ENVISION 21

DEEP LEARNING • CFSD

SCIENCE

Academic Standards
Three Dimensions of Science
Learning Goals

June 2020

GRADE 7

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 7 OVERVIEW

By the end of **seventh grade**, students will explore how forces cause changes in motion and how energy is transferred in geologic, atmospheric, and environmental processes. Students investigate force and motion in a wide variety of systems, model how heat energy drives cycles in weather and climate, and explain the structure and function of cells. 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 seventh grade focus on helping students understand phenomena through the concepts of *patterns; scale, cause and effect,* and *structure and function.*

The seventh 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 seventh 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.

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<tr><th></th><th>Area of Science</th><th>Title</th><th>Content</th></tr>
<tr><td>1</td><td>Physical Science</td><td>Forces at a Distance</td><td rowspan="2">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.</td></tr>
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<tr><td>6</td><td>Computer Science</td><td>Computational Thinking & Data and Analysis</td><td>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.</td></tr>
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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.

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.

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.

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 7	
PHYSICAL SCIENCE: FORCES AT A DISTANCE	
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.P2U1.1 Collect and analyze data demonstrating how electromagnetic forces can be attractive or repulsive and can vary in strength.

Learning Goals

I can:

- Collect data (*e.g., from investigations, models demonstrations, texts, data sets, simulations, etc.*):
  - Ask (a) scientific question(s) about electromagnetic forces to frame data collection.
  - Determine what tools are needed to gather data.
  - Determine how measurements will be recorded.
  - Determine how much data will be needed to answer the question(s).
  - Collect and record data to answer scientific questions.
  - Evaluate the accuracy of various methods for collecting data.
- Use tools to analyze and interpret data (*e.g., from investigations, demonstrations, texts, data sets, simulations, etc.*) to show how electromagnetic forces can be attractive or repulsive and can vary in strength:
  - Construct a graphical representation of data to display the linear relationship between strength and size of an electromagnetic field.
  - Use trends and patterns in data to describe the relationship between strength and size of an electromagnetic field.
  - Construct a graphical representation of data to display the relationship between distance and magnetic strength.
  - Use trends and patterns in data to explain the relationship between distance and magnetic strength.
  - Analyze the data to identify similarities and differences between electromagnetic forces based on size, distance, and magnitude or strength.
  - Analyze the data to identify cause and effect relationships between variables in an electromagnetic system.
  - Consider limitations of data analysis *(e.g., measurement error),* and seek to improve precision and accuracy of data with better technological tools and methods *(e.g., multiple trials).*

Core Ideas

Knowing Science

P2: Objects can affect other objects at a distance.

- Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.

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 electromagnetic forces by gathering and analyzing data in response to their scientific questions.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems	**Patterns**

• Ask questions that arise from careful observation of phenomena, models, or unexpected results. **Analyzing and Interpreting Data** • Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible. • Construct, analyze, and interpret graphical displays of data to identify linear and nonlinear relationships. • Consider limitations of data analysis (e.g., measurement error), and seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials). • Analyze and interpret data in order to determine similarities and differences in findings.	• 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.

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 7

PHYSICAL SCIENCE: FORCES AT A DISTANCE

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.P2U1.2 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)* that represents forces acting on objects at a distance:
  - Represent attractive forces that act upon objects at a distance (*i.e., electric, magnetic*).
  - Identify limitations of the model.
  - Modify the model, based on the limitations, to improve its representation of how forces act on objects at a distance.
- Use a model to predict how forces act on objects at a distance:
  - Use models to predict phenomena in electric and magnetic systems.

Core Ideas

Knowing Science

P2: Objects can affect other objects at a distance.

- The 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). Gravitational forces are always attractive.

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.

- Since it is difficult to directly observe how forces act upon objects at a distance, students use models to investigate this phenomena and make predictions.

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.
- Modify models—based on their limitations—to increase detail or clarity, or to explore what will happen if a component is changed.
- Develop a model that allows for manipulation and testing of a proposed object, tool, process or system.

Crosscutting Concepts

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.

