Teacher Reference Materials

Article 1

Welcome to the Science Companion Curriculum

ScienceCompanion® CHICAGO SCIENCE GROUP

Teachers find excitement and gratification in seeing young children learn and grow. When children learn science, they do what comes naturally: energetically pursuing their curiosity, eagerly trying new ideas, and attempting to understand how the world works. These are traits that children and adult scientists share. Children are drawn to science because it encourages wonder and invites hands-on exploration. Pairing the sound teaching principles you've been using in your classroom with children's natural curiosity is the key to a successful science program.

The goals of the Science Companion program are to preserve the open-mindedness that a child brings to science and link accurate science content with hands-on explorations in the real world. The program strives to help learners identify, develop, and refine their abilities to explore and answer questions. They'll solve problems, ask more questions, and, ultimately, make informed decisions. You'll be a partner in the children's learning, modeling processes of investigation and discovery. You don't need to be an expert in all content areas; it's more important that you are actively involved in the journey with your class.

The activities in the lessons draw on the children's immediate lives and environment. The children's questions, as well as their answers, are essential to the elementary science curriculum. This emphasis is encouraged from the beginning, starting in kindergarten, and will continue with children as they grow.

The Science Companion program is developed for children and teachers. Your science classroom will be a place filled with children's wonder and excitement. You may even find that your own sense of awe and inquisitiveness about science is rekindled!

You'll Find Inside:

How to Use the *Teacher Reference Materials*

The *Teacher Reference Materials'* collection of articles was created to guide your Science Companion teaching. The material is organized in a magazine-like format, with separate articles that you can read as your busy schedule allows. In each of these articles you'll find information that explains how the Science Companion program works, how to best teach it, and some pedagogical strategies for making science happen in your classroom. Hopefully this material will be useful, inspiring, and instructive. It's designed to be used by teachers and other people interested in learning about Science Companion. It is our goal to have the *Teacher Reference Materials* evolve over time. We plan to include more articles in the future as we learn from our audience: administrators, teachers, and students of science. This version of the *Teacher Reference Materials* includes these articles:

- **Welcome to the Science Companion Curriculum—**Discusses methods for personal involvement in the classroom that foster science learning. This article also describes the scope and sequence of the entire program.
- **Setting Up a Science-Friendly Environment—**Deals directly with setting up your classroom and creating an environment conducive to learning and discussing science. It specifically addresses setting up a Science Center, organizing science materials, and using displays.
- **Developing the Child Scientist—**Includes information about presenting scientific processes and skills, discussing science with children, cultivating cooperative learners, and helping all children be successful in science.
- **Planning a Science Companion Unit—** Explains how to plan and schedule a science unit for your classroom situation. It describes unit components, discusses ways to link and integrate science with other subject areas, and explains how to use Science Companion's suggested full-year schedules.
- **Planning a Science Companion Lesson—** Describes the components of the lessons and discusses the importance of science notebooks and class books. This information, used in combination with other sections of the *Teacher Reference Materials*, is intended to help you implement successful lessons.
- **Assessing A Child's Science Abilities—** Provides suggestions about how to effectively evaluate your children's participation, understanding, interactions, and growth over time. It suggests assessment strategies and explains how to use the assessment section and assessment opportunity notes in every Science Companion lesson, as well as each unit's assessment charts.

As you review each of these articles, you'll become better acquainted with the processes and skills emphasized by the Science Companion curriculum. Use the *Teacher Reference Materials* to assist you in planning, communicating about the program, and building an understanding of science in your classroom. As you use the Science Companion program, keep in mind the ideas presented in these articles.

What is a Scientist?

"Don't bother me," he said. "I am a scientist and I have to concentrate on my writing."

William, a first grader who liked science in school more than language arts but found out that scientists do a fair bit of writing.

We're All Scientists

The child brings an open mind, active body, and enthusiasm to the classroom. Teaching science to young children offers an exciting opportunity to participate in a dynamic learning environment. The attitudes and interests that young children bring to the science classroom are perfect for nurturing and maximizing engagement with science. These potential and developing characteristics are sometimes referred to as "habits of mind"[1] and are crucial for combining science literacy and skills with science content knowledge. They are reflected in national science standards and benchmarks, and mostly likely those of your school or district as well. Recognizing and developing these "habits of mind" is an important goal of the Science Companion program.

Child Scientists

As a child matures, these "habits of mind" develop incrementally; therefore, they are fostered throughout the Science Companion program. As a teacher, you'll reinforce these qualities when you encourage children to:

- Ask questions and pursue answers through playful exploration and purposeful investigation
- Pursue ideas in depth over time and make connections with their findings
- Carefully observe, considering details and attributes
- Clearly communicate ideas and observations in a variety of ways
- Collaborate and share both tasks and opinions with small and large groups
- Develop critical response skills to promote high-level thinking skills needed as a scientist
- Provide explanations based on observations
- Begin using initial research skills such as independent reading to find information
- Compare what they know to stated facts such as those in printed materials or visuals
- Use curiosity to pursue questions and ideas in depth, which may include outside research and reading
- Examine answers by balancing open-mindedness with skepticism

Keep in mind that in any group of children the same age there is likely to be a two-and-a-half year span of development. The acquisition of these "habits of mind" will differ for each individual.

