Orange School District

Science

Curriculum Guide - Grades K-7
2011 Edition

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Philosophy

"Today more than ever before, science holds the key to our survival as a planet and our security and prosperity as a nation" (Obama, 2008).

Science is a way of relating to and experiencing our world as a process that helps one search for solutions to problems faced everyday. This curriculum aims to provide students with the knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and productivity in a global economy. It emphasizes critical thinking skills through an inquiry-based and hand-on approach to learning.

The goal of science education is to develop scientifically literate students who understand how science, technology and society influence one another; and who are able to use this knowledge and its applications in their every day decision-making processes as members of a global society. Essential to this conceptual understanding is the philosophy that science is a process rather than an accumulation of facts.

Course Description

Science in our Kindergarten through Grade 6 utilizes the hands-on approach with the use of science kits that cover a myriad of topics which are aligned with the New Jersey Core Curriculum Content Standards, and the National Science Standards.

New Jersey Core Curriculum Content Standards for Science

INTRODUCTION

Science Education in the 21st Century

Scientific literacy assumes an increasingly important role in the context of globalization. The rapid pace of technological advances, access to an unprecedented wealth of information, and the pervasive impact of science and technology on day-to-day living require a depth of understanding that can be enhanced through quality science education. In the 21st century, science education focuses on the practices of science that lead to a greater understanding of the growing body of scientific knowledge that is required of citizens in an ever-changing world.

Mission: *Scientifically literate students possess the knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity.*

Vision: A quality science education fosters a population that:

- Experiences the richness and excitement of knowing about the natural world and understanding how it functions.
- Uses appropriate scientific processes and principles in making personal decisions.
- Engages intelligently in public discourse and debate about matters of scientific and technological concern.
- Applies scientific knowledge and skills to increase economic productivity.

Intent and Spirit of the Science Standards

"Scientific proficiency encompasses understanding key concepts and their connections to other fundamental concepts and principles of science; familiarity with the natural and designed world for both its diversity and unity; and use of scientific knowledge and scientific ways of thinking for individual and social purposes" (American Association for the Advancement of Science, 1990).

All students engage in science experiences that promote the ability to ask, find, or determine answers to questions derived from natural curiosity about everyday things and occurrences. The underpinning of the revised standards lies in the premise that science is experienced as an *active* process in which inquiry is central to learning and in which students engage in observation, inference, and experimentation on an ongoing basis, rather than as an isolated a *process*. When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others in their community and around the world. They actively develop their understanding of science by identifying their assumptions, using critical and logical thinking, and considering alternative explanations.

Revised Standards

The revision of the science standards was driven by two key questions:

- *What are the core scientific concepts and principles that all students need to understand in the 21st century?*
- *What should students be able to do in order to demonstrate understanding of the concepts and principles?*

In an attempt to address these questions, science taskforce members examined the scientific concepts and principles

common to the National Science Education Standards, Benchmarks and Atlases for Science Literacy , and the National Assessment of Educational Progress (NAEP) Framework .This resulted in narrowing the breadth of content from 10 standards to four standards that include 17 clearly-defined key concepts and principles.

- **Science Practices** (standard 5.1) embody the idea of "knowledge in use" and include understanding scientific explanations, generating scientific evidence, reflecting on scientific knowledge, and participating productively in science. Science practices are integrated into the Cumulative Progress Indicators within each science domain in recognition that science content and processes are inextricably linked; science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge.
- Science content is presented in **Physical Science** (standard 5.2), **Life Science** (standard 5.3), and **Earth Systems** (standard 5.4). The most current research on how science is learned informed the development of learning progressions for each strand, which increase in depth of understanding as students progress through the grades.

Laboratory Science in the 21stCentury

Laboratory science is a *practice* not a *place.* It is important to emphasize that standards-driven lab science courses do *not* include student manipulation or analysis of data created by a teacher as a replacement or substitute for direct interaction with the natural or designed world.

The revised standards and course descriptions emphasize the importance of students independently creating scientific arguments and explanations for observations made during investigations. Science education thereby becomes a sense-making enterprise for students in which they are systematically provided with ongoing opportunities to:

- Interact directly with the natural and designed world using tools, data-collection techniques, models, and theories of science.
- Actively participate in scientific investigations and use cognitive and manipulative skills associated with the formulation of scientific explanations.
- Use evidence, apply logic, and construct arguments for their proposed explanations.

The 2009 Science Standards implicitly and explicitly point to a more student-centered approach to instructional design that engages learners in inquiry. Inquiry, as defined in the revised standards, envisions learners who:

- Are engaged by scientifically-oriented questions.
- Prioritize evidence that addresses scientifically-oriented questions.
- Formulate explanations from that evidence to address those scientifically-oriented questions.
- Evaluate their explanations in light of alternative explanations, particularly those reflecting scientific understanding.
- Communicate and justify their proposed explanations.

Fundamental principles of instructional design assist students in achieving their intended learning goals through lab-science experiences that:

- Are designed with clear learning outcomes in mind.
- Are sequenced thoughtfully into the flow of classroom science instruction.
- Integrate learning of science content with learning about science practices.
- Incorporate ongoing student reflection and discussion (National Research Council, 2007).

Students K-12 lab-science experiences should include the following:

- **Physical manipulation of authentic substances or systems:** This may include such activities as chemistry experiments, plant and animal observations, and investigations of force and motion.
- **Interaction with simulations:** In 21st-century laboratory science courses, students can work with computerized models, or simulations, that represent aspects of natural phenomena that cannot be observed directly because they are very large, very small, very slow, very fast, or very complex. Students may also model the interaction of molecules in chemistry or manipulate models of cells, animal or plant systems, wave motion, weather patterns, or geological formations using simulations.
- **Interaction with authentic data:** Students may interact with authentic data that are obtained and represented in a variety of forms. For example, they may study photographs to examine characteristics of the Moon or other heavenly bodies or analyze emission and absorption spectra in the light from stars. Data may be incorporated in films, DVDs, computer programs, or other formats.
- **Access to large databases:** In many fields of science, researchers have arranged for empirical data to be normalized and aggregated - for example, genome databases, astronomy image collections, databases of climatic events over long time periods, biological field observations. Some students may be able to access authentic and timely scientific data using the Internet and can also manipulate and analyze authentic data in new forms of laboratory experiences (Bell, 2005).
- **Remote access to scientific instruments and observations:** When available, laboratory experiences enabled by the Internet can link students to remote instruments, such as the environmental scanning electron microscope (Thakkar et al., 2000), or allow them to control automated telescopes (Gould, 2004).

Curriculum Outline

Kindergarten
- Looking at the Night Sky
- Exploring the Senses
- Animals 2 X 2
- Fabrics

Grade 1
- Air and Weather
- Pebbles, Sand and Silt
- Magnets
- Kinds of Living Things

Grade 2
- Light and Color
- Balance and Motion
- Solids and Liquids

Grade 3
- Forms of Energy
- Insects

Grade 4
- Weather and Climate
- Earth Materials
- Magnetism and Electricity

Grade 5
- Food and Nutrition
- Environments
- Solar System and Beyond

Grade 6
- Levers and Pulleys
- Oceanography
- Diversity of Life
- Chemical Interactions
- Astronomy

Grade 7
LIFE SCIENCE

- ***LIVING SYSTEMS***

Studying Life
- Measurements
- Thinking Like a Scientist
- Graphs

Connection: The Role of a Scientist
Activity: Population Graphs

Living Things
- Is It Alive?
- How Living Things are Organized

Connection: Is There Proof of Life on Mars?
Activity: The Powers of Observation

Classifying Living Things
- Types of Living Things
- Dichotomous Keys

Connection: Discovering a New Species
Activity: Whose Shoes? Making a Dichotomous Key

- ***ORGANISMS AND THE ENVIRONMENT***

Physical Science Connections
- Elements and Compounds
- The Compounds of Life
- Physical Variables

Connection: Chef or Scientist?
Activity: What's on Your Label?

