy can transfer from one object to another or be converted from one form to another. They also develop an understanding of the nature of matter.

Science Standard: 6.P1U1.1 **Analyze and interpret data to show that changes in states of matter are caused by different rates of movement of atoms in solids, liquids, and gases (Kinetic Theory).**

Learning Goals

I can:

- Use tools to analyze and interpret data (*e.g., from investigations, demonstrations, texts, data sets, simulations, etc.*) to show the relationship between changes in states of matter and different rates of movement of atoms in solids, liquids, and gases:
    - Ask questions to frame data analysis and interpretation.
    - Represent data graphically to display relationships between the motion of molecules in a system and the kinetic energy of the particles in the system.
    - Construct a graphical representation of data (collected or simulated) to display the linear relationship between temperature and/or pressure versus phase change.
    - Interpret data to describe the relationship between temperature and/or pressure and states of matter.
    - Analyze graphs depicting rates and motion of atoms in solids, liquids, and gases to identify patterns of movement.
    - Analyze data to distinguish between causal and correlational relationships with atom movement versus phase changing.
    - Analyze the data to identify similarities and differences, including the changes in physical and chemical properties before and after the interaction.
    - Use the data to make inferences about the relationship between the motion of molecules in a system and the kinetic energy of the particles in the system.

Core Ideas

Knowing Science

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

- The differences between substances in the solid, liquid or gas state can be explained in terms of the speed and range of the movement of particles and the separation and strength of the attraction between neighboring 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.
- All the particles of a particular substance are the same and different from those of other substances. The particles are not static but move in random directions. The speed at which they move is experienced as the temperature of the material.

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.

- Careful and systematic observations and accurate descriptions of what is observed are fundamental to scientific investigation. Students come to understand the states of matter in relation to Kinetic Theory by examining data.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, or unexpected results.	**Energy and Matter: Flows, Cycles, and Conservation** • Matter is conserved because atoms are conserved in physical and chemical processes.

• Ask questions to clarify or identify evidence and the premise(s) of an argument. • Ask questions that challenge the interpretation of a data set. **Analyzing and Interpreting Data** • Construct, analyze, and interpret graphical displays of data to identify linear and nonlinear relationships. • Analyze and interpret data in order to determine similarities and differences in findings. • Distinguish between causal and correlational relationships.	• 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). **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. **Cause and Effect: Mechanism and Prediction** • Cause and effect relationships may be used to predict phenomena in natural or designed systems.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 6 SCIENCE STANDARD

PHYSICAL SCIENCE: ENERGY AND MATTER

Students develop an understanding of forces and energy and how energy can transfer from one object to another or be converted from one form to another. They also develop an understanding of the nature of matter.

Science Standard: 6.P1U1.2 **Plan and carry out an investigation to demonstrate that variations in temperature and/or pressure affect changes in state of matter.**

Learning Goals

I can:

- Observe models of atom/molecule/compound movement due to temperature and/or pressure changes to generate clarifying questions that can be tested.
- Design an investigation individually and collaboratively to demonstrate the effects of a phase changing process or system under a range of conditions *(i.e., temperature and pressure):*
    - Form scientific (testable) questions based on careful observations of phenomena and information.
    - Ask questions regarding relationships between independent and dependent variables.
    - Frame a hypothesis (a possible explanation that predicts a particular and stable outcome) based on a model or theory.
    - Design a procedure that will produce data in response to the testable question(s).
    - Identify independent and dependent variables and controls.
    - Determine the tools needed to gather data relevant to the testable question.
    - Evaluate the accuracy of various methods for collecting data.
    - Determine how measurements will be recorded.
    - Determine the amount of data needed to produce reliable measurements of the effects of temperature and pressure changes on states of matter.
- Conduct an investigation individually and collaboratively to demonstrate the effects of a phase changing process or system under a range of conditions *(i.e., temperature and pressure):*
    - Follow the procedure with precision.
    - Make observations about how variations in temperature and pressure affect change in states of matter.
    - Collect data and generate evidence to answer the testable question.
    - Evaluate and revise the experimental design to ensure that the data generated can meet the goals of the experiment.
    - Use the data from the investigation to make and support a claim about how variations in temperature and pressure affect changes in states of matter.