We're All Scientists

Teachers of Science

Just as children bring their attitudes and interests to the science classroom, teachers bring their preferences and background to teaching science. Keep in mind that this program doesn't expect you to be a nuclear physicist. You'll find plenty of opportunities to experience those joyful teaching moments that brought you into the profession and keep you there. Regardless of your background in science, use your best teaching skills and draw on those science skills with which you're most comfortable.

The following guidelines may help you create a science classroom environment that makes both you and the children feel secure and confident:

- *Don't worry about always being the expert with all the answers.* Learning is a collaborative experience. Enjoy the discovery process with the children and share your new understandings with them.
- *Model a scientific disposition or mental attitude.* Demonstrate curiosity and openness to new ideas to the class, as well as a healthy dose of skepticism. Think out loud.
- *Encourage children to test their ideas and explanations.* Focus on asking questions that make children look for evidence or prove their explanations. Gently challenge answers like, "Because." Ask questions such as: "What did you see that made you decide this?" "Where did you find that out?" "How did you measure it?" Extend a lesson if the children have an idea that can be tested.
- *Be on the lookout for misconceptions.* Allow time for children to express various points of view and to elaborate on explanations. The more you do this, the more you will understand the patterns of thinking and types of understanding that exist among your class. Children (and adults) have a set of experiences from which they develop their own sense of the world. Some of that "sense" may include misconceptions, so it is important to not only identify those misunderstandings, but to provide ways to redirect their thinking, including further investigation and questioning before committing to a final answer.
- *Respond to children's explanations in a positive constructive way.* When someone's explanation or response is actually "wrong," help children reconsider their ideas, channel their thinking in a new direction, and restate their comments. Reduce the fear that is often associated with responding in class. Start with a compliment such as the following: "I'm glad you're sharing. Have you considered…?" "That's a creative way to look at it. How about…?" "Perhaps that might happen on television. Can you think of a different idea?"
- *Foster diversity and understanding.* Post examples through the classroom of model thinking questions and respectful comments. Encourage children to participate in the development of these examples.
- *Make learning relevant to the world of your children.* To make science relevant, focus on what is going on in the children's homes and within their community.

What Teachers Say Kids Think About Science Companion

- *"Kids who were normally struggling felt free and successful."*
- *"Kids engaged fully!"*
- *"Kids came to life in a new way!"*
- *"On the spot—'I get it!'"*
- *"Kids loved the program. It was grabbing and connecting."*

Involving Family at Home

To improve children's understanding that science isn't done only in school, give parents background information and suggest ways to encourage children to watch and think about science at home. The Science Companion curriculum provides methods for you to encourage real life science experiences outside of the classroom. Try out the following suggestions and personalize them as you see fit.

Family Links Within Lessons

Some of the lessons include related activities, called Family Links, which can be used as homework. They also serve as a point of contact with families. Family Links may be requests for sending or collecting materials to support explorations, invitations for adults to participate or help with science activities and projects, or summaries of projects that can be continued at home. You will find black line masters for Family Links in the Teacher Masters packet.

Science Companion Web Site (www.sciencecompanion.com)

This web site provides a host of ideas for teachers and an overview of the Science Companion curriculum. There is a parent resource section that you can suggest for parents.

Letter for Families

In each unit's Teacher Masters packet, you'll find a letter for families that introduces the unit and describes what will be taught. The letter also suggests how families can become involved in their child's learning. The content of this letter is also available on the Science Companion web site at **www.sciencecompanion.com**. Feel free to download it and customize the text to meet your needs.

Other Communication with Families

In addition to the family letter for each unit, include a description of your weekly science activities in your classroom newsletter or other regular communication with home. You might include work the children created such as drawings or writings, photographs you've taken, or photocopies of the science notebook pages. Whatever you choose, use the content to help connect families to the science curriculum.