Ecosystems
- Ecosystems, Energy, and Nutrients
- Food Chains and Food Webs
- Ecosystems—a Natural Balance

Connection: Food Webs of the Deep
Activity: Create a Species

Biomes
- Climates and Biomes
- Deserts and Grasslands

- Temperate Forests and Rainforests
- Taigas and Tundras

Connection: Ecological Impact of Forest Fires
Activity: Biome Expedition

- ***CELL BIOLOGY***

Cell Structure and Function
- What Are Cells?
- Cells: A Look Inside

Connection: Organ Transplants
Activity: Building a Scale Model of a Cell

Cell Processes
- The Cell Membrane
- Cells and Energy

Connection: Amazing Cells!
Activity: Making a Concept Map

The Microscopic World
- Protozoans
- Bacteria
- Viruses

Connection: The Good, The Bad, The Microbe
Activity: Outbreak! Patient Zero

- ***GENETICS***

Reproduction
- Growth and Cell Reproduction
- Sexual Reproduction and Meiosis

Connection: Differences Between Twins Start With Cells
Activity: Chromosome Square Dance

Heredity
- Traits
- Predicting Heredity
- Other Patterns of Inheritance

Connection: An Inherited Blood Disease
Activity: Making a Pedigree

The Code of Life
- The Role of DNA in Heredity
- DNA and Technology

Connection: Cracking the Code
Activity: Gene Drama

- ***EVOLUTION AND CHANGE***

Evolution
- Evidence for Evolution
- How Evolution Works
- Natural Selection

Connection: Chameleons of the Sea
Activity: The Hunter and the Hunted

Earth and Life History
- Evidence from Rocks
- How Earth Changes
- Life History

Connection: Mass Extinctions: Devastation and Opportunity
Activity: Radioactivity and Half-life

- ***STRUCTURE AND FUNCTION IN LIVING THINGS***

The Diversity of Life
- Taxonomy and Systematics
- Algae and Fungi

Connection: Likeable Lichens
Activity: How to Make a Simple Cladogram

Plants
- What Are Plants?
- Roots, Stems, and Leaves
- Reproduction in Flowering Plants

Connection: The Buds and the Bees
Activity: Design Your Own Pollinator

Animals
- What Is an Animal?
- Invertebrate Structure and Function
- Vertebrate Structure and Function

Connection: Snails vs. Crabs: An Undersea Arms Race
Activity: Making an Evolutionary Tree

- ***THE HUMAN BODY***

Human Body Systems
- Circulation and Respiration
- Other Organ Systems

Connection: Skin Grafts for Burn Victims
Activity: Build a Lung Model

Support and Movement
- Bones and Muscles
- The Human Body as a Machine

Connection: Prosthetic Legs and Technology
Activity: Leg levers - Digger or Runner?

Vision and Hearing
- The Nervous System
- Color Vision
- Light and Images
- Hearing

Connection: Keeping Things in Focus
Activity: Human Ear Model

Kindergarten
Science

Physical Science: All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.
Earth Systems Science: All students will understand that Earth operates as set of complex, dynamic, and interconnected systems, and is part of the all-encompassing system of the universe.
Life Science: All students will understand that life science principals are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicated through the use of mathematics.
Scientific Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

Key ELEMENTS	*Students should know:*	*Students should be able to:*
• Fabric • Observe Fabrics • Compare Fabrics • Weaving • Clean Fabric • Dye Fabric	• Fabrics have observable properties. • Fabrics are made from different materials. • Fabrics can be compared and sorted by their properties. • Fabric is used for many things in our everyday lives. • Many fabrics are made by weaving thread through more than one piece of fabric to join them. • Scientists communicate problems, designs, and solutions. • Some fabrics absorb water, and others repel water. • Some fabric stains can be cleaned by washing. • Cleaning fabric with soap and a scrub brush is better than using water only. • Fabric can be permanently dyed a wide variety of colors. • Different properties of fabrics make them useful for different purposes.	• Observe and discuss properties of several different fabrics. • Analyze how fabric is put together and how it can be taken apart. • Communicate observations and comparisons of different kinds of fabrics. • Compare and contrast the properties of different fabrics. • Observe how water is absorbed at different rates by different kinds of fabric. • Compare evaporation of water in an open and closed container. • Observe the transformation of dirty cloth to clean cloth. • Communicate observations and comparisons of interactions. • Compare and contrast the permanence of a variety of stains. • Determine the best uses of fabrics based on their properties.
Key ELEMENTS	***Students should know:***	***Students should be able to:***
• Sky	• The sun is a star. • The sun can be seen during the day.	• Observe and describe objects in the daytime sky. • Collect, record, interpret, and communicate data about objects

• Daytime Sky • Sun • Earth • Night Time Sky • Moon • Moon Phases	• The sun provides heat and light to Earth. • The sun appears to be in different positions in the sky during the day. • The moon can be seen during the day and at night. • The moon has craters on its surface. • The different shapes (phases) of the moon. • There are many other stars in the sky besides the sun that can only be seen at night. • Stars form patterns in the sky called constellations.	in the daytime sky. • Describe objects in the daytime sky using properties such as size, shape, color, brightness, and movement. • Identify the sun as a star. • Explain how the sun is important to Earth. • Infer that the sun provides light to the Earth. • Conclude that light helps us see. • Infer that the sun provides light and heat to the Earth. • Observe and identify objects in the nighttime sky. • Compare the objects visible in the sky during the day and at night. • Observe the changes in the shape of the moon on different days. • Observe the various features on the moon's surface. • Investigate the causes of craters on the moon's surface. • Conclude that there are many stars in the sky. • Infer that these stars can only be seen at night. • Infer that some stars appear to form patterns called constellations.
Key ELEMENTS • Animals • Animal Structures • Body Parts • Animal Habitats • Animal Behaviors • Animal Growth Stages • Animal Life Cycles	***Students should know:*** • Fish have identifiable structures. • All animals deserve respect and gentle care. • Fish have basic needs. • Fish impact changes to their environment. • Fish behavior is influenced by conditions in the environment. • Fish have senses that help them detect objects in their environments. • Each kind of fish has unique structures and behavior. • Different kinds of fish have similar structures and behaviors. • Objects from an environment can be classified as living or non-living. • Animals have basic needs, such as air, water, food and shelter. • Animals go through stages of growth and development. • Animals go through predictable life cycles.	***Students should be able to:*** • Observe fish in a simple aquarium. • Care for goldfish giving them food and fresh water and adding plants to the aquarium. • Observe and describe fish behavior. • Create paper aquariums to model fish behavior they observe. • Compare the structures of guppies to those of goldfish, and identify the guppies by gender. • Investigate the structures and behaviors of isopods, (drawing upon prior fish knowledge). • Compare isopods and sort them into groups based on the different structures they observe. • Investigate isopod movements by conducting races. • Build a class terrarium to observe how several animals live together. • Set up a classroom incubator to hatch eggs. • Compare chicks to other animals they observed in the unit.

		• Examine different body parts of the chick. • Observe how chicks eat and drink and how they behave around each other and what they do as people approach.
Key ELEMENTS • Human Body • External Parts • Internal Parts • Five Senses • Sensory Organs • Near and Far • Classify Objects • Properties of Matter	***Students should know:*** • The human body has various external parts. • The human body has various internal parts. • Hands help a person to perform a variety of tasks. • Bones are body parts that support and give shape to your body. • Muscles are body parts that help move bones. • The heart is a muscle that pumps blood throughout the body. • The stomach is a muscle that helps with the digestion of food. • The brain is a body part that helps us think. • The sense organs help the body by providing different kinds of sensory information. • People use their five senses to find out about their surroundings and themselves. • Each sensory organ provides different information. • A person can get different information about the same thing by moving closer to it or farther away. • Physical characteristics of objects can be observed and used to describe and classify objects. • Objects are made up of different kinds of materials and can be described in terms of those materials. • The sense of smell can be used to group different scents. • The sense of hearing can be used to group different sounds. • Materials that make up an object have observable physical properties that can be measured and compared. • The properties of matter are independent of the amount of material.	***Students should be able to:*** • Identify and locate various external body parts. • Explain the functions of various external body parts. • Locate and identify various internal body parts. • Analyze and evaluate the dexterity of the human hand in performing a variety of everyday tasks. • Identify ways that hands are useful in performing many tasks. • Construct a three-dimensional model of a human backbone. • Recognize that bones give support and shape to the body. • Test the ability of muscles to move different bones in the body. Describe the movement of muscles and bones. • Compare the heart rate before the exercise with the heart rate after exercise. • Describe the role the heart plays in pumping blood throughout the body. • Identify the path food takes to the stomach. • Describe the noise the stomach makes as part of the process of digestion. • Apply thinking skills in a problem-solving situation. Identify a variety of behaviors that the brain controls. • Compare the kinds of sensory information that the sense organs provide. • Identify different foods by using the senses. • Identify sense organs and the sense that it is responsible for. • Use the sense of touching, seeing, hearing, smelling, and tasting to identify objects. • Discuss the kinds of information that each sensory organ provides. • Draw conclusions about information gathered about a nearby object and name the object seen at a distance. • Classify objects based on their observable characteristics. • Describe objects in terms of the materials they are made of.
First Grade		