Core Ideas

Knowing Science

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

- The differences between substances in the solid, liquid or gas state can be explained in terms of the speed and range of the movement of particles and the separation and strength of the attraction between neighboring 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.

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 design investigations to explore phenomena pertaining to changes in states of matter. The design of the investigation and the procedures through which it is carried out are critical to ensuring that the data collected will provide evidence in response to the investigative question.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, or unexpected results. **Planning and Carrying Out Investigations** • Conduct an investigation and evaluate and revise the experimental design to ensure that the data generated can meet the goals of the experiment. • Design an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how much data are needed to support their claim. • Evaluate the accuracy of various methods for collecting data. • Collect data and generate evidence to answer scientific questions or test design solutions under a range of conditions.	**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. **Energy and Matter: Flows, Cycles, and Conservation** • 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.

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 6 SCIENCE STANDARD
PHYSICAL SCIENCE: ENERGY AND MATTER
Students develop an understanding of forces and energy and how energy can transfer from one object to another or be converted from one form to another. They also develop an understanding of the nature of matter.

Science Standard: 6.P1U1.3 **Develop and use models to represent that matter is made up of smaller particles called atoms.**

Learning Goals

I can:

- Develop models *(e.g., diagrams, drawings, physical replicas, mathematical representations, analogies, and/or computer simulations)* that represent how matter is made up of smaller particles called atoms:
    - Represent that substances (matter) can be divided into smaller particles called atoms, and atoms combine in patterns to make up all substances.
    - Represent that matter in solid, liquid, and gas forms can be divided into smaller particles called atoms.
    - Identify limitations of the model.
    - Modify the model, based on the limitations, to improve its representation of how matter is made up of smaller particles called atoms.
- Use models to show how matter is made up of smaller particles called atoms:
    - Use models to demonstrate that substances (matter) can be divided into smaller particles called atoms, and atoms combine in patterns to make up all substances.
    - Use models to support the explanation that all things are made up of atoms.
    - Use models to support the explanation that when substances are divided into smaller particles, they remain the same substance.

Core Ideas

Knowing Science

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

- If a substance could be divided into smaller and smaller pieces it would be found to be made of very, very small particles, smaller than can be seen even with a microscope. These particles are not in a substance; they are the substance.
- 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.

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.

- To help explain observations, scientists create models to represent what they think may be happening. Sometimes they are physical models while other models are theoretical or more abstract. Because atoms are too small to be observed directly, students use models to better understand their structures.

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.	**Patterns** • Macroscopic patterns are related to the nature of microscopic and atomic-level structure. **Systems and System Models**

• Modify models—based on their limitations—to increase detail or clarity, or to explore what will happen if a component is changed.	• Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. **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 6 SCIENCE STANDARD
PHYSICAL SCIENCE: ENERGY AND MATTER
Students develop an understanding of forces and energy and how energy can transfer from one object to another or be converted from one form to another. They also develop an understanding of the nature of matter.

Science Standard 6.P2U1.4 Develop and use a model to predict how forces act on objects at a distance.

Learning Goals

I can:

- Develop a model *(e.g., diagram, drawing, physical replica, mathematical representation, analogy, and/or computer simulation)* to represent how forces act on objects at a distance:
  - Represent how gravitational force acts upon objects at a distance *(i.e., larger planets cause smaller objects like moons to orbit them).*
  - Develop a model to increase detail or clarity, or to explore what will happen when forces act upon objects at a distance.
  - Identify limitations of the model.
  - Modify the model, based on the limitations, to improve its representation of forces acting upon objects at a distance.
- Use a model to predict gravitational force between two masses based on the size of objects *(i.e., Sun-Earth-Moon system).*

Core Ideas

Knowing Science

P2: Objects can affect other objects at a distance.