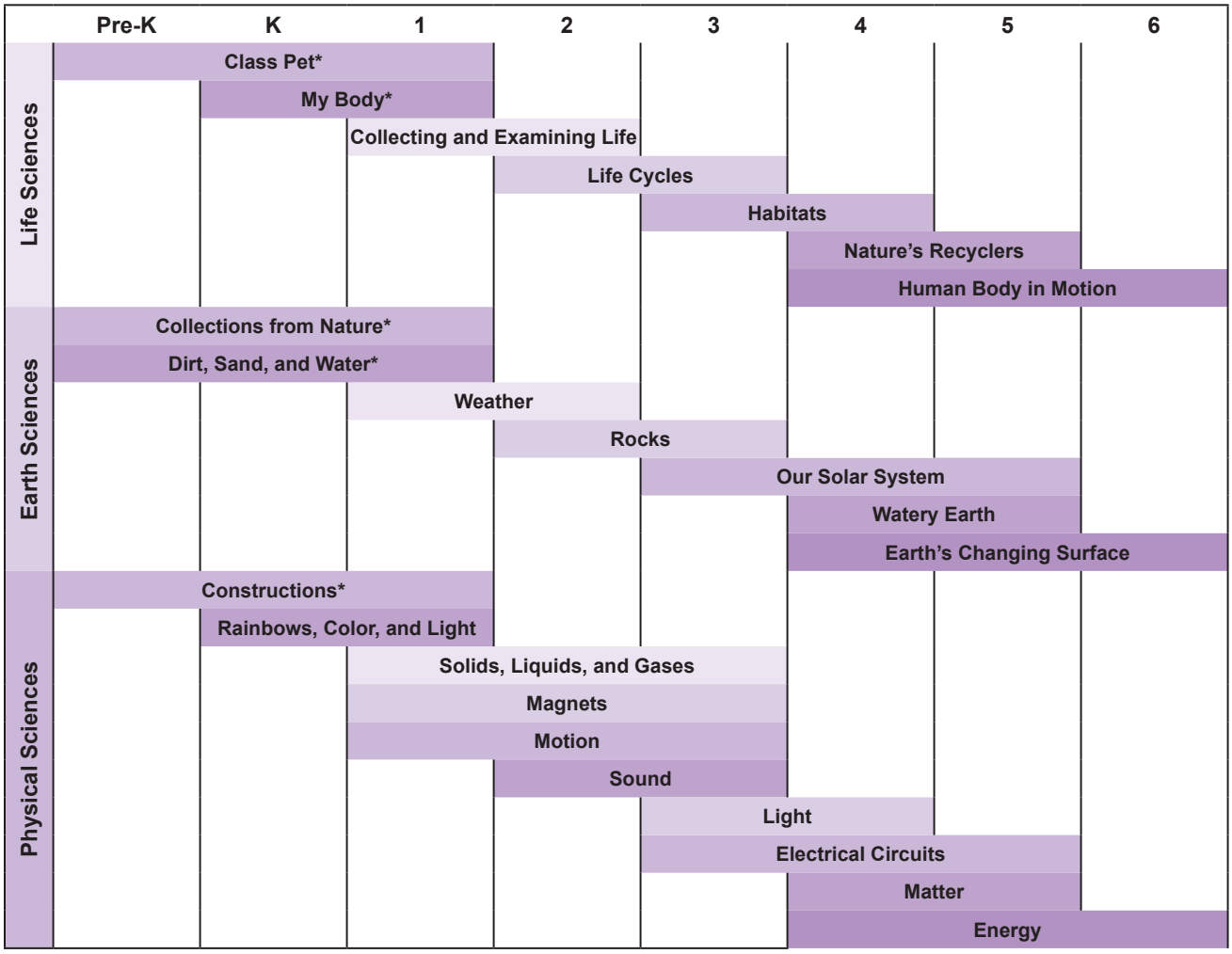
"I think our parents appreciate the fact that our science program is such a 'hands-on' subject. We aren't just reading out of a book. The kids go home talking about what we've done, and that is good! "

Christie Rice—Science Companion teacher

Scope and Sequence

The Science Companion curriculum developers have carefully and deliberately selected the content of the program based on the National Science Education Standards and the AAAS Benchmarks for Science Literacy. The Science Companion approach is one of depth not breadth. Focusing on a manageable number of topics allows you and your students to delve deeply in the "big ideas" and to stick with a topic for an extended period of time.

The scope and sequence chart below lists the titles of the units that are recommended for grades pre-K through 6.



* These topics are in a single book of activities.

[1]National Research Council. National Science Education Standards. Washington, D.C.: National Academy Press, 1996.

[2]American Association for the Advancement of Science (Project 2061). Benchmarks for Science Literacy. New York: Oxford University Press, 1993.

Scope and Sequence

The Science Companion curriculum offers children concrete science experiences based on natural phenomena. Each lesson incorporates interesting and relevant scientific content, as well as science values, attitudes, and skills that children in elementary school should begin to develop. Below are overviews and descriptions of the pre-K through 6 units.