Science

Standards

Life Science: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.
Physical Science: All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.
Earth Systems Science: All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

Key ELEMENTS	***Students should know:***	***Students should be able to:***
• New Plants • Seeds • Germination • Plant Growth • Pollination • Plant Needs • Plant Parts • Bulbs	• Seeds are alive and grow into new plants. • Plants need water, air, nutrients, and light to grow and develop. • As plants grow, they develop roots, stems, leaves, buds, flowers, and seeds in a sequence called a life cycle. • Bees and other insects help some plants by moving pollen from flower to flower. • Seeds need water and light to grow into plants. • Some plants die and some plants continue to grow after they are mowed. • New plants can grow from stems of mature plants. • Leaves, twigs, and roots develop on stems at the nodes. • Potatoes are underground stems. • Bulbs are alive. • Bulbs need water to start growing. • Parts of roots will grow into new plants.	• Develop a curiosity and interest in plants as living things. • Experience some of the diversity in the plant kingdom. • Infer and provide for the needs of plant growth and development. • Observe and describe the changes that occur as plants grow and develop. • Identify and describe structures and functions of flowering plants (root, stem, leaf, bud, flower, seeds). • Discover various ways that new plants can develop from mature plants. • Compare and contrast change over time in different kinds of plants. • Organize and communicate observations of plants through illustrations and journal entries.
Key ELEMENTS	***Students should know:***	***Students should be able to:***
• Magnets • Magnetic Interactions • Magnetic Force • Magnetic Fields	• Magnets are pieces of metal that stick to some metal materials. • Magnets have many uses. • Magnets come in different shapes and sizes. • Magnets are only attracted to objects containing iron. • Magnetic interactions are caused by magnetic force. (A force is a push or a pull). • Magnets have different amounts of strength and the size is not always an indication of the strength. • Magnetic force can pass through air and certain materials, making it possible to move objects without touching them. • Magnetic force weakens as distance increases. • Magnetic force is greatest at the ends or poles of a magnet. • Magnets always act in the same way when they	• Observe the interaction of magnets with a variety of common materials. • Classify and describe materials based on whether they are attracted to a magnet. • Discover that magnets display forces of attraction and repulsion. • Explain that magnets produce forces that can push and pull objects. • Compare the strengths of various magnets. • Infer that magnetic force can pass through certain materials and identify the materials. • Investigate the interactions between two magnets. • Identify a magnets two poles. • Explain that two like poles repel and two unlike poles attract.

	are brought near each other: two like poles repel each other, and two unlike poles attract each other. • A magnetic field is the space around the magnet which the force of a magnet is felt and can be observed using iron fillings.	• Draw the shape of a magnetic field. • Use a compass to find north and explain how a compass works. • Infer that the strength of the magnetic force will weaken as the distance increases. • List common uses of magnets.
Key ELEMENTS • Rock Sizes • Rock Separation • Pebbles • Sand • Silt • Clay • Rock Usage • Soil	***Students should know:*** • Rocks are the solid portion of the earth. • Rocks can be sorted into groups by properties, including color, shape, and texture. • Rocks can be broken into smaller pieces. • Rocks change appearance when wet. • Rocks can be found in many different places. • Rock sizes can be separated with screens and by settling in water. • Silt and clay have different properties. • Earth materials can be used in a variety of constructions. • Soil is made up of a combination of materials, including different-sized particles of rock and humus. • Soil differs from one location to another.	***Students should be able to:*** • Develop a growing curiosity and interest in the physical world around them. • Observe, describe, and sort earth materials based on properties. • Separate earth materials by size using different techniques. • Observe the similarities and differences in the materials in a river rock mixture: silt, sand, gravel, and small and large pebbles. • Explore places where earth materials are found and ways that earth materials are used. • Compare the ingredients in different soils. • Use sand and clay to create and construct different sculptures/structures.
Key ELEMENTS • Air • Air Pressure • Air Resistance • Weather • Weather Conditions • Weather Patterns • Weather Instruments • Temperature • Seasons • Clouds	***Students should know:*** • Air is matter, takes up space, and is all around us. • Air is a common gas that has observable properties. • Air resistance affects how things move. • Air can be compressed. • The pressure from compressed air can move things. • Weather is the condition of the atmosphere (air) at a given time. • Many factors contribute to weather, such as how hot or cold, wet or dry, calm or stormy, clear or cloudy it is. • Temperature describes how hot or cold the air is. • Clouds are made of water drops that form in the sky. • There are different types of clouds including cumulus, stratus and cirrus. • Wind moves clouds in the sky. • Rain is water that comes from clouds. • Wind is moving air.	***Students should be able to:*** • Explore properties of air. • Construct parachutes and observe how they move through air. • Discover that air occupies space and can be compressed. • Observe that compressed air pushes with a usable pressure. • Explain how air pressure can propel a balloon-rocket system. • Observe daily weather and record observations. • Use a calendar to monitor daily weather and record sunrise/sunset. • Monitor and record daily outdoor temperature. • Analyze temperature changes and other weather data. • Use different weather instruments, including a thermometer and rain gauge. • Identify and categorize several types of clouds. • Identify natural sources of water. • Observe evidence of wind speed using bubbles, pinwheels, and anemometers.

	• Wind speed and direction can be measured. • Patterns and changes in weather conditions can be seen by graphing weather data. • Weather conditions change over time. • Each season has a typical weather pattern that can be observed, compared, and predicted.	• Observe evidence of wind speed and direction using bubbles and wind vanes. • Use different weather instruments to measure weather. • Observe the effect of wind direction and speed on kites. • Graph weather observations taken over a period of time. • Look for patterns of changes in weather conditions. • Monitor and record weather.

Second Grade
Science

Standards

Life Science: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.
Physical Science: All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.
Scientific Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

Key ELEMENTS	***Students should know:***	***Students should be able to:***
• Balance • Counter Balance • Weight • Counterweight • Motion • Axis and Rotational Motion • Air Resistance	• Objects can by balanced in many ways • Counterweights can help balance an object. • A stable position is one that is steady; the object is not falling over. • Objects and systems that turn on a central axis exhibit rotational motion. • Force is needed to spin a top. • The motion of an object can be changed by pushing or pulling. • Air resistance can act as a force that initiates or impedes rotational motion of spinning objects. • Wheels roll down slopes. • Cups roll in the direction of the smaller end. • Spheres are round in all directions and roll in all directions.	• Develop a growing curiosity and interest in the motion of objects. • Investigate materials constructively during free exploration and in a guided discovery mode. • Solve problems through trial and error. • Develop persistence in tackling a problem. • Explore concepts of balance, counterweight, and stability. • Observe systems that are unstable and modify them to reach equilibrium. • Discover different ways to produce rotational motion. • Construct and observe toys that spin. • Explore and describe some of the variables that influence the motion of rolling spheres.