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 7
PHYSICAL SCIENCE: FORCES AT A DISTANCE
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.P4U2.5 **Analyze how humans use technology to store (potential) and/or use (kinetic) energy.**

Learning Goals

I can:

- Analyze how people use technology to store, convert, and/or utilize energy (*e.g., batteries connected to a circuit to store potential energy and transfer it back to kinetic energy*):
  - Ask questions to frame the analysis.
  - Use information from multiple sources to analyze how humans use technology to store and use energy.
  - Describe the mechanisms, advantages, and limitations of different technologies used to store and/or use 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.

- The chemicals in the cells of a battery store energy which is released when the battery is connected so that an electric current flows, transferring energy to other components in the circuit and on to the environment.
- Motion energy is properly called kinetic energy.
- A system of objects may also contain stored (potential) energy, depending on their relative positions.

Using Science

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

- Students explore how humans use technology to solve problems related to energy storage and use.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, or unexpected results. **Analyzing and Interpreting Data** • Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success. **Obtaining, Evaluating, and Communicating Information** • Gather, read, and communicate information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used.	**Energy and Matter** • Matter is conserved because atoms are conserved in physical and chemical processes. • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. • Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). • The transfer of energy can be tracked as energy flows through a designed or natural system. **Systems and System Models: Flows, Cycles, and Conservation**

	• 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.

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 7

PHYSICAL SCIENCE: NEWTON'S LAWS

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.P3U1.4 Use non-algebraic mathematics and computational thinking to explain Newton's laws of motion.

Learning Goals

I can:

- Apply computational thinking to explain Newton's laws of motion:
  - Use data to represent *(e.g., diagram)* the cause and effect relationships between total forces *(i.e., balanced and unbalanced)* acting on an object *(i.e., Newton's first and second law).*
  - Explain the patterns in proportional relationships among force, mass, and acceleration *(i.e., Newton's third law).*
  - Explain action and reaction force pairs and represent them visually *(e.g., force diagrams).*
- Use mathematical arguments to calculate and describe the sum of the forces acting on an object and support the conclusion of the resulting motion *(i.e., Newton's laws of motion).*

Core Ideas

Knowing Science

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

- For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first but in the opposite direction.
- The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change.
- The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. Forces on an object can also change its shape or orientation.

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 explore Newton's laws. They use mathematical evidence to explain predictable patterns of motion.

Science and Engineering Practices	Crosscutting Concepts
Using Mathematics and Computational Thinking • Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends. • Create algorithms (a series of ordered steps) to solve a problem. • Use mathematical arguments to describe and support scientific conclusions and design solutions.	**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 7
EARTH AND SPACE SCIENCES: EARTH SYSTEMS
Students develop an understanding of the patterns of energy flow along with matter cycling within and among Earth's systems.

Science Standard: 7.E1U1.5 Construct a model that shows the cycling of matter and flow of energy between and among the atmosphere, hydrosphere, and geosphere.

Learning Goals

I can:

- Develop a model *(e.g., diagram, drawing, physical replica, mathematical representation, analogy, and/or computer simulation)* that shows the cycling of matter and flow of energy in the atmosphere, hydrosphere, and geosphere:
    - Represent how energy flows through Earth's spheres.
    - Represent interactions among the atmosphere, hydrosphere, and geosphere.
    - Represent the physical and chemical changes that result from energy flows and matter cycles.
    - Represent the role of temperature in the cycling of matter and flow of energy in Earth's spheres.
    - Use a model that allows for manipulation and testing of matter and flow of energy in the atmosphere, hydrosphere, and geosphere.
    - Evaluate limitations of models in representing the cycling of matter and flow of energy in Earth's atmosphere, hydrosphere, and geosphere.

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 processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. Radioactive decay of material inside the Earth since it was formed is its internal source of energy.
- Radiation from the Sun provides the energy that enables plants containing chlorophyll to make glucose through the process of photosynthesis. The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. 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 use models to explore the complex interactions among Earth's atmosphere, hydrosphere, and geosphere.

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.	**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. **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. **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 7
EARTH AND SPACE SCIENCES: EARTH SYSTEMS
Students develop an understanding of the patterns of energy flow along with matter cycling within and among Earth's systems.

Science Standard: 8.E1U1.8 Construct and support an argument about how human consumption of limited resources impacts the biosphere.