Life Science

Class Pet (Levels Pre-K, K, and 1)

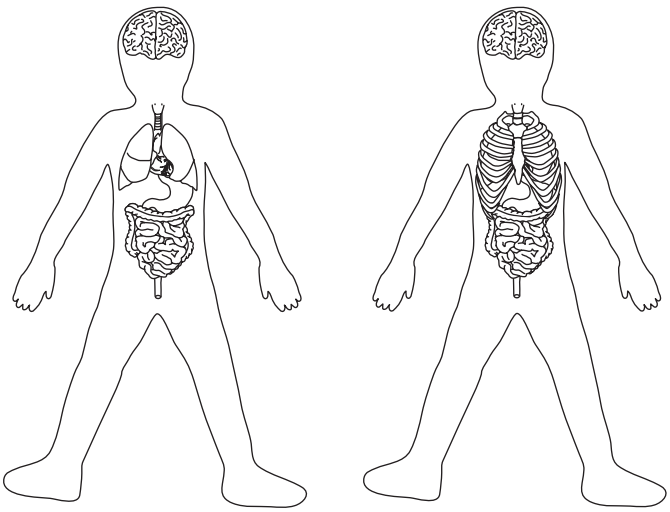
Children's ongoing interactions with a class pet provide an ideal opportunity for introducing the concept of scientific inquiry. By living with, caring for, closely observing, and documenting observations of a pet over time, children learn a great deal about the characteristics and needs of a single animal. In addition, activities that extend this learning help children make connections and comparisons with other animals. Safe handling and humane treatment of animals are emphasized.

Big ideas from Class Pet:

- Pets require daily care, including feeding and providing water.
- Pets grow and change. You can monitor some changes by weighing and measuring pets.
- You can design simple experiments to learn more about pets.
- Animals have many common characteristics.
- Our pets may be found in the wild in natural settings.
- A pet's body is suited to its needs and to its environment.

My Body (Levels K-1)

Children learn about the inner workings of their bodies through multi-sensory observation, experimentation, modeling, and other scientific methods of inquiry. They learn about their brain and five senses, and make a simple model of their circulatory, respiratory, skeletal, and muscular systems inside a life-size body outline. Children explore the topics presented in the context of their own bodies, with a focus on concrete activities and experiences.



Big ideas from My Body:

- Our senses help us understand our world.
- Blood moves through the circulatory system.
- We breathe in and out using our respiratory system.
- Food nourishes our bodies through the digestive system.
- Our skeletal system includes bones that are joined together and give our bodies shape and mobility.
- Our muscles give us strength and allow us to move.
- Our bodies have natural ways to heal.

Scope and Sequence

Life Science

Collecting and Examining Life (Levels 1-2)

Children explore the natural world outside the classroom door. They begin by studying animals. They continue by learning about plants and fungi. Outside the classroom, two nature walks provide opportunities to make collections of living and once-living things. Inside the classroom, experiments and observations help children understand what makes something alive. During the unit, children have experiences with a variety of animals and plants to help them learn similarities and differences within each group of living things.

Big ideas from the Collecting and Examining Life Unit:

- How can we tell when something is alive?
- Many different kinds of living things share our neighborhood environment.
- Animals are living things. They have many parts that help them move, breathe, eat, and sense their environment.
- Plants are living things. They have many parts that help them move, breathe, eat, and sense their environment.
- Fungi are living things that are neither plants nor animals.

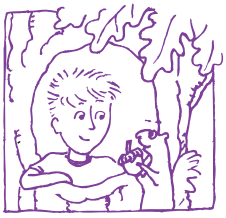
Life Cycles (Levels 2-3)

Children study the lives of humans, trees, flowering plants, and butterflies. They look at the life stages and life spans of humans. Then they embark on a year-long study monitoring growth and change in themselves and a class tree. During this extended period of time, they analyze the subtle changes that occur in organisms with relatively long life spans. They also study the relatively short life cycles of butterflies and peas. The fast and dynamic changes in these organisms provide a stark contrast to the slower changes in their own life cycles.

Big Ideas from Life Cycles:

- All living things have life cycles that include being born, growing up, reproducing, and eventually dying.
- The stages of a life cycle repeat from one generation to the next.
- The details of the life cycle are different for different organisms.
- Physical growth and change are important parts of the life cycles of all organisms.
- All organisms have special needs that must be met in order to survive.

Life Science



Habitats (Levels 3-4)

Children examine habitats as diverse natural homes that are shared with many other living things. They look closely at how individual organisms meet their survival needs in a habitat, how physical and behavioral characteristics help organisms survive in their habitat, and how biomes and habitats differ. As the children solidify their understanding of habitats, they use their knowledge to design organisms that can survive in a specific habitat within a biome.

Big Ideas from Habitats:

- All organisms have basic survival needs: air, food, water, protection, and space. A habitat is the place where an organism gets everything it needs to survive.
- Many organisms share an environment and interact because their habitats overlap.
- Organisms have characteristics that make it possible for them to survive in their habitat.
- A biome is a large geographic area that contains many habitats.