Key ELEMENTS	*Students should know:*	*Students should be able to:*
• Living Things • Plants • Animals • Environments • Non Living Resources • Plant and Animal Characteristics • Adaptation	• Objects from an environment can be classified into two categories: living and once-living, and nonliving. • Most plants and animals need air, food, water, light, and suitable environments to survive. • Green plants have specific parts that enable them to meet their basic needs. • Living things are dependent on both living and nonliving parts of their environments for survival. • Animals use living and nonliving resources in their environment to provide shelter. • Animals' characteristics and body structures are uniquely adapted to their environment and to the kinds of food they eat. • Some animals change the places that they live to make the environment better meet their needs. • Environments can be changed by both natural and human forces. • Different environments contain plants and animals that are suited to that environment and are able to survive under the conditions of that environment. • Specific plants and animals have features that allow them to survive in specific environments.	• Compare objects from the schoolyard environment and a woodland environment. • Classify objects into two groups: living and once-living, and nonliving. • Identify the main parts of green plants. • Explain the functions of roots, stems, and leaves. • Describe ways that some living things interact with living and nonliving resources in their environment to meet their needs. • Identify plants and animals that live in a swamp. • Describe how an animal uses living and nonliving resources to make a home for itself and its young. • Generalize that body parts help animals to survive in their environments. • Observe and demonstrate how some animals can change their environment to better meet their needs. • Experiment to determine how plants affect the flow of water downhill. • Describe how people and natural forces can change the environment. • Describe a desert environment and identify some plants and animals that live there. • Make a model of a desert environment. • Differentiate between a woodland plant and a desert plant based on the different features of each plant and justify why each type of plant is suited for a particular environment. • Compare the physical features of plants and animals from different environments.
Key ELEMENTS	***Students should know:***	***Students should be able to:***
• Matter • Solids • Liquids • Gas	• Solids, liquids and gases are states of matter. • Solid, liquids and gases have properties that separate them from one another. • Solid and liquids can be sorted by their properties. • Mixtures of solid particles and liquids can be separate. • Adding or removing heat to water changes its state of matter. • Some solids dissolve in water; evaporation leaves the solid behind • Some liquids mix with water; other liquids form a layer above or below water.	• Observe several kinds of solid materials • Compare properties of solids materials • Sort solids in different ways. • Observe and describe properties of different liquids in bottles. • Compare the appearance and behavior of different liquids in containers. • Observe properties of solid particles in different containers. • Separate a mixture of solids by using screens. • Observe and describe the properties of solid particles based on size. • Observe and describe what happens when solids and water are mixed. • Observe and describe what happens when liquids and water are mixed.

		• Organize observations of mixtures.
Key ELEMENTS • Light Sources • Illumination • Shadows • Spectrum • Color	***Students should know:*** • There exists a variety of sources of light, some that are natural and others that are made by people. • An object can be seen when the object is illuminated by a light source. • Light sources produce both light and heat. • Light travels in straight lines. • Different objects transmit light in different ways • Objects placed in a beam of light cast shadows. • The size and clarity of a shadow can be altered by adjusting the distance and angle between the light source and the object casting the shadow. • White light is a combination of many colors, and can be separated to produce the colors of the spectrum. • Mixing primary colors, (hues) produces different colors.	***Students should be able to:*** • Identify sources of light. • Classify sources of light as natural or man-made. • Conclude that the sun is the most important source of light. • Observe that objects and their characteristics cannot be seen without a light source illuminating those objects. • Observe that a light source gives off both heat and light. • Observe that heat travels in a straight line. • Classify objects according to how well light can pass through them. • Infer that the amount of light that can pass through a material determines how well we can see through that material. • Identify an object by the shadow that is cast when the object is placed in a beam of light. • Explore ways of making shadows of different shapes. • Observe how the shadow cast by an object changes when the position of the light source changes. • Predict where shadows would be at different times of the day. • Produce and identify the colors of the spectrum. • Identify the colors resulting from the mixture of two different colors.
Third Grade **Science**		
Standards **Life Science**: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth.		

Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.
Physical Science: All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.
Earth Systems Science: All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.
Scientific Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

Key ELEMENTS	***Students should know:***	***Students should be able to:***
• Energy • Energy of Motion • Energy Transfer • Heat	• Energy, which is the ability to cause change in matter, can change forms. • Energy of motion can be stored and released. • Energy can be transferred form one place to another. • Heat energy is transferred from warmer things to colder things • In many energy changes, heat is one of the energy forms released. • Heat, the energy of movement of the particles that make up matter, can be measured. • Heat results when substances burn and when certain kinds of materials rub against each other. • Increasing the temperature of any substance requires the addition of energy • Transportation and electricity production use great quantities of fossil fuels, creating problems of pollution and supply.	• Observe different types of energy • Infer causes and predict effects of energy at work. • Predict, observe, and record different kinds of energy changes. • Identify and make hypotheses about how and why energy changes occur. • Describe the effect of energy on temperature. • Investigate ways heat is produced. • Predict, observe, and classify objects that transmit heat. • Experiment to find out which materials transmit heat better. • Investigate the different ways heat travels through different kinds of matter. • Observe the cooling effect of evaporation. • Predict and measure how much sugar will dissolve in cold and hot water. • Investigate how adding or subtracting heat changes matter. • Describe social dependence on fossil fuels. • Explain how alternate energy sources are used. • Describe how coal forms. • Demonstrate the importance of energy conservation. • Propose ways to conserve energy.
Key ELEMENTS	***Students should know:***	***Students should be able to:***
• Sun • Shadows • Moon • Moon Phases • Stars • Earth	• The sun is a star that can only be seen during the day. • The moon is not a star and can be seen sometimes at night and sometimes during the day. • The moon appears to have different shapes on different days. • Objects in the sky have patterns of movement. • The sun and moon appear to move across the sky on a daily basis. • The shadows of an object on Earth changes over the course of a day, indicating the changing position of the sun during the day. • The observable shape of the Moon changes from day to day	• Use a model of earth and the moon to determine the relative size of the moon compared to earth. • Determine how activities would be different on the moon because of gravity. • Compare models of the sun and Earth to determine size and distance. • Construct a star clock and use it to infer how people could use them and star patterns to tell time. • Determine that the suns path across the sky change the temperatures we feel on Earth. • Identify patterns of the moon's appearance and make predictions about its future appearance based observational

	in a cycle that lasts 29.5 days. • Earth is approximately spherical in shape. • Objects fall towards the center of the Earth because of the pull of the force of gravity. • Earth is the third planet from the sun in our solar system, which includes seven other planets.	data. • Use models of the sun and Earth to demonstrate how seasons occur.
Key ELEMENTS • Water • Water Properties • Surface Tension • Density • Evaporation • Condensation • Surface Area • Volume	***Students should know:*** • Water has several observable properties, including transparency, shapelessness, and movement or flow. • Water beads up on some materials and is absorbed by other materials. • Surface tension is the skin-like surface of water that pulls it together into the smallest possible volume. • Drops of water form domes on pennies because of surface tension. • Surface tension can be disrupted by the addition of some other substances. • Water flows downhill. • Increasing the amounts of water and/or the slope over which water flows makes it flow more quickly. • Water expands when heat is added. • Water contracts when heat is taken away. • Warm water is less dense than room-temperature water. • Cold water is denser than room-temperature water. • A material that floats in water is less dense than the water; a material that sinks is denser. • Evaporation is the process by which liquid water changes into water vapor, a gas. • Temperature and surface area of a volume of water affects the rate of evaporation. • Condensation occurs when water vapor touches a cool surface and changes into liquid. • Evaporation and condensation contribute to the movement of water through the water cycle. • Some earth materials, like soils, absorb more water than other earth materials. • Water flows more easily through some earth materials than through others. • Flowing water can be used to do work. • Waterwheels are a kind of machine powered by flowing water. • Water contains different materials that affect its quality. • Evaporation can be used to detect materials dissolved in water	***Students should be able to:*** • Observe the interaction of water with different materials. • Investigate the property of waters' surface tension • Investigate and observe the movement of water on a slope. • Construct a thermometer to observe that water expands as it warms and contracts as it cools. • Observe and describe the interaction between two masses of water at different temperatures. • Compare properties of two states of water: solid (ice) and liquid. • Investigate the effect of surface area and air temperature on evaporation. • Observe condensation. • Investigate the effect of temperature on condensation. • Investigate what happens when water is poured through two earth materials, soil and gravel. • Construct a waterwheel and use it to lift objects. • Compare the properties of local water samples.