Learning Goals

I can:

- Construct, use, and present an oral and/or written argument about the impact of human consumption of limited resources on the biosphere:
    - Make an evidence-based claim that evaluates the implications of human consumption of limited resources.
    - Compare multiple viewpoints to evaluate how human consumption of limited resources impacts the biosphere.
    - Support and refute claims with empirical evidence and scientific reasoning.
    - Respectfully provide and receive critiques on scientific arguments by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail.
    - Determine whether the evidence is sufficient to determine causal relationships between consumption of natural resources and the impact on the biosphere.

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.

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing extinction of many other species. But changes to Earth's environment 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 perspectives about the impact of human consumption of natural resources. In the process, they will acknowledge the various positive and negative implications of human activities.

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

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

CATALINA FOOTHILLS SCHOOL DISTRICT

GRADE 7

EARTH AND SPACE SCIENCES: EARTH SYSTEMS

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

Science Standard: 7.E1U2.7 Analyze and interpret data to construct an explanation for how advances in technology have improved weather prediction.

Learning Goals

I can:

- Use tools to analyze and interpret data (*e.g., from investigations, demonstrations, texts, data sets, simulations, etc.*) regarding advances in weather prediction technology:
  - Ask questions about advances in technology in weather prediction to frame the data analysis and interpretation.
  - Construct a graphical representation to identify relationships between weather phenomena and weather prediction.
  - Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize weather data.
  - Analyze data from graphical displays to identify anomalies and/or trends in weather phenomena and prediction.
  - Interpret patterns and trends in weather phenomena and weather prediction data to identify cause and effect relationships.
  - Analyze and interpret data to compare weather prediction with actual weather phenomena.
  - Analyze and interpret data to determine the correlation between improvement in technology and improvement in forecast accuracy.
  - Analyze the reliability of technology tools for weather prediction.
  - Consider limitations of data analysis *(e.g., measurement error),* and seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials).
- Use data to construct an explanation for how advances in technology have improved weather prediction:
  - Apply scientific knowledge and evidence to explain the relationship between weather phenomena and weather prediction.
  - Explain limitations to weather prediction.
  - Explain the role of weather patterns and probability in weather prediction.
  - Explain how technology has advanced to improve weather prediction.
  - Apply scientific reasoning to show why the data are adequate for the explanation.

Core Ideas

Knowing Science

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

- Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. Because these patterns are so complex, weather can be predicted only probabilistically.
- The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.
- Some natural hazards are preceded by phenomena that allow for reliable predictions. Mapping the history of natural hazards in a region, combined with an understanding of related geological forces can help forecast the locations and likelihoods of future events.

Using Science

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

- Students engage in data analysis to evaluate technological tools for weather prediction. Students explore how humanity's growing understanding of weather patterns contributes to the development of more reliable tools for weather prediction.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, or unexpected results. **Analyzing and Interpreting Data** • Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible. • Analyze and interpret data in order to determine similarities and differences in findings. **Constructing Explanations and Designing Solutions** • 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. • Graphs, charts, and images can be used to identify patterns in data. • Patterns can be used to identify cause and effect relationships. **Cause and Effect: Mechanism and Prediction** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. **Stability and Change** • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. • Small changes in one part of a system might cause large changes in another part. • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

LIFE SCIENCE

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 7
LIFE SCIENCE: CELLS: STRUCTURE AND FUNCTION
Students develop an understanding of the structure and function of cells.

Science Standard: 7.L1U1.8 Obtain, evaluate, and communicate information to provide evidence that all living things are made of cells, cells come from existing cells, and cells are the basic structural and functional unit of all living things.

Learning Goals

I can:

- Obtain and evaluate evidence of the cell theory:
  - Ask questions to frame the collection of information about the cell theory.
  - Select relevant evidence that supports the cell theory from multiple appropriate sources *(e.g., scientific texts, media, models, investigations, demonstrations, etc.).*
  - Assess the credibility, accuracy, and possible bias of each publication and methods used.
  - Read critically using scientific knowledge and reasoning to evaluate data, hypotheses, and conclusions that appear in scientific or technical texts in light competing information or accounts.
  - Provide an accurate summary of a scientific text distinct from prior knowledge or opinions.
- Communicate scientific information about the cell theory:
  - Use different formats *(e.g., verbally, graphically, textually, and mathematically)* to communicate evidence that all living things are made of cells, cells come from existing cells, and cells are the basic structural and functional unit of all living things.
  - Compare, integrate, and evaluate multiple sources of information presented in different media or formats *(e.g., visually, quantitatively)* in order to support cell theory.
  - Use evidence to explain that organisms can be made of one cell or many and varied cells.