Nature's Recyclers (Levels 4-5)

Through a wide variety of hands-on investigations, students discover that living organisms carry out the process of decomposition. In caring for and working with living organisms, students have the opportunity to develop good habits of environmental stewardship. They also learn that the decomposition process makes nutrients available for plants and other organisms. This unit provides many opportunities for students to collect and analyze data and draw conclusions, as they set up their own experiments to investigate their own ideas about decomposition.

Big Ideas from Nature's Recyclers:

- Nature's waste and remains don't just pile up. They decompose.
- Nature's recyclers—scavengers, fungi, and bacteria—feed on dead organisms and waste. They carry out the process of decomposition.
- Nature's recyclers return nutrients to the soil (or water) to be used by plants and other organisms.

Scope and Sequence

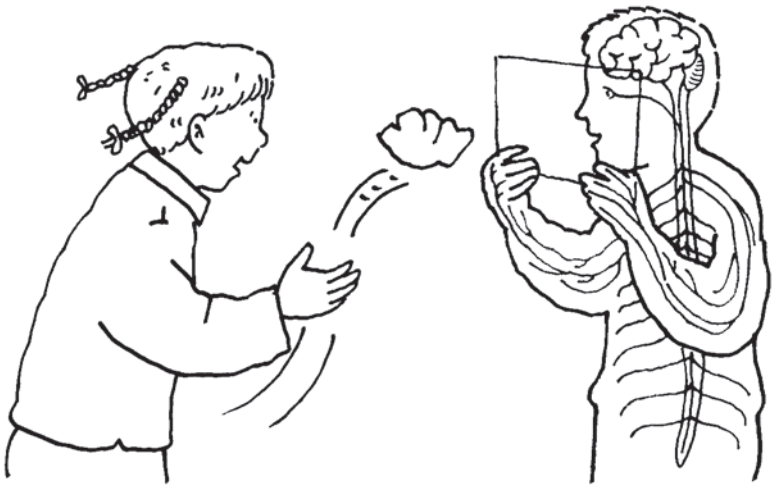
Life Science

Human Body in Motion (Levels 4-6)

Students get an inside view of their bodies to see how they move. They discover that movement, like all bodily functions, requires many parts of the body to work together. Students explore the skeletal, muscular, nervous, circulatory, respiratory, and digestive systems to uncover the specific role each plays in bringing about movement. They come to appreciate the complex intricacies and dependencies between parts of their bodies and learn what they can do to maintain and protect these parts.

Big Ideas from Human Body in Motion:

- To move, many parts of the body must work together.
- Muscles move our bodies by pulling on bones that meet at joints.
- Nerves carry signals to our muscles to move parts of our body.
- Bones are made of unique cells important to movement.
- To produce energy and function properly, all cells need a constant supply of oxygen, nutrients, and water.
- Muscles are made of unique cells important to movement.
- To produce the energy needed for movement, muscle cells need a constant supply of oxygen, nutrients, and water.
- The human body is made up of many different types of cells. Each type of cell has unique characteristics for performing a specific "job."



Earth Science

Collections from Nature (Levels Pre-K, K, and 1)

This study channels and deepens children's natural impulses to explore and collect as the class builds a collection of a particular type of natural objects and conducts an in-depth investigation of the collection. Children weigh and measure objects, closely observe form and texture, and make simple classifications through sorting activities. They also learn various ways to acquire information about their collections, including observation, experimentation, research, and communication with an "expert." Children become "experts" themselves about the items in their collection.

Big Ideas from Collections from Nature:

- There are many ways to scientifically study collections from nature.
- You can sort, classify, and describe objects according to their similarities and differences.
- You can investigate materials by weighing and measuring them.
- Describing objects in detail is a scientific skill.
- An object has a certain form which is related to its function.
- Experts can help us to understand things we are interested in. We can become experts too.

Dirt, Sand, and Water (Levels Pre-K, K, and 1)

As children pack and pour, and dig and squirt, they explore the properties of dirt, sand, and water and investigate states of matter. Activities such as "Adding Water," "Mud Pies," and "Mixing and Un-mixing" validate and build on children's urge to cook and concoct, while leading them to discoveries about interactions between materials and the nature of change. A close examination of dirt, sand, and water increases children's awareness of the complexity of the natural world and the science in their own backyards.

Big Ideas from Dirt, Sand, and Water:

- You can see, feel, smell, and move sand, dirt, and water to find out some of their properties.
- Dirt is composed of many different materials.
- Water can freeze to become a solid. Ice can melt to become a liquid.
- Water mixes with materials in many different ways.
- Materials can be mixed together. Some can be separated, some cannot.
- Some objects sink and some objects float in water. Objects displace water.
- Clay is a special type of soil.

Weather (Levels 1-2)

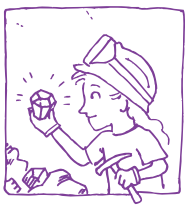
Children build on their experiences with weather to make connections between the internal world of their feelings and the external world of natural science. They observe and document the daily weather, and graph data at the end of each month to discern monthly and seasonal weather patterns. They learn to quantify weather, using tools such as thermometers, rain gauges, and wind tools. Children ultimately find that weather is dynamic and not completely predictable giving them wonderful insight into the complexity of nature.