- Gravity is the universal attraction between all objects, however large or small, although it is only apparent when one of the objects is very large. This gravitational attraction keeps the planets in orbit around the Sun, the Moon round the Earth and their moons round other planets. The effect of gravity on an object on the Moon is less than that on Earth because the Moon has less mass than the Earth, so a person on the Moon weighs less than on Earth even though their mass is the same. The pull of the Earth on the Moon keeps it orbiting the Earth while the pull of the Moon on the Earth gives rise to tides.
- Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—for example, Earth and the sun. Long-range gravitational interactions govern the evolution and maintenance of large-scale systems in space, such as galaxies or the solar system, and determine the patterns of motion within those structures. Forces that act at a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object (a ball, a charged object, or a magnet, respectively).

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.

- To help explain observations, scientists create models to represent what they think may be happening. Sometimes they are physical models while other models are theoretical or more abstract. Distant forces can be difficult to conceptualize because they are often unseen. Modeling helps students make sense of this phenomena and allows them to make scientific predictions.

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.	**Systems and Systems Models** • Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.

• 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.	• 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. **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. • Phenomena that can be observed at one scale may not be observable at another scale.

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CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 6 SCIENCE STANDARD

PHYSICAL SCIENCE: ENERGY AND MATTER

Students will explore how cause and effect take place within and between a wide variety of force and motion systems from forces on individual objects to the forces that shape our Earth.

Science Standard 7.P3U1.3 Plan and carry out an investigation that can support an evidence-based explanation of how objects on Earth are affected by gravitational force.

Learning Goals

I can:

- Design an investigation individually and collaboratively to explore how objects on Earth are affected by gravitational force:
  - Form scientific (testable) questions based on careful observations of phenomena and information.
  - Ask questions regarding relationships between independent and dependent variables.
  - Frame a hypothesis (a possible explanation that predicts a particular and stable outcome) based on a model or theory.
  - Design a procedure that will produce data in response to the testable question(s).
  - Identify independent and dependent variables and controls.
  - Determine the tools needed to gather data relevant to the testable question.
  - Evaluate the accuracy of various methods for collecting data.
  - Determine how measurements will be recorded.
  - Determine the amount of data needed to produce reliable measurements of the effects of gravity on objects on Earth.
- Conduct an investigation individually and collaboratively to demonstrate how objects on Earth are affected by gravitational force:
  - Follow the procedure with precision.
  - Make observations about how objects on Earth are affected by gravitational force.
  - Collect data and generate evidence to answer the testable question.
  - Evaluate and revise the experimental design to ensure that the data generated can meet the goals of the experiment.

Core Ideas

Knowing Science

P3: Changing the movement of an object requires a net force to be acting on it.

- Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass. Forces that act at a distance (gravitational) can be explained by force fields that extend through space and can be mapped by their effect on a test object (e.g., a ball).
- On Earth, gravity results in everything being pulled down towards the center of the Earth. This downward attraction is called the weight of an object. The object pulls the Earth as much as the Earth pulls the object, but because the Earth's mass is much bigger, people observe the resulting motion of the object, not of the Earth.

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 investigate their questions about gravitational force and use the evidence from their investigation to better understand how gravity affects objects on Earth. The design of the investigation and the procedures through which it is carried out are critical to ensuring that the data collected will provide evidence in response to the investigative question.

Science and Engineering Practices	Crosscutting Concepts
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 determine relationships between independent and dependent variables. **Planning and Carrying Out Investigations** • Conduct an investigation and evaluate and revise the experimental design to ensure that the data generated can meet the goals of the experiment. • Design an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how much data are needed to support their claim. • Evaluate the accuracy of various methods for collecting data. • Collect data and generate evidence to answer scientific questions or test design solutions under a range of conditions. **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.	**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.