Key ELEMENTS • Insects • Insect Characteristics • Life Cycle • Molting • Insect Structure • Insect Behavior • Insect Food Source	***Students should know:*** • Insects need air, food, water, and space. • Insects have characteristic structures and behaviors. • The life cycle of the beetle is egg, larva, pupa, and adult, which produces eggs. • Live organisms need to be treated with care and respect. • As insects grow, they molt their hard, external covering. • Adult insects have a head, thorax, and abdomen. • Some insects, moths, produce silk threads. • The life cycle of the wax worm is egg, larva, pupa, and adult moth, which produces eggs. • The structures and behaviors of wax worms change as they grow. • Larvae produce silk. • Wax worms and mealworms have similar structures and behaviors. • Insects hatch from eggs. • The life cycle of some insects is egg, nymph stages, and adult, which produces eggs. • Silkworm larvae have unique behaviors and structures. • Silkworm larvae have characteristic structures. • Silkworms spin silk to make a cocoon around them as they pupate. • The life cycle of silkworms is egg, larva, pupa, and adult, which produces eggs. • The life cycle of the butterfly is egg, larva, pupa, and adult, which produces eggs. • Insects have two common types of life cycles, those with nymphs and those with larvae and pupae. • Insects can live underground, above ground, and in water.	***Students should be able to:*** • Observe mealworms change from larvae to pupae to adults. • Describe larval segments, legs, and other structures of organisms. • Learn the three parts of insect (head, thorax, and abdomen). • Communicate observations of the structure and behavior of insects in words and drawings. • Provide for the needs of living insects (air, food, water, and space). • Observe the waxworm life cycle (larva to pupa to adult to egg, and back to larva). • Learn that some insects make silk. • Observe insects hatching from eggs. • Observe the sequence of changes that organisms go through as they mature into adults. • Observe that different insects have different food needs. • Compare larvae and adults of various insects. • Observe silk production of the larvae for making cocoons. • Observe insect mating and laying eggs. • Observe complete metamorphosis. • Experience an insect's life cycle. • Observe complete metamorphosis in the butterfly and compare it to other insects. • Observe organism in their habitats. • Separate insects from non-insects. • Study local insects and compare them to ones studied in class.

Fourth Grade
Science

Standards

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Key ELEMENTS	*Students should know:*	*Students should be able to:*
• Air • Atmosphere • Air Pressure • Weather • Weather Instruments • Water Cycle • Clouds • Forecasting • Storms • Earth's Tilt • Seasons • Climate	• Air is a mixture of gases that takes up space and has weight. Air is matter. • Air is largely composed of nitrogen, oxygen, carbon dioxide and water vapor. • Air is vital to life on Earth. • Changes in the conditions of the air result in different kinds of weather. • Air pressure, which can be measured with a barometer, is the push of air against its surroundings. • The direction from which the wind is blowing is determined by use of a wind vane. • The speed of the wind can be measured with an anemometer. • Fluctuations in the water vapor or content of the air result in variations in humidity, clouds, and precipitation. • The amount of relative humidity is measured with a hydrometer. • Clouds of different sizes, shapes, and altitudes provide clues about changes in weather. • Weather data can be interpreted and used for forecasting. • Tornadoes, hurricanes, and thunderstorms are dangerous storms, during which people must take safety precautions. • The tilt of the Earths' axis and the orientation of the axis to the Sun cause variations in the number of hours and intensity of sunlight per day, which result in seasonal change. • Climate is the weather in an area over an extended period of time.	• Infer that air takes up space and has weight. • Describe the makeup of the atmosphere. • Compare the atmosphere with a greenhouse. • Predict and observe how temperature changes air pressure. • Make and use models of barometers, wind vanes, anemometers, rain gauges, thermometer and hydrometers. • Explain how gravity relates to air pressure. • Discover how air pressure is measured. • Demonstrate how air pressure pushes against its surroundings. • Explain how wind can be a source of energy. • Describe ways that snow affects people around the world. • Explain ways the amount of water vapor in the air affects weather. • Observe and classify different types of clouds. • Identify clouds associated with different types of weather. • Analyze, evaluate, and apply information about severe weather and safety precautions. • Study and interpret data to make predictions about weather. • Analyze data relating hours of sunlight in winter and summer to changes in seasons. • Investigate how the tilt of the Earth's axis affects changing seasons worldwide. • Identify and describe various climate regions. • Analyze the climate conditions in a particular geographical area.

Key ELEMENTS	*Students should know:*	*Students should be able to:*
• Magnets • Magnetic Force • Induced Magnetism • Temporary Magnetism • Electricity • Electric Circuit • Conductors • Insulators • Electromagnetism	• Magnets stick to metal objects made of iron. • Magnetic interactions are caused by magnetic forces. • Magnets display forces of attraction and repulsion that are affected by distance. • Magnetism can be induced in a piece of steel that is close to or touching a magnet. • Electricity flows through pathways called circuits. • A switch is a device used to open and close circuits. • An open circuit is an incomplete electrical pathway; a closed circuit is a complete pathway. • Materials that allow electricity to flow are conductors; those that do not are insulators. • A circuit with only one pathway for current flow is a series circuit. The components share the electrical energy source. • A circuit with two or more pathways for current flow is a parallel circuit. The components each have a direct pathway to the energy source. • A core of iron or steel becomes an electromagnet when electricity flows through a coil of insulated wire surrounding it. • There are a number of ways to change the strength of an electromagnet, including changing the number of winds of wire around the core.	• Predict how magnets interact with common materials and other magnets. • Observe the interaction of permanent magnets with a variety of common materials. • Discover that magnets display forces of attraction and repulsion. • Measure the change in force between two magnets as the distance between them changes. • Identify materials that are conductors and insulators. • Understand and construct simple open, closed, parallel, and series circuits. • Construct and manipulate an electromagnet to discover the relationship between electricity and magnets. • Analyze the relationship between the number of turns of wire around an electromagnet core and the strength of the magnetism. • Use their knowledge of electromagnets to make a telegraph.
Key ELEMENTS	***Students should know:***	***Students should be able to:***
• Earth Materials • Geology • Rock Properties • Rock Composition • Fossils • Soil • Minerals Properties • Mineral Composition	• A geologist is a scientist that studies rocks, minerals and other Earth materials using specialized tools. • An earth material has properties that can be observed and described such as color, shape, size, mass and texture. • Rocks are composed of different components called minerals. • Rocks are broken down to make soil. • Fossil provide evidence about the plants and animals that lived long ago, including whether they lived on the land or in the sea as well as ways species over time. • A mineral is a rock component that cannot be physically reduced to more elementary minerals. • Minerals cannot be physically broken down into any other substance. • Minerals have different properties such as crystal structure, hardness, and chemical composition. • Hardness is the resistance of a mineral to being scratched and is measured using the Mohs Harndness Scale.	• Observe and describe the physical properties of rocks. • Use tools to gather data about rocks. • Record and compare observations about rocks. • Make a model to show how soil is formed from broken down rocks. • Discuss how fossils provide evidence and information about Earth's history. • Use observations to determine whether a fossil is terrestrial or marine in origin. • Observe that some minerals dissolve in water. • Observe that dissolved minerals reappear as crystals when water evaporates. • Identify minerals by their crystalline shapes or patterns. • Compare personal studies to the work of geologists. • Explore the properties of a group of minerals. • Investigate the hardness of minerals using a scratch test. • Classify minerals according to hardness. • Investigate rocks using acid as an indicator for calcite.

	• Calcite is a mineral that can be identified through its chemical reaction with acid. • When a solid dissolves in a liquid, it can be recovered by evaporating the liquid. • Crystal residue from evaporation can be used to identify minerals.	• Observe and compare the formation of crystals after the evaporation of various salt solutions. • Analyze and classify crystals based on their structure.
Key ELEMENTS • Structures of Life • Seed Development • Properties of Seeds • Germination • Plant Needs • Plant Life Cycle • Animal Structures • Animal Habitats • Animal Behavior • Territory	***Students should know:*** • Seeds develop in the plant part called a fruit. • Seed structure and quantity varies with different kinds of fruit. • Seeds have a variety of properties. • A seed is a living organism. • A seed contains an embryo plant and stores food and water. • When seeds are soaked in water, they undergo changes leading to germination; the onset of a seed's growth. • Plants need water, light and nutrients to grow. • Plants can grow in water if nutrients are added. • The life cycle is the process of a seed growing into a mature plant, which in turn produces seeds. • The fruit of the plant develops from the flower. • Organisms have observable and identifiable structures as well as particular requirements for life. • A habitat is where an animal lives. • A niche is the role an animal plays in its habitat. • Organisms have specific structures and behaviors that are necessary to their survival. • The structures found on different kinds of organisms show some similarities and some differences. • Organisms are to be treated humanly, responsibly and ethically.	***Students should be able to:*** • Explore common fruits to find seeds. • Observe and compare properties of seeds and fruits. • Organize and communicate information about seeds. • Set up a seed sprouter and maintain a watering schedule. • Monitor and record changes in seeds. • Investigate the effect of water on seeds. • Compare the mass of dry seeds and those soaked in water. • Describe and compare properties of germinated seeds. • Plant seedlings in nutrient solution and observe them throughout their life cycles. • Observe plant structures as they appear during the plant's life cycle. • Maintain a care-and-feeding routine for living organisms. • Compare the structures, functions, and behaviors of living organisms. • Monitor and record observations of living organisms over time. • Evaluate whether an investigation might harm the animal being studied.