Big Ideas from Weather:

- Weather is how the sky looks and feels.
- Weather is measurable. A meteorologist observes, measures, records, and describes the weather.
- We notice weather patterns by observing, measuring, and graphing weather over time.
- Water, in its many forms, can play a role in weather.
- Air, which surrounds us and takes up space, plays a role in weather.
- Wind is the flow of moving air.

Scope and Sequence

Earth Science



Rocks (Levels 2-3)

Children study rocks, minerals, and fossils. They sort rock and non-rock objects. They examine rocks, note their similarities and differences, and describe rocks according to properties such as color, size, shape, smell, and texture. Children learn that all rocks are made of minerals and then examine mineral properties, including hardness and streak. They discuss minerals as resources that are usually nonrenewable, but often reusable. Finally, children learn about the processes that create fossils and how fossils preserve the shapes and textures of animals and plants.

Big Ideas from Rocks:

- What makes a rock a rock?
- You can learn a lot about an object by carefully observing and describing its properties.
- The earth forms and changes rocks. Some of a rock's properties are a result of how it was formed.
- Rocks are made of minerals. Some of a rock's properties are a result of the properties of the minerals it is made of.
- Minerals provide many of the resources we use.
- Fossils are rocks that contain evidence of ancient life. Different fossils form in different ways.

Our Solar System (Levels 3-5)

Children explore their ideas about the position of the Earth in the solar system. They build knowledge through direct observations of the sun and moon. Children track the changing position of the sun during the school year, and observe the changing phases of the moon through a lunar cycle. They engage in hands-on activities to model difficult concepts such as the earth's rotation, its orbit around the sun, the moon's position in relation to the earth and sun, and the scale of the solar system.

Big Ideas from Our Solar System:

- The sun appears to travel through the sky in a predictable daily pattern. This pattern can be explained by the rotation of the earth.
- Both the apparent path of the sun across the sky and the length of daylight change slowly over the year. These changes are a result of the Earth orbiting the sun once a year.
- The observable shape of the moon changes from day to day in a predictable pattern. We see different views of the moon's sunlit portion as the moon orbits the Earth.
- The sun is the center of our solar system, and Earth is one of nine planets that orbit it.
- The sun is a star like all other stars.

Earth Science

Watery Earth (Levels 4-5)

Students consider water resources on both a global and a local level. As they learn about the water cycle and the distribution of Earth's water, students realize that although water is abundant and renewable, it must be protected because there is a limited amount of fresh, clean water available at any given time. Students have many opportunities to see the relevance and applications of science and technology in their own lives. They are encouraged to use this knowledge to positively impact water resources through their own choices and actions.

Big Ideas from Watery Earth:

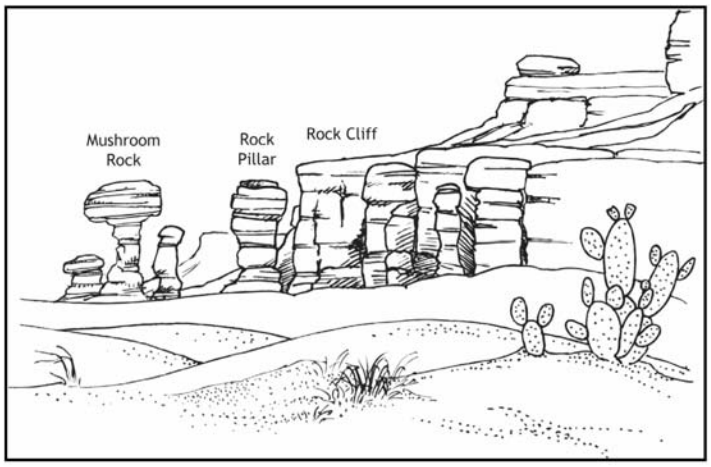
- Water is a natural resource that is essential for humans and other organisms.
- Water can be on Earth's surface, underground, or in the air. All water on Earth circulates through the water cycle.
- To use water, we must develop ways to access it and clean it.
- Sometimes humans use more water than they need.
- Water resources are limited. It is important to protect and conserve water.

Earth's Changing Surface (Levels 4-6)

Students explore the processes that create the astonishing variety of landforms across our planet. Through a range of hands-on explorations, students discover the slow processes and subtle forces that carve, shape, and weather the earth's surface. Students engage in activities of geologists: making careful observations, analyzing them, and drawing conclusions. By the end of the unit, students shed their image of landscapes as unchanging and develop a view of the earth's surface as dynamic and constantly changing.