EARTH AND SPACE SCIENCES

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 6 SCIENCE STANDARD
EARTH AND SPACE SCIENCES: SOLAR RADIATION
Students develop an understanding that the atmosphere is transparent to allow energy from the Sun to pass, keeping the Earth warm.

Science Standard: 6.E1U1.6 Investigate and construct an explanation demonstrating that radiation from the Sun provides energy and is absorbed to warm the Earth's surface and atmosphere.

Learning Goals

I can:

- Ask questions about the relationship between the Sun's radiation, energy, and the Earth's surface and atmosphere:
  - Ask testable questions that arise from careful observation of phenomena or models.
  - Ask questions about relationships between variables.
- Investigate how radiation from the Sun provides energy and is absorbed to warm the Earth's surface and atmosphere *(e.g., through experimentation, texts, media, demonstrations):*
  - Frame a hypothesis (a possible explanation that predicts a particular and stable outcome) based on a model or theory.
  - Gather information from multiple texts in response to the investigative question(s).
  - Collect data and generate evidence in response to the investigative question(s).
  - Identify patterns that provide evidence for an explanation of the phenomenon.
- Construct an explanation based on evidence from the investigation to demonstrate that radiation from the Sun provides energy and is absorbed to warm the Earth's surface and atmosphere:
  - Explain relationships between variables and the control.
  - Explain the relationship between the Earth's atmosphere and surface and the Sun's radiation.
  - Explain the greenhouse effect.
  - Explain the role of greenhouse gases in regulating Earth's average surface temperature.

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.

- The layer of air at the Earth's surface is transparent to most of the radiation coming from the Sun, which passes through.
- The radiation that is absorbed at its surface is the Earth's external source of energy. The radiation from the Sun absorbed by the Earth warms the surface which then emits radiation of longer wavelength (infrared) that does not pass through the atmosphere but is absorbed by it, keeping the Earth warm. This is called the greenhouse effect because it is similar to the way the inside of a greenhouse is heated by the Sun. Greenhouse gases in the atmosphere absorb and retain the energy radiated from land and ocean surfaces, thereby regulating Earth's average surface temperature and keeping it habitable.

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 investigate the relationship between the Sun's radiation and the Earth's surface and atmosphere. Students examine evidence to better understand how the Earth uses energy from the Sun to remain habitable, and they select evidence to develop scientific explanations.

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 determine relationships between independent and dependent variables. **Planning and Carrying Out Investigations** • Conduct an investigation and evaluate and revise the experimental design to ensure that the data generated can meet the goals of the experiment. • Design an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how much data are needed to support their claim. • Collect data and generate evidence to answer scientific questions or test design solutions under a range of conditions. **Constructing Explanations and Designing Solutions** • Construct explanations for either qualitative or quantitative relationships between variables. • 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. • Apply scientific knowledge and evidence to explain real-world phenomena, examples, or events.	**Systems and System Models** • Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. **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). • The transfer of energy can be tracked as energy flows through a designed or natural system. **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.

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 6 SCIENCE STANDARD
EARTH AND SPACE SCIENCES: MOVEMENT IN THE SOLAR SYSTEM
Students develop an understanding of the scale and properties of objects in the solar system and how forces (gravity) and energy cause observable patterns in the Sun-Earth-Moon system.