Fifth Grade
Science

Standards

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Key ELEMENTS	*Students should know:*	*Students should be able to:*
• Terrestrial Environments • Preferred Environments • Environmental Factors • Optimal Conditions • Organism Growth • Organism Survival • Organism Reproduction • Environmental Population • Ecosystem • Biotic Factors • Abiotic Factors • Food Chain • Energy Pathways	• Everything that surrounds an organism makes up the organism's environment. • Terrestrial environments include both living (biotic) and nonliving (abiotic) factors. • All animals and most plants depend on both other organisms and their environment to meet their basic needs. • Each organism has a set of preferred environmental conditions. • Organisms have ranges of tolerance for environmental factors. • Optimum conditions are those most favorable to an organism's survival, growth, and reproduction. • Various human activities have changed the capacity of the environment to support some life forms. • The number of organisms and populations an ecosystem can support depends on the biotic resources available and on abiotic factors, such as quantities of light and water, range of temperatures, and soil composition. • All organisms cause changes in the ecosystem in which they live. If this change reduces another organism's access to resources, that organism may move to another location or die. • Changes in environmental conditions can affect the survival of individual organisms and the entire species. • Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms. • The chain of feeding relationships between a series of organisms is called a food chain. • A series of interconnected food chains is called a food web. • Plants are producers: they use the energy from light to make food (sugar) from carbon dioxide and water. • Plants are used as a source of food (energy) for other organisms. • All animals, including humans, are consumers that meet their energy needs by eating other organisms or their products.	• Determine what an organism's environment includes. • Distinguish between biotic and abiotic factors in an environment or ecosystem. • Predict the impact that altering biotic and abiotic factors have on an environment or ecosystem. • Describe how one population of organisms may affect other plants and/or animals in an ecosystem. • Observe and describe changes in a terrarium environment over time. • Relate the behavior of an animal to environmental factors. • Conduct a plant experiment to determine range of tolerance for water and salinity. • Observe changes in an aquarium over time. • Use a chemical indicator to indirectly measure an environmental factor. • Relate differences in acid content to change in carbon dioxide. • Compare experimental data from different kinds of plants. • Illustrate the flow of energy (food) through a community. • Explain the impact of human needs and wants on local and global ecosystems. • Construct and diagram food chains. • Construct and diagram food webs. • Trace the flow of energy through a food web. • Identify and discuss feeding relationships in an ecosystem.

Key ELEMENTS	*Students should know:*	*Students should be able to:*
• Food • Fat Indicators • Saturated Fats • Unsaturated Fats • Sugar Indicators • Metabolism • Carbohydrate • Vitamin C Indicators • Calories • Nutrition • Nutritional Information	• Brown paper can be used to indicate the fat content in foods. • Fat is a nutrient found in many foods. • Foods contain different kinds of fats, saturated (solid at room temperature) or unsaturated (liquid at room temperature). • Yeast can be used to indicate sugar in foods. • A product of yeast metabolism is carbon dioxide, the same gas produced by most organisms. • Sugar is a simple carbohydrate, which is a nutrient found in foods. • The sour taste of foods is due to the presence of acid. • Baking soda and acid react chemically to form new products, one of which is carbon dioxide. • Baking soda can be used to indicate acid. • Indophenol can be used to indicate vitamin C, ascorbic acid. • Calories are the measure of the amount of energy in foods. • Labels on food packages provide nutritional information on carbohydrates, proteins, fats, vitamins, and calories. • Fats have more than twice as many nutritional calories as carbohydrates and proteins. • A balanced diet and good nutrition are essential for the function of a healthy body system.	• Conduct investigations with common foods to discover fats. • Determine relative amounts of fat in foods by controlling variables in the fat test. • Estimate the percentage of fat in various foods. • Learn nutritional information about saturated and unsaturated fats. • Record and compare data and communicate discoveries. • Observe that dry yeast becomes active (metabolizes) when mixed with warm water and sugar to produce gas (carbon dioxide). • Test foods to see which ones contain the most sugar. • Observe that acid and baking soda react to form carbon dioxide. • Use baking soda as an indicator of acid. • Test unknowns (fruit juices) for acid. • Test unknowns for vitamin-C concentration. • Discover a relationship between sour taste and acid concentration. • Describe the concept of calories as units of energy. • Read and interpret labels on packaged food for nutritional information. • Plan hypothetical meals based on nutritional information.
Key ELEMENTS	***Students should know:***	***Students should be able to:***
• Earth's Rotations • Earth's Revolution • Earth Axis • Earth Tilt • Stars • Planets • Earths Position • Planets Characteristics • Sun • Gravity • Stars • Constellations	• The nightly and yearly movement of stars in the sky results from Earth's rotation and revolution. • Scientists use different methods such as examining meteorites and using telescopes to study a variety of objects visible in the night sky. • Stars, planets and moons are objects in the night sky that can be differentiated from one another by their appearance, location, and apparent motion. • The height of the path of the Sun in the sky and the length of a shadow change over the course of a year. • Earth's position relative to the Sun and the rotation of Earth on its axis result in patterns and cycles that define time units of days and years. • Our solar system's planets differ in size and distance from the sun, resulting in different characteristics for each planet. • The Sun's gravity holds planets and other objects in the solar system in orbit, and planets' gravity holds moons in	• Observe and identify constellations. • Explain why the stars, Sun, and planets appear to move. • Distinguish between stars, planets and moons. • Compare and analyze evidence (through simulation) that the Sun's apparent motion across the sky changes over the course of a year. • Construct and evaluate models demonstrating the rotation of Earth on its axis and the orbit of Earth around the Sun. • Describe different methods that astronomers use to study space. • Infer what would happen to an orbiting object if gravity were increased, decreased, or taken away. • Model the relative positions and motions of the planets and their distances from the Sun. • Identify the major objects in the solar system. • Explore and discuss ideas about the origin of the solar system. • Compare and contrast the major physical characteristics

	orbit. • The Sun is the central and most massive body in our solar system, which includes eight planets, moons that orbit the planets, asteroids, and comets. • Stars are huge balls of gas that produce heat and light by converting hydrogen into helium. • Individual stars vary in brightness, size, temperature, and color. • Stars go through life cycles in which they have different characteristics at each stage. The final stage depends on the star's original mass. • Stars are clustered into large moving groups called galaxies that occur in several typical shapes. • Astronauts experience "weightlessness" in space, must carry with them all of the resources they need for survival, and encounter a variety of conditions there.	(including size, scale, compositions, surface features, moons, and movement) of solar system objects using evidence in the form of data tables and photographs. • Make a model of the solar system. • Investigate the characteristics of stars and how they differ from one another. • Observe and classify galaxies into groups. • Collect and interpret data about the size, shape, and movement of the galaxy. • Discuss and conceptualize what it would be like to be in space and how astronauts need to live in order to combat unfavorable space conditions.