Core Ideas

Knowing Science

L1: Organisms are organized on a cellular basis and have a finite life span.

- All living organisms are made of one or more cells, which can be seen only through a microscope.
- All the basic processes of life are the results of what happens inside cells. Cells divide to replace aging cells and to make more cells in growth and in reproduction. Food is the energy source they need in order to carry out these and other functions. Life is the quality that distinguishes living things - composed of living cells, from nonliving objects or those that have died.

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 cell theory by examining a variety of sources on the topic. Rather than accepting evidence at face value, students compare sources and evaluate information to determine its validity.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, or unexpected results.	**Patterns** • Macroscopic patterns are related to the nature of microscopic and atomic-level structure.

• Ask questions to clarify or identify evidence and the premise(s) of an argument. **Obtaining, Evaluating, and Communicating Information** • Gather, read, and communicate information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used. • Read critically using scientific knowledge and reasoning to evaluate data, hypotheses, conclusions that appear in scientific and technical texts in light of competing information or accounts; provide an accurate summary of the text distinct from prior knowledge or opinions.	**Scale, Proportion, and Quantity** • The observed function of natural and designed systems may change with scale. • Phenomena that can be observed at one scale may not be observable at another scale. **Structure and Function** • Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 7
LIFE SCIENCE: CELLS: STRUCTURE AND FUNCTION
Students develop an understanding of the structure and function of cells.

Science Standard: 7.L1U1.9 **Construct an explanation to demonstrate the relationship between major cell structures and cell functions (plant and animal).**

Learning Goals

I can:

- Apply scientific knowledge to explain how major cell structures (*i.e., nucleus, chloroplasts, mitochondria, cell membrane, and cell wall*) are specialized for particular functions (*i.e., structure and support, growth, transport, energy production, reproduction*).
- Base explanations on scientific evidence from texts, experiments, demonstrations, investigations, representations, and/or models.

Core Ideas

Knowing Science

L1: Organisms are organized on a cellular basis and have a finite life span.

- While a simple definition of life can be difficult to capture, all living things - that is to say all organisms - can be characterized by common aspects of their structure and functioning. Some cells in multicellular organisms, as well as carrying out the functions that all cells do, are specialized; for example, muscle, blood and nerve cells carry out specific functions within the organism.
- Organisms range in composition from a single cell (unicellular microorganisms) to multicellular organisms, in which different groups of large number of cells work together to form systems of tissues and organs (e.g., circulatory, respiratory, nervous, musculoskeletal), that are specialized for particular functions. Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.

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 relationship between structure and function within the cell, using scientific evidence to construct explanations about phenomena which are too small to observe directly.

Science and Engineering Practices	Crosscutting Concepts
Constructing Explanations and Designing Solutions • Construct explanations for either qualitative or quantitative relationships between variables. • Apply scientific knowledge and evidence to explain real-world phenomena, examples, or events. • Construct explanations from models or representations.	**Structure and Function** • Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function. **Systems and System Models** • Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.

CATALINA FOOTHILLS SCHOOL DISTRICT	
GRADE 7	
LIFE SCIENCE: CELLS: BODY SYSTEMS	
Students develop an understanding of the structure and function of cells.	

Science Standard: 7.L1U1.10 Develop and use a model to explain how cells, tissues, and organ systems maintain life (animals).
 	
Learning Goals
I can:
• Develop a model *(e.g., diagram, drawing, physical replica, mathematical representation, analogy, and/or computer simulation)* that represents the cells, tissues, and organ systems of animals:
    o Represent the hierarchy of animal cells, tissues, and organ systems.
    o Represent the functions of animal cells, tissues, and organ systems with regard to maintaining life.
    o Represent interrelationships among animal cells, tissues, and organ systems.
    o Identify limitations of the model.
    o Modify the model, based on the limitations, to improve its representation of animal cells, tissues, and organ systems or to explore what will happen if a component is changed.
• Use a model to explain how animal cells, tissues, and organ systems maintain life:
    o Use evidence from a model to explain relationships among organ systems that are necessary to maintain life.
    o Use a model to describe how cells, tissues, and organ systems are part of the hierarchy of the organization of life.	