Science Standard: 6.E2U1.7 **Use ratios and proportions to analyze and interpret data related to scale, properties, and relationships among objects in our solar system**

Learning Goals

I can:

- Use tools to analyze and interpret data *(e.g., from investigations, demonstrations, texts, data sets, simulations, etc.)* related to scale, properties, and relationships among objects in our solar system:
  - Ask questions to frame data analysis and interpretation.
  - Use ratios and proportions to compare the relative size and distance of objects in our solar system:
    - use scale to determine how large or small the planets are compared to Earth.
    - use scale to show the relative distances between planets and between the planets and the Sun.
  - Organize and interpret provided data on solar system objects *(e.g., surface features, object layers, orbital radii).*
  - Describe similarities and differences among solar system objects by describing patterns of features of those objects at different scales.
  - Construct a graphical display of data to identify the relationship between the gravitational pull of the Sun and the distances of the planets.
  - Use ratios and proportions to interpret patterns and trends in data to explain the relationship between the gravitational pull of the Sun and the distances of the planets.

Core Ideas

Knowing Science

E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.

- The Earth is one of eight (so far known) planets in our solar system which, along with many other smaller bodies, orbit the Sun, in roughly circular paths, at different distances from the Sun and taking different times to complete an orbit. The distances between these bodies are huge – Neptune is 4.5 billion km from the Sun, 30 times further than Earth.
- As seen from Earth, planets move in relation to the positions of the stars which appear fixed relative to each other. The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.

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 mathematical thinking to make sense of the size and scope of our solar system. They analyze and interpret data to develop their understanding of the distances between planets, their moons, and asteroids, and the relationship between the Sun's gravitational pull and the properties of the objects in the solar system.

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 that challenge the interpretation of a data set. **Analyzing and Interpreting Data**	**Patterns** • Patterns can be used to identify cause and effect relationships. • Graphs, charts, and images can be used to identify patterns in data. **Scale, Proportion, and Quantity** • Time, space, and energy phenomena can be observed at various scales using models

• Construct, analyze, and interpret graphical displays of data to identify linear and nonlinear relationships. • 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. **Using Mathematics and Computational Thinking** • Apply concepts of ratio, rate, percent, basic operations, and simple algebra to scientific and engineering questions and problems.	to study systems that are too large or too small. • The observed function of natural and designed systems may change with scale. • 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. **Cause and Effect: Mechanism and Prediction** • Cause and effect relationships may be used to predict phenomena in natural or designed systems.

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 6 SCIENCE STANDARD
EARTH AND SPACE SCIENCES: MOVEMENT IN THE SOLAR SYSTEM
Students develop an understanding of the scale and properties of objects in the solar system and how forces (gravity) and energy cause observable patterns in the Sun-Earth-Moon system.

Science Standard: 6.E2U1.8 Develop and use models to explain how constellations and other night sky patterns appear to move due to Earth's rotation and revolution.

Learning Goals

I can:

- Develop models *(e.g., diagrams, drawings, physical replicas, mathematical representations, analogies, and/or computer simulations)* that represent the apparent motion of constellations and other night sky patterns due to Earth's rotation and revolution:
  - Represent the Earth's rotation and revolution relative to the apparent motion of constellations and other night sky patterns.
  - Develop a model that allows for manipulation and testing of how night sky patterns appear to move.
  - Identify limitations of the model.
  - Modify the model, based on the limitations, to improve its representation of the apparent motion of constellations and other night sky patterns due to Earth's rotation and revolution.
- Use models to explain and predict the apparent motion of constellations and other night sky patterns due to Earth's rotation and revolution:
  - Use models to explain why constellations and other objects in the sky appear to move in relation to the tilt of the Earth's axis, rotation, and revolution.
  - Use models to explain why certain groups of stars disappear from the visible night sky depending on the time of year and the viewer's location on Earth.
  - Apply scientific knowledge to explain the apparent motion of constellations and other night sky patterns.

Core Ideas

Knowing Science

E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.

- The Earth rotates about an axis lying north to south and this motion makes it appear that the Sun, Moon and stars are moving round the Earth. This rotation causes day and night as parts of the Earth's surface turn to face towards or away from the Sun. It takes a year for the Earth to pass round the Sun.

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 the phenomenon of apparent motion in the night sky as they deepen their understanding of Earth's properties. Because stars, planets, and moons are so large, it is difficult to conceptualize their relationships to one another; modeling helps students make sense of and explain the phenomena they examine.