Sixth Grade
Science

Standards

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Key ELEMENTS	*Students should know:*	*Students should be able to:*
• Simple Machines • Levers • Fulcrum • Load • Pulley Systems • Advantages • Work	• A lever is a simple machine that people use to gain an advantage, such as making work easier. • Advantage is a gain in effort, distance, or a change of direction resulting from the use of a simple machine. • A fulcrum is the point at which a lever arm pivots. • Load is a mass lifted or a resistance overcome by a lever. • A single-pulley system can be set up in two ways, fixed or movable. • A single-movable-pulley system provides no mechanical advantage, but changes the direction of the effort.	• Construct and use levers to lift loads. • Identify the parts of lever. • Relate the load to the effort force when using a lever. • Discuss and observe an advantage that can be gained by using a lever. • Collect, organize, and analyze data from lever experiments. • Identify and describe class-1, class-2, and class-3 levers. • Analyze common tools in terms of levers. • Assemble and investigate one- and two pulley systems • Discover the advantages of using pulleys: decrease in effort

	• Two pulley systems can be made with one fixed pulley and one movable pulley. • A two- pulley system in which the effort is applied upward provides a greater advantage than one in which the effort is applied downward. • The effort needed to lift a load with a pulley system can be predicted and calculated. • The amount of work put into a system is equal to the work output of the system.	and change in the direction of effort • Diagram pulley systems. • Investigate pulley systems with one and two pulleys. • Record and compare the effort in four different pulley systems.
Key ELEMENTS • Matter • Properties of Matter • Periodic Table • Measuring Matter • Mixtures • Chemical Reaction • Solutions • Solubility • Methods of Separation	***Students should know:*** • Chemistry is the study of the structure of matter and the changes or transformations that take place in it. • Changes in matter can be controlled to produce new materials and to give off energy to run machines. • The volume of some objects can be determined using liquid (water) displacement. • The density of an object can be determined from its volume and mass. • Pure substances have characteristic properties which are independent of the amount of the sample. • All matter is made of atoms. • Matter made of only one type of atom is called an element. • All substances are composed of one or more of approximately 100 elements. • Properties of solids, liquids, and gases are explained by a model of matter composed of tiny particles (atoms) in motion. • The Periodic Table organizes the elements into families of elements with similar properties. • Elements are a class of substances composed of a single kind of atom. • Compounds are substances that are chemically formed and have properties that differ from the reacting substances. • A mixture combines two or more materials that retain their own properties. • A solution is a type of mixture that forms when a material dissolves in a liquid (solvent) and cannot be retrieved with a filter. • Evaporation can separate a liquid from a solid in a solution. • Solubility is the property that substances have of dissolving in solvents. • Solubility is different for different materials and can change with the temperature and different solvents. • A solution is saturated when as much solid material as possible has dissolved in the liquid.	***Students should be able to:*** • Observe, describe, and measure physical properties of matter. • Calculate densities of common substances. • Investigate how the identity of an object can be determined by its physical properties. • Observe, describe, and classify various elements and compounds. • Observe, describe, and classify mixtures. • Investigate how mixtures are made, and how the parts can be identified and separated. • Infer which methods of separation work best for mixtures. • Compare the difference between solutions and other mixtures. • Measure solids and liquids to make mixtures and solutions. • Observe the behavior of solid materials in water. • Compare the weight of a mixture to the weight of its parts. • Observe and describe the behavior of a saturated solution. • Compare the quantities of two solid materials required to saturate a volume of water. • Relate the added weight of the solution to the dissolved material in the saturated solution. • Compare the solubility of materials in water. • Determine the rate of saturation for a solution. • Measure volumes of solids and liquids to make solutions that have different concentrations. • Relate the concentrations of a solution to the amount of solid material dissolved in a volume of water. • Determine the relative concentrations of solutions. • Describe a chemical reaction. • Conduct chemical reactions between solids and liquids and record the changes. • Compare properties of precipitations to determine their identities. • Compare the properties of reactants with the properties of the products when two or more substances are combined to react chemically.

	• When equal volumes of two solutions made from the same ingredients are compared, the heavier one is the more concentrated solution. • Concentration expresses a relationship between the amount of dissolved material and the volume of solvent. • The more materials dissolved in a liquid, the more concentrated the solution. The more solvent added to the solution, the more dilute (or less concentrated) the solution will be. • When a change results from mixing two or more different materials, that change is a chemical reaction. A reaction results in new materials. • When a new substance is made by combining two or more substances, it has properties that are different from the original substances. • The formation of gas and/or a solid precipitate can occur in some chemical reactions. • Not all chemicals react when they are mixed.	
Key ELEMENTS • Characteristic of Livings Things • Microscope • Plant Development • Plant Reproduction • Cells • Micro-Organisms • Living Organism • Adaptations • Behaviors • Diversity of Life • Kingdoms	***Students should know:*** • All living organisms exhibit common characteristics; they grow, consume nutrients, exchange gases, respond to stimuli, reproduce, need water, eliminate waste, and are composed of cells. • Any free-living thing including plant, animal, or other is an organism. • An optical microscope is composed of a two-lens system (eyepiece and objective lens), a stage on which to mount the material being observed, a light source (radiant or reflective), and a mechanical system for adjusting the position of the focal plane. • Focal plane is a thin plane at a fixed distance from the objective lens where the image is in focus. • Optical power is the product of the magnifications of the eyepiece and the objective lens. • A microscope image appears reversed (flipped left to right) and inverted (flipped top to bottom). • The cell is the basic unit of life. • Cells have the same needs and perform the same functions as more complex organisms. • Plant and animal cells have similarities and differences in their structures and functions. • Paramecia have shape, a membrane, cilia, an oral groove, and organelles, including vacuoles. • The major subdivision in cells is whether they have a nucleus (eukaryote) or not (prokaryote).	***Students should be able to:*** • Describe the characteristics of living things. • Classify objects as living or non-living. • Observe five materials for evidence of life when they are placed in suitable environments. • Differentiate the concepts of living, nonliving, dead, and dormant. • Calculate the magnification for each objective lens on the microscope. • Demonstrate proper use of the microscope when studying various samples. • Draw scale representations of images seen in a microscope to estimate size accurately. • Explain how the focal plane affects the image seen through a microscope. • Discover cells by examining Elodea leaves with a microscope. • Observe structures and behaviors of single-celled microorganisms with a microscope. • Compare paramecium cells to Elodea cells. • Generate evidence to support the idea that single-celled paramecia are organisms. • Describe the difference between living cells that are organisms and living cells that are not organisms. • Define the cell as the basic unit of life. • Prepare a wet mount to observe cheek scrapings, and see evidence that humans, too, are made of cells.

	• Bacteria have prokaryotic cells. All other life-forms have eukaryotic cells. • Cells have defining structures, such as membranes, cell walls, nuclei, chloroplasts, ribosome, mitochondria, and cytoplasm. • Seeds contain the dormant, living embryo of a plant. • Germination is the onset of growth and differentiation in plant seeds. • Xylem is the system of tube-like connected cells that transports water from the roots to all structures of the plant. • Stomates are openings on leaves that are controlled by guard cells. • Water in the form of water vapor, a gas, continually leaves a plant through stomates. • Sepals, petals, stamens, and pistils are the major structures of typical flowers. • Pollen from the anthers on the stamens and eggs in the ovules of the pistil are the male and female cells that combine during sexual reproduction to develop into the embryo (seed) of a new plant. • An organism's habitat is the supportive environment in which it lives. • Adaptations are structures or behaviors of organisms that enhance their chances to survive and reproduce in their habitat. • Microbe is the general name for microscopic bacteria and fungi, especially those that cause disease and promote fermentation. • Bacteria, fungi, and algae have the characteristics of living organisms. • Bacteria have a cell membrane but no internal organelles.	• Dissect seeds to discover their structures. • Observe germinating seeds to determine the sequence of development. • Investigate and record the early development of two groups of complex plants, monocots, and dicots. • Investigate the effect of light on germinated seeds. • Explain the role of cotyledons in early plant growth. • Discuss the development and function of roots in early plant growth. • Design an experiment to determine the absorption and transpiration of water in a plant. • Prepare and study a leaf peel to discover stomates. • Observe evidence of transpiration and condensation in plants. • Describe how water enters a plant's roots and flows through the plant during transpiration. • Explain how stomates open and close to regulate the rate of transpiration. • Describe transpiration as a component of the water cycle. • Dissect and mount the structures of a simple flower. • Examine a variety of seeds to discover their dispersal mechanisms and how they contribute to a plant's survival. • Explain the function of flowers and pollination. • Describe the production of seeds in terms of sexual reproduction. • Conduct structured investigations to determine an organisms' preference for a number of environmental factors. • Compare distantly related organisms using fossil evidence. • Describe habitat in terms of the needs and preferences of an organism. • Observe and identify several behavioral and structural adaptations in living organisms. • Inquire about the behaviors of living organisms and design experiments to answer those questions. • Make inferences about the habitat of organisms based on observing their structural and behavioral characteristics. • Observe and analyze the growth of bacteria and fungi. • Calculate the reproductive potential of bacteria. • Explain that bacteria and fungi are found on all surfaces and in the water and air around us. • Explain how bacteria and fungi carry out the functions of living organisms. • Describe the role of microorganisms in transforming foods and recycling nutrients through decomposition.