Big Ideas from Earth's Changing Surface:

- Landforms are the result of changes to the earth's surface.
- Moving water, ice, and wind break down rock, transport materials, and build up the earth's surface.
- The earth's rock is slowly weathered or broken down into smaller fragments.
- Movements of the earth's crust shape the surface of the earth.



Scope and Sequence

Physical Science

Constructions (Levels Pre-K, K, and 1)

Children explore scientific concepts involved in design, architecture, and construction. They acquire knowledge through experience as they use trial and error to construct and improve their structures. They have opportunities to build with many materials, to visit a construction site, and to make their own building sites in the sand, block, and dramatic play areas. They also seek information from adults involved in the building trades and culminate the study by building a model of their own homes from assorted materials.

Big Ideas from Constructions:

- Some construction problems can be solved through trial and error.
- We can build structures by following a sequence.
- We can build structures using many different materials.
- Pulleys and levers can make the construction job easier.
- There are many ways to make structures stronger.
- Beam, arch, and suspension are the three main types of bridges.

Rainbows, Color, and Light (Levels K-1)

An arching rainbow across the sky is a source of wonder to children. In this study, children bring rainbow effects into their classroom and onto the playground through experiments with prisms, mirrors, bubbles, water, sunlight, and flashlights. Children also bring the scientific approach to color mixing. They observe that colored light produces different results than mixing pigmented paints, dough, or water. Children are also introduced to how their eyes perceive light and color as they explore what objects look like in the dark.

Big Ideas from Rainbows, Color, and Light:

- We can create rainbows by using a variety of different materials along with a light source.
- Light affects our ability to see in color as well as in black and white.
- Colored paints and liquids mix to create new colors.
- Colored light mixes to create new colors. These colors vary from mixtures of paints and liquids.
- Colors that have been mixed together can be separated.

Solids, Liquids, and Gases (Levels 1-3)

Children begin by exploring and describing the properties of everyday objects. They consider the materials that make up various objects and think of how the properties of these materials make the objects useful. Children then focus on properties that distinguish liquids, solids, and gases. They compare and contrast different liquids to identify properties that liquids share. They change the shapes of solids by folding, tearing, or breaking, and then identify properties that solids share. Finally, the children make predictions about water and observe water as it freezes, melts, and evaporates.

Big Ideas from Solids, Liquids, and Gases:

- Objects have many properties that we can observe directly and with tools.
- Materials have properties that make them useful. Objects are made of many materials.
- We classify objects as solid, liquid, or gas based on their properties.
- Water can change from a liquid to a solid, and back to a liquid. Water "disappears" from an open cup, becoming a gas.

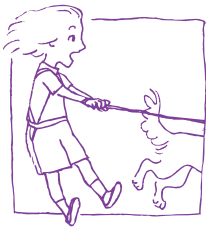
Physical Science

Magnets (Levels 1-3)

Children are introduced to the properties of magnets and explore the pushing and pulling forces exerted by them. Through a variety of hands-on investigations, they test what types of materials are attracted to magnets and how magnets interact with one another. They set up simple investigations to test whether the force of magnets works through different materials and test the strength of different magnets. Children examine a number of useful objects in everyday life that employ magnets, and explore how compasses work.

Big Ideas from Magnets:

- Magnets cause a push or pull (a force).
- Magnets pull on (attract) some materials and not others.
- Magnetic forces push or pull even if objects don't touch the magnet.
- Magnets can push or pull at a distance and through different materials.
- You can do useful things with magnets.



Motion (Levels 1-3)

Children examine motion closely by observing how their own bodies move and by experimenting with ways to make other things move. They learn to describe motion by how long it takes an object to get somewhere, how fast it goes, and what path it follows. As they investigate what changes an object's motion, they recognize the effects of several specific types of forces, including collisions, friction, and gravity.

Big Ideas from Motion:

- Motion is movement. You can describe an object's motion by how long it takes, how far the object travels, how fast the object goes, and what path it follows.
- The way to change how something moves is to give it a push or a pull.
- Collisions cause pushes that may change the motion of all the colliding objects.
- Friction is a force (a pull) that slows down moving objects.
- On Earth, gravity is a force that pulls everything down all the time.

Sound (Levels 2-3)

Children heighten their awareness and attention to sound. They explore ideas about how sound is created, and learn that all sounds are produced by vibrations. They discuss how sound travels. They create a simple model of the human ear. The children explore sound volume and pitch by experimenting with a wide variety of simple wind, string, and percussion instruments. Finally, they apply their accumulated knowledge of sound by designing, building, and playing musical instruments.

Big Ideas from Sound:

- Sounds are produced by sources all around us. You can describe sound in a variety of ways.
- All sounds are made by vibrations. Changing the vibrations changes the sounds.
- Sound travels through air and other materials. Sound travels through some materials better than others.
- The shape and parts of the ear allow sound to travel through it so we can hear.
- You can apply what you know about sound and vibration to design and build musical instruments that can change pitch and volume.