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	**Patterns** • Patterns can be used to identify cause and effect relationships. **Cause and Effect: Mechanism and Prediction** • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

what will happen if a component is changed. • Use and develop models of simple systems with uncertain and less predictable factors. • Develop a model that allows for manipulation and testing of a proposed object, tool, process or system. **Constructing Explanations and Designing Solutions** • Apply scientific knowledge and evidence to explain real-world phenomena, examples, or events. • Construct explanations from models or representations.	• Cause and effect relationships may be used to predict phenomena in natural or designed systems. **System 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. **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 6 SCIENCE STANDARD	
EARTH AND SPACE SCIENCES: MOVEMENT IN THE SOLAR SYSTEM	
Students develop an understanding of the scale and properties of objects in the solar system and how forces (gravity) and energy cause observable patterns in the Sun-Earth-Moon system.	

Science Standard: 6.E2U1.9 Develop and use models to construct an explanation of how eclipses, moon phases, and tides occur within the Sun-Earth-Moon system.
Learning Goals
I can:
• Observe phenomena pertaining to eclipses, moon phases, and tides.
• Develop models *(e.g., diagrams, drawings, physical replicas, mathematical representations, analogies, and/or computer simulations)* that represent the occurrence of eclipses, moon phases, and tides within the Sun-Earth-Moon system:
  ○ Represent solar and lunar eclipses in terms of the position of the Moon, Earth, and Sun.
  ○ Represent the phases of the Moon in terms of the position of the Moon, Earth, and Sun.
  ○ Represent the relationship between the Moon's gravitational pull and Earth's tides.
  ○ Develop a model that allows for manipulation and testing of how eclipses, moon phases, and tides occur.
  ○ Identify limitations of models.
  ○ Modify the models, based on the limitations, to improve their representation of eclipses, moon phases, and tides within the Sun-Earth-Moon system.
• Use models to explain and predict how eclipses, moon phases, and tides occur within the Sun-Earth-Moon system:
  ○ Use models to collect data about how interactions between the Earth, Moon, and Sun cause eclipses.
  ○ Use evidence from models to explain how interactions between the Earth, Moon, and Sun cause portions of the Sun or Moon to become blocked or shadowed.
  ○ Use models to collect data about how interactions between the Earth, Moon, and Sun cause the phases of the Moon.
  ○ Use evidence from models to explain how interactions between the Earth, Moon, and Sun cause us to see different portions of the Moon illuminated.
  ○ Use models to collect data about how interactions between the Earth, Moon, and Sun cause tides.
  ○ Use evidence from models to explain how interactions between the Earth, Moon and Sun cause water levels on Earth to rise and fall in predictable patterns.	

Core Ideas	
Knowing Science E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe. • The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. This model of the solar system can explain tides, eclipses of the sun and the moon, and the motion of the planets in the sky relative to the stars. Earth's spin axis is fixed in direction over the short term but tilted relative to its orbit around the sun. **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 explore interactions among bodies in our solar system, using models to better understand the phenomena of eclipses, moon phases, and tides.	
Science and Engineering Practices	**Crosscutting Concepts**
Developing and Using Models	**Patterns**

• 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. • Develop a model that allows for manipulation and testing of a proposed object, tool, process or system.	• Patterns can be used to identify cause and effect relationships. **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. **System 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 6 SCIENCE STANDARD
EARTH AND SPACE SCIENCES: MOVEMENT IN THE SOLAR SYSTEM
Students develop an understanding of the scale and properties of objects in the solar system and how forces (gravity) and energy cause observable patterns in the Sun-Earth-Moon system.

Science Standard: 6.E2U1.10 Use a model to show how the tilt of Earth's axis causes variations in the length of the day and gives rise to seasons.