Seventh Grade
Science

Standards

Life Science: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.
Scientific Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

Key ELEMENTS	*Students should know:*	*Students should be able to:*
• Measurement • Scientific Process • Graph • Characteristics of Living Things • Organization of Living Things • Ecosystems • Cells Structure and function • Cell Processes and Energy • Single and Multi-cellular Organism • Cell Processes • Compounds of Life • Heredity traits • Genetics • Natural Selection • Evolution • Human Body Systems • Scientific Inquiry • Research • Scientific Experiment	• Proper tools and instruments are needed to accurately measure in English and metric units. • Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models. • It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists. • Living systems at all levels of organization demonstrate the complementary nature of structure and function. • Important levels of organization for structure and function include cells, organs, tissues, organ systems, whole organisms, and ecosystems. • All organisms are composed of cells, the fundamental unit of life. Most organisms are single cells; other organisms, including humans, are multi-cellular. • Cells carry on the many functions needed to sustain life. They grow and divide, thereby producing more cells. • Cells take in nutrients, which provide energy for the work they do to make the materials needed. • Specialized cells perform specialized functions in multicellular organisms. • Groups of specialized cells cooperate to form a tissue, such as a muscle. • Different tissues are grouped together to form larger functional units, called organs. • Each type of cell, tissue, and organ has a distinct structure and set of functions that serve the organism as a whole. • Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. • Some organisms reproduce asexually. Other organisms	• Differentiate between measurement of length, area, and volume. • Express measurement in both English units and metric units. • Compare Fahrenheit and Celsius temperature scales. • Measure various objects/substances using scientific tools. • Evaluate how the scientific method is used in an experiment. • Distinguish between experimental and control variables. • Demonstrate scientific skills while conducting investigations. • Design and test a hypothesis. • Construct a graph to illustrate data and to identify relationships between variables. • Classify objects as living or nonliving using evidence-based criteria. • Describe the levels of organization in a living system and relate the structures of each level to their functions in supporting life. • Explain how different variables affect homeostasis. • Compare and classify organisms into groups based on similar characteristics. • Compare and classify examples as either an element or compound. • Describe the structure and function of water, carbohydrates, lipids, and proteins as it relates to sustaining life. • Relate the energy and nutritional needs of organisms in a variety of life stages and situations, including stages of development and periods of maintenance. • Illustrate the make-up of an ecosystem and explain the interactions of its components. • Explain that organisms can survive only in ecosystems in which their basic needs are met. • Describe the relationship between sunlight and photosynthesis. • Recognize the nonliving parts of an ecosystem.

	reproduce sexually. • In many species, including humans, females produce eggs and males produce sperm. • Plants also reproduce sexually; the egg and sperm are produced in the flowers of flowering plants. • An egg and sperm unite to begin development of a new individual. That new individual receives genetic information from its mother (via the egg) and its father (via the sperm). • Sexually produced offspring are never identical to either of their parents. • Every organism requires a set of instructions for specifying its traits. • Heredity is the passage of these instructions from one generation to another. • Hereditary information is contained in genes, which is a single unit of information located in the chromosomes of each cell. • An inherited trait of an individual can be determined by one or many genes, and a single gene can influence more than one trait. • A human cell contains many thousands of different genes. • The characteristics of an organism can be described in terms of a combination of traits. • Some traits are inherited and others result from interactions with the environment. • All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment. • Regulation of an organism's internal environment involves sensing the internal environment and changing physiological activities to keep conditions within the range required to survive. • Behavior is one kind of response an organism can make to an internal or environmental stimulus. • A behavioral response requires coordination and communication at many levels, including cells, organ systems, and whole organisms. • Behavioral response is a set of actions determined in part by heredity and in part from experience. • An organism's behavior evolves through adaptation to its environment. How a species moves, obtains food, reproduces, and responds to danger is based in the species' evolutionary history. • A population consists of all individuals of a species that occur together at a given place and time.	• Evaluate the roles of organisms in a food chain and a food web. • Explain how energy flows in food chains. • Analyze the components of a consumer's diet and trace them back to plants and plant products. • Interpret an energy pyramid. • Distinguish between populations and communities and describe how their interactions create balance. • Analyze and model how different environmental factors (positive and negative) affect population size and growth in an ecosystem. • Explore the cell theory and analyze similarities and differences among cells. • Differentiate between cell structure and function. • Identify and describe parts of a cell and their functions. • Classify and differentiate between prokaryotic and eukaryotic cells. • Model and explain ways in which organelles work together to meet the cell's needs. • Compare the benefits and limitations of a single-celled organism vs. a multicellular organism. • Compare and contrast animal and plant cells. • Describe the processes of diffusion and osmosis through a cell membrane. • Compare and contrast active transport with diffusion. • Compare and contrast cellular respiration and photosynthesis. • Describe the function of mitosis and cell division. • Observe the cell cycle and compare the different stages. • Explain what happens to a chromosome during cell division. • Differentiate between sexual and asexual reproduction. • Describe the process of meiosis. • Summarize the process of fertilization. • Explain cell differentiation and specialized cells. • Infer how traits are inherited. • Describe Mendel's experiment and explain how his work is used to predict heredity. • Differentiate between phenotype and genotype. • Demonstrate how to complete and interpret punnett squares. • Describe the relationship between punnett squares and probability. • Describe the importance of sex chromosomes. • Compare and contrast incomplete dominance and codominance. • Explain how environmental factors influence inheritance. • Construct a model of the DNA molecule and explain its function.

	• All populations living together and the physical factors with which they interact compose an ecosystem. • Populations of organisms can be categorized by the functions they serve in an ecosystem. • Plants and some micro-organisms are producers, which make their own food. • All animals, including humans, are consumers, which obtain food by eating other organisms. • Decomposers, primarily bacteria and fungi, are consumers that breakdown waste materials and dead organisms for food. • Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem. • The major source of energy in an ecosystem is sunlight, which is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs. • The number of organisms an ecosystem can support depends on the resources available and abiotic factors. • Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem. • Although different species might look dissimilar, the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry. • Biological evolution accounts for the diversity of species developed through gradual processes over many generations. • Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations. • Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment. • Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival. • Fossils indicate that many organisms that lived long ago are extinct. • Most of the species that have lived on the earth no longer exist. • Although all scientific ideas are tentative and subject to change and improvement, for most major ideas in science,	• Demonstrate the process of DNA replication. • Explain mutations, their origin, and their outcomes. • Describe the environmental conditions or factors that may lead to a change in a cell's genetic information or to an organism's development, and how these changes are passed on. • Explain adaptation and how it relates to evolution. • Analyze cladograms to understand evolutionary relationships. • Compare the anatomical structures of a living species with fossil records to derive a line of decent and provide evidence of the past. • Differentiate between artificial and natural selection. • Explain Darwin's theory of evolution and natural selection. • Describe the importance of genetic variation. • Defend the principle that, through reproduction, genetic traits are passed from one generation to the next, using evidence collected from observations of inherited traits. • Justify the source of variation among siblings. • Explain the connection between natural selection and heredity. • Summarize how a new species evolves. • Discuss extinction and the common causes. • Organize and present evidence to show how the extinction of a species is related to an inability to adapt to changing environmental conditions using quantitative and qualitative data. • Explain the importance of the circulatory system and describe the flow of blood through the body. • Differentiate between arteries, capillaries, and veins. • Explain the structure and function of the respiratory system. • Describe the functions of the skin. • Differentiate between the different glands in the endocrine system. • Compare and contrast the digestive system and the excretory system. • Identify the organs of the reproductive system. • List the functions of the skeletal system. • Describe the structure of a bone. • Differentiate between fixed and moving joints. • Identify the three different types of moving joints. • Explain the functions of the muscular system. • Distinguish between flexor and extensor muscles. • Distinguish between central and peripheral nervous systems. • Explain that a nerve impulse is a combination of electrical and chemical signals. • Describe the parts of the brain.

	there is much experimental and observational confirmation. • Those ideas are not likely to change greatly in the future. Scientists do and have changed their ideas about nature when they encounter new experimental evidence that does not match their existing explanations. • The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, coordination, and for protection from disease that interact with one another.	• Model the interdependence of the body's major systems in regulating its internal environment.