Core Ideas	
Knowing Science L1: Organisms are organized on a cellular basis and have finite life span. • Cells divide to replace aging cells and to make more cells in growth and in reproduction. Cells are often aggregated into tissues, tissues into organs, and organs into organ systems. • Organisms range in composition from a single cell (unicellular microorganisms) to multicellular organisms, in which different groups of large number of cells work together to form systems of tissues and / organs (e.g. circulatory, respiratory, nervous, musculoskeletal), that are specialized for particular functions. • Some cells in multicellular organisms, as well as carrying out the functions that all cells do, are specialized; for example, muscle, blood and nerve cells carry out specific functions within the organism. • In the human body, systems carry out such key functions as respiration, digestion, elimination of waste and temperature control. The circulatory system takes material needed by cells to all parts of the body and removes soluble waste to the urinary system. Cells function best in certain conditions. **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 the complex, interconnected, and hierarchical systems of cells, tissues, organs, and organ systems. Evidence from models helps students explore phenomena that operate on the cellular level to make survival possible.	
Science and Engineering Practices	**Crosscutting Concepts**
Developing and Using Models	**Systems and System Models**

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

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 7
LIFE SCIENCE: CELLS: BODY SYSTEMS
Students develop an understanding of the structure and function of cells.

Science Standard: 7.L1U1.11 Construct an explanation for how organisms maintain internal stability and evaluate the effect of the external factors on organisms' internal stability.

Learning Goals

I can:

- Apply scientific knowledge to explain the processes organisms use to maintain internal balance (*i.e., homeostasis*).
- Base explanations on scientific evidence from texts, experiments, demonstrations, investigations, representations, and/or models.
- Apply evidence to explain how external factors affect an organism's internal stability.
- Use scientific data to determine the degree to which external factors (*i.e., stimuli, such as light and temperature*) affect organisms' internal stability.

Core Ideas

Knowing Science

L1: Organisms are organized on a cellular basis and have a finite life span.

- Both single cell and multi-cellular organisms have mechanisms to maintain temperature and acidity within certain limits that enable the organism to survive.
- Organisms respond to stimuli from their environment and actively maintain their internal environment through homeostasis. Plant species have adaptations to obtain the water, light, minerals and space they need to grow and reproduce in particular locations characterized by climatic, geological and hydrological conditions.

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 relationship between external stimuli and internal stability to further examine the conditions that make survival possible. Students explain homeostasis using evidence from various sources.

Science and Engineering Practices	Crosscutting Concepts
Constructing Explanations and Designing Solutions • Apply scientific knowledge and evidence to explain real-world phenomena, examples, or events. • Apply scientific reasoning to show why the data are adequate for the explanation or conclusion.	**Stability and Change** • Stability might be disturbed either by sudden events or gradual changes that accumulate over time. **Cause and Effect: Mechanism and Prediction** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 7
LIFE SCIENCE: CELLS: STRUCTURE AND FUNCTION
Students develop an understanding of the structure and function of cells.

Science Standard: 7.L2U1.12 Construct an explanation for how some plant cells convert light energy into food energy.

Learning Goals

I can:

- Apply scientific reasoning to explain how plant cells convert light energy into food energy (*i.e., sugars*).
- Explain the role of water, carbon dioxide, and light in photosynthesis.
- Base explanations on scientific evidence from texts, experiments, demonstrations, investigations, representations, and/or models.

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 most cases, the energy needed for life is ultimately derived from the sun through photosynthesis (although in some ecologically important cases, energy is derived from reactions involving inorganic chemicals in the absence of sunlight e.g. chemosynthesis). Plants, algae (including phytoplankton), and other energy-fixing microorganisms use sunlight, water and carbon dioxide to facilitate photosynthesis, which stores energy, forms plant matter, releases oxygen, and maintains plants' activities.
- The chemical reaction by which plants produce complex food molecules (sugar) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based molecules and release oxygen.

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 scientific evidence to construct explanations for the process some plants use to convert light energy into food energy.

Science and Engineering Practices

Constructing Explanations and Designing Solutions

- Apply scientific knowledge and evidence to explain real-world phenomena, examples, or events.
- 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.

Crosscutting Concepts

Structure and Function

- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.
- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.

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. • The transfer of energy can be tracked as energy flows through a designed or natural system.

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
- Perform operations on variables as needed to accomplish a task. *(i.e., camelCase).*

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

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