Learning Goals

- Use a model *(e.g., diagram, drawing, physical replica, mathematical representation, analogy, and/or computer simulation)* to show how the tile of Earth's axis causes variations in the length of the day and gives rise to seasons:
  - Utilize a model to collect data about how the tilt of the Earth is responsible for the seasons in the different hemispheres.
  - Use evidence from a model to display the relationship between the tilt of Earth's axis, temperature, and the seasons.
  - Use evidence from a model to demonstrate how interactions between the Earth and the Sun cause seasons.
  - Use evidence from a model to demonstrate how the tilt of Earth's axis causes variations in day length.

Core Ideas

Knowing Science

E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.

- The Earth's axis is tilted relative to the plane of its orbit around the Sun so that the length of day varies with position on the Earth's surface and time of the year, giving rise to the seasons.
- Earth's spin axis is fixed in direction over the short term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.

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 understand and explain the relationship between the Earth's axis, the length of the day, and seasons.

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. • 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.	**Patterns** • Patterns can be used to identify cause and effect relationships. **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. **System 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. **Stability and Change** • Small changes in one part of a system might cause large changes in another part.

LIFE SCIENCE

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 6 SCIENCE STANDARD
LIFE SCIENCE: ECOSYSTEMS
Students develop an understanding of how energy from the Sun is transferred through ecosystems.

Science Standard: 6.L2U3.11 Use evidence to construct an argument regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems.

Learning Goals

I can:

- Use scientific evidence to construct an oral and/or written argument:
  - Make an evidence-based claim about the impact of human activities on the environment.
  - Analyze positive and negative effects of human activities on the competition for energy and resources in an ecosystem.
  - Provide empirical evidence to support the claim.
  - Apply scientific reasoning to support claims and explain evidence.
- Provide and receive critiques on scientific arguments by citing relevant evidence and posing and responding to questions.

Core Ideas

Knowing Science

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

- In any given ecosystem there is competition among species for the energy resources and the materials they need to live. The persistence of an ecosystem depends on the continued availability in the environment of these energy resources and materials.
- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of many other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Typically, as human populations and per capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Using Science

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

- Students explore the impact of human activities on the environment, engaging with the positive and negative implications with regard to the use of energy and resources. Because of the various perspectives involved in this issue, it will be important for students to evaluate evidence and apply scientific reasoning as they construct their argument.

Science and Engineering Practices

Engaging in Argument from Evidence

- 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.

Crosscutting Concepts

Patterns

- Patterns can be used to identify cause and effect relationships.

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.

Cause and Effect: Mechanism and Prediction

• 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.	• 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.

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 6 SCIENCE STANDARD
LIFE SCIENCE: ECOSYSTEMS
Students develop an understanding of how energy from the Sun is transferred through ecosystems.

Science Standard: 6.L2U3.12 **Engage in argument from evidence to support a claim about the factors that cause species to change and how humans can impact those factors.**

Learning Goals
I can:

- Evaluate arguments regarding factors that cause species to change and how humans can impact those factors:
    - Compare two arguments and analyze whether they emphasize similar or different evidence and/or interpretations of facts.
    - Provide and receive critiques on scientific arguments by citing relevant evidence and posing and responding to questions.
    - Use scientific evidence to refute arguments about the human impact on factors that can cause a species to change over time.
- Use scientific evidence to construct an oral and/or written argument:
    - Make an evidence-based claim about the human impact on factors that can cause a species to change over time.
    - Provide empirical evidence to support the claim.
    - Apply scientific reasoning to support claims and explain evidence.
- Provide and receive critiques on scientific arguments by citing relevant evidence and posing and responding to questions.

Core Ideas

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

- A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.
- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of many other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Typically, as human populations and per capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

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

- Students explore the impact of human activities on the environment, engaging with the human impact on factors leading to changes in species. Because of the various perspectives involved in this issue, it will be important for students to evaluate evidence and apply scientific reasoning as they construct their argument.