Scope and Sequence

Physical Science

Light (Levels 3-4)

Children study light in their environment. They look closely at how light surrounds them and think about how light moves from place to place. Using simple materials, they explore how light travels in straight lines. They investigate how light bounces directly back from an object, creating a mirror-like reflection, or bounces in many directions, and scatters. They develop an awareness that light can "go through" opaque, transparent, and translucent materials as they explore the concepts of reflection and refraction. Several concepts in this module are closely linked to the Levels 3-5 Our Solar System module.

Big Ideas from Light:

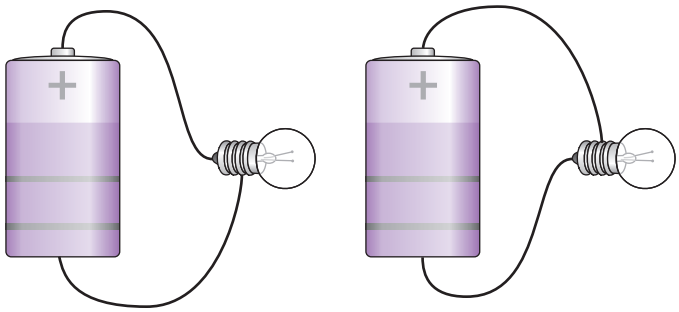
- Light is all around us. If you can see something, then light must be present.
- Light travels in straight lines. It moves outward in all directions from a source until it hits something.
- When light hits something, one or more of these things can happen: the light can bounce off the object, go through it, or be absorbed by it.
- The eye detects light and allows you to see.
- When light goes through a transparent object, it either goes straight through or changes direction.

Electrical Circuits (Levels 3-5)

Students study and explore the basics of electricity. Through a variety of explorations, students observe, describe, and investigate static electricity and low-voltage current electricity. They test their ideas on how to light a bulb. They further investigate circuits that produce motion, sound, and magnetic effects. They explore everyday materials and classify them as either conductors or insulators of electricity. And finally, they wrap up their studies by recognizing electrical hazards and the safe use of electricity.

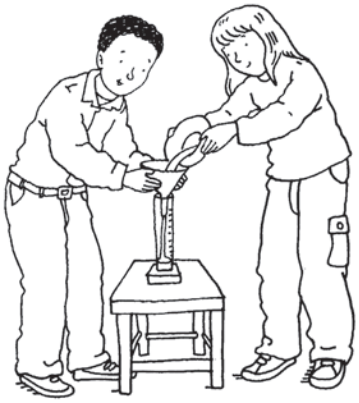
Big Ideas from Electrical Circuits:

- Electrically charged objects attract or repel other objects.
- For an electric current to flow, there must be a complete path or loop for it to follow around a circuit and return to its source.
- The flow of electric current can produce light, heat, sound, motion, or magnetic effects.
- Some materials allow electric current to flow more easily than others.
- It is important to avoid electrical hazards by using electricity safely.



Matter (Levels 4-5)

Students study properties, changing states, and mixtures of matter. They learn about the properties of solids, liquids, and gases as well as those such as mass, volume, and density. They discover that matter can change states between a solid, a liquid, and a gas and learn that temperature can affect the state of matter. Students design and conduct a fair test to learn some of the variables that affect evaporation and condensation. They mix solids together and use a variety of their properties. They experiment with other mixtures, and discover some differences between physical changes and chemical changes.



Big Ideas from Matter:

- Matter commonly exists in three states: solid, liquid, or gas.
- All matter takes up space (has a volume) and has mass (which we usually measure by weight.
- Materials can be described in terms of their properties.
- Matter can change between states. Temperature affects the change of matter from one state to another.
- When you mix materials together, the result weights the same as the sum of the parts.
- Some mixtures can be separated based on the materials' properties. Some mixtures form a new material with different properties.

Energy (Levels 4-6)

Students discover basic concepts of energy and energy transfers. They explore the forms energy takes, how energy transfers from one object to another, and how easily heat energy passes through different materials. They play with energy toys and discover the energy transfers that make each toy work. They design and build toy boats that use energy transfers for propulsion. They investigate heat energy transfer by designing and testing insulators for hot water bottles. To understand energy efficiency, students compare light and heat output of different types of light bulbs. As a culmination, they design a machine with a collection of ordinary objects that interact in a chain-like reaction to perform a task.

Big Ideas from Energy:

- Energy takes many forms. We can observe energy all around us.
- Energy can move, or transfer, from place to place. Sometimes it changes form as it transfers.
- Machines help us use energy transfers to perform useful tasks.
- Warmer things lose heat, or transfer heat energy, to cooler things until they both become the same temperature.
- Some materials conduct heat energy better than others.
- Not all transfers of energy are desirable. Often energy is "wasted" or transferred to non-useful forms.

Notes