Science and Engineering Practices	Crosscutting Concepts
Engaging in Argument from Evidence • 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	**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. **Cause and Effect: Mechanism and Prediction**

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.	• Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 6 SCIENCE STANDARD
LIFE SCIENCE: ECOSYSTEMS
Students develop an understanding of how energy from the Sun is transferred through ecosystems.

Science Standard: 6.L2U1.13 Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.

Learning Goals

I can:

- Develop models *(e.g., diagrams, drawings, physical replicas, mathematical representations, analogies, and/or computer simulations)* to demonstrate the interdependence of organisms and their environment:
  - Represent relationships among organisms and multiple factors, including abiotic and biotic, in an ecosystem.
  - Represent relationships among producers, consumers, and decomposers.
  - Represent competition among species for energy and resources needed for survival.
  - Represent predatory and mutually beneficial interactions among organisms.
  - Identify limitations of models.
  - Modify the models, based on the limitations, to improve their representation of the interdependence of organisms and their environment.
- Use models *(e.g., diagrams, drawings, physical replicas, mathematical representations, analogies, and/or computer simulations)* to demonstrate the interdependence of organisms and their environment:
  - Use models to demonstrate the overall health of an ecosystem based on the interdependencies among organisms and their environment.
  - Use models to explain the relationships between living and nonliving parts of ecosystems.
  - Use models to explain the relationships among producers, consumers, and decomposers in an ecosystem.
  - Use models to explain the types of interactions in an ecosystem, including competitive, predatory, and mutually beneficial interactions.

Core Ideas

Knowing Science

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

- Interdependent organisms living together in particular environmental conditions form an ecosystem. In a stable ecosystem there are producers of food (plants), consumers (animals) and decomposers, (bacteria and fungi which feed on waste products and dead organisms). The decomposers produce materials that help plants to grow, so the molecules in the organisms are constantly re-used. The persistence of an ecosystem depends on the continued availability in the environment of these energy resources and materials.
- Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving factors. Growth of organisms and population increases are limited by access to resources.
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. Predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

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 roles and relationships among biotic and abiotic factors in an ecosystem. The evidence generated by the models helps students make meaning of interdependencies within the ecosystem.

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. • Modify models—based on their limitations—to increase detail or clarity, or to explore what will happen if a component is changed.	**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. **Cause and Effect: Mechanism and Prediction** • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. **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—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 6 SCIENCE STANDARD

LIFE SCIENCE: ECOSYSTEMS

Students develop an understanding of how energy from the Sun is transferred through ecosystems.

Science Standard: 6.L2U1.14 Construct a model that shows the cycling of matter and flow of energy in ecosystems.

Learning Goals

I can:

- Develop a model (*e.g., diagram, drawing, physical replica, mathematical representation, analogy, and/or computer simulation*) to show the cycling of matter and flow of energy in ecosystems:
  - Represent how energy resources flow through an ecosystem and that energy starts with the Sun.
  - Represent how energy changes form as it flows through the ecosystem.
  - Represent how nutrient cycles sustain ecosystems.
  - Represent energy use and energy loss at various points in the cycle.
  - Represent relationships among producers, levels of consumers, and decomposers.
  - Identify limitations of models in depicting natural phenomena.
  - Modify the models, based on the limitations, to improve their representation of the cycling of matter and flow of energy in ecosystems.

Core Ideas

Knowing Science

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

- Energy resources pass through the ecosystem. When food is used by organisms for life processes some energy is dissipated as heat but is replaced in the ecosystem by radiation from the Sun being used to produce plant food.
- The persistence of an ecosystem depends on the continued availability in the environment of these energy resources and materials. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life.

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 explore the cycling of matter and flow of energy in ecosystems through models that display relationships among the parts of the system.

Science and Engineering Practices

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.

Crosscutting Concepts

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.
- 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. • 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.

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
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
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.

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.