CATHOLIC DIOCESE OF MEMPHIS

K – 8 Science Academic Content

Standards and Indicators
with Educator Support

FOREWORD

The mission statement of the Catholic schools in the Diocese of Memphis is:

> The Catholic Diocese of Memphis, Tennessee, System of Catholic Schools is committed to quality education in the spirit of Christ in accordance with the teachings of the Roman Catholic Church. Working in partnership with parents and families, we are dedicated to providing a safe and nurturing environment while preparing our students for the future through spiritual, intellectual, physical, emotional and moral formation.

The above mission statement requires that each school provide relevant, meaningful, and quality instruction, not only in the Catholic religion, but also in all academic subjects.

In promoting the implementation of the mission statement, the Assistant Superintendent of Catholic Schools, Sr. Angela T. Lydon, SBS, PhD, researched current trends in education and developed a curricular process and plan to involve principals and teachers.

A volunteer committee of principals was formed to establish curricular parameters. Utilizing the research of professional educational organizations, the committee agreed on the following curricular guidelines. The curriculum would be: systemic, Gospel-based, standards-based, flexible, usable, and adaptable to the needs of individual schools. The principal's committee also suggested the adoption of academic content standards and indicators for all grade levels, PreK – 12. We are sincerely grateful to the following principals for the initial input:

Kathy Brooks, Richard Bush, Sr. Trudy Foster, Gail Fox, Denise Mason, Sr. Noelita McDermott, Darren Mullis, Richard Orians, Barbara Pettit, Jim Pohlman, Sr. Lynn Marie Ralph, Br. Mark Snodgrass, Karen Stimart, George Valadie, and Patricia Wyckoff.

Throughout the 2004-2005 academic school year, curriculum meetings were held at each school. The sessions detailed what curriculum is, how curriculum is developed, what process would be used, and general information about contemporary objectives in curriculum. Soliciting input was foundational to the meeting structure. All were encouraged to volunteer for the initial core committee that would develop the curriculum during the summer.

The next step in the process was to choose the standards and indicators best suited to our needs. The standards and indicators developed by the State of Ohio for its PreK – 12 schools were selected. The Ohio State Academic Content Standards are coherent and rigorous. They provide a set of clear expectations for students and teachers and they are user-friendly for parents and others. The standards and indicators delineate expectations at each grade level and facilitate the integration of subjects during instruction. Even further, standards and indicators promote educational equity and opportunity for all students.

Developing a systemic curriculum is an enormous undertaking and requires the commitment, hard work, and dedication of skilled professionals who possess a strong knowledge-base in multiple disciplines. The present curriculum document is testimony to this reality and affirms the dedication of the Catholic school educators who gave freely of their time to align the standards, organizers, and grade-level indicators with realistic classroom instructional modes. We extend our deepest gratitude and appreciation to the dedicated educators of the Diocese of Memphis who gave of their time, energy, and expertise to undertake this curriculum project. We cannot thank them enough.

They are:

Jean Rae Bowers, Catherine Mary Brickhill, Alicia A. Brown, Maureen Conley, Sandra S. M. Dawkins, Sr. Judy Franz, SBS, Nancy Gronostaj, Teddi Niedzwiedz, Linda D. Padawer, Barbara Pettit, Susan S. Powell, Jennifer Styers, and Lou Tansey.

We also wish to thank **St. Benedict High School and Christian Brothers High School** for their assistance in helping us complete this project. They willingly shared expertise and resources with us. For their gracious and generous help, we are greatly indebted.

In August of 2005, elementary and middle schools received draft copies of the PreK – 8 language arts, mathematics, social studies, and science curricula. Grade-level meetings at each school were held in September and October. The purpose of these meetings was to explain the curricular format, answer any questions, and solicit input from the teachers and principals. A process for teacher and principal input to take place in the spring of 2006 was developed at these meetings.

During the 2005-2006 academic school year, a process for developing a standards-based curriculum for the high schools was formulated. High school chairpersons and teachers met to structure and plan a standards-based curriculum for required courses. At present, a draft curriculum has been formulated and will be used during the 2006-2007 academic school year. Input and evaluation will be ongoing as part of the process. We are most grateful for the hard work and dedication of the high school teachers and thank each of them. We thank especially the following chairpersons:

Adrien Alsobrook, Betsy Baker, Sr. Mary Louis Baltz, OP, Cornelius Barnes, Sr. Mary Brigid Burnham, OP, Wesley Corzine, Annette Dabaldo, Jack Grannin, Eileen Huey, John Juniker, Frank Maranise, Loretta McGrail, Patsy Rush, Sam Sharpe, and Peggy Steffan.

The curriculum project of the Diocese of Memphis is truly in its beginning stages. More meetings will occur and more committees will be rallied. The ultimate goal of the project is to provide systemic academic content standards in all major areas of learning -- religion, math, language arts, science, social studies, technology, foreign language, speech, art, music, library and physical education. Agreed upon standards, organizers, and indicators guiding standards-based teaching plans and outcome reporting will change how we deliver instruction and how we assess learning.

As a living document, the curriculum of the Diocese of Memphis will continue to develop and evolve. Above all, it will challenge educators to rethink curriculum and more appropriately meet the needs of the community of children and families we serve in the Diocese of Memphis.

GENERAL INFORMATION

The following is general information which may be helpful in understanding our curriculum and the terminology used.

Standards are general statements of content that all students should know in order to be considered literate in a discipline or subject.
(In our curriculum document, the standards are in bold print and numbered in Roman Numerals)

Organizers categorize the standards; they break down the standards into smaller subgroups.
(In our curriculum document, organizers are italicized)

Indicators are grade-level specific statements of knowledge that all students should demonstrate at their particular grade level.
Indicators serve as checkpoints; they monitor progress for each grade level.
(In our curriculum document, the indicators are numbered in Hindu-Arabic numbers)

The standards for language arts, mathematics, social studies and science are listed below.

Language Arts has 10 standards; Mathematics has 5 standards; Social Studies has 7 standards; and Science has 6 standards.

LANGAUGE ARTS STANDARDS
Phonemic Awareness, Word Recognition, & Fluency
Acquisition of Vocabulary
Reading Process: Concepts in Print, Comprehension Strategies, & Self-Monitoring Strategies
Reading Application: Informational, Technical, & Persuasive Text
Reading Application: Literary Text
Writing Process
Writing Application
Writing Convention

Research
Communication: Oral & Visual

MATH
Number, Number Sense, and Operations
Measurement
Geometry and Spatial Sense
Patterns, Functions, and Algebra
Data Analysis and Probability

SOCIAL STUDIES
History
People in Society
Geography
Economics
Government
Citizenship Rights
Social Studies Skills & Methods

SCIENCE
Earth & Space Science
Life Science
Physical Science
Science and Technology
Scientific Inquiry
Scientific Ways of Knowing

CONTENT STANDARDS

The content standards of the Catholic Diocese of Memphis describe essential concepts and skills for students to learn and do in the areas of English language arts, mathematics, social studies, and science. The standards and indicators serve as a framework for designing and implementing meaningful curricula and intentional learning experiences within all school settings. Based on research, these achievable indicators serve as checkpoints for the specific knowledge and the understandings and skills students can demonstrate as a result of their learning at the end of the school year. Therefore, educators must understand the range and scope of content represented by the indicators.

The **design of these standards**, which is the same for all grade levels, **is a continuum from which educators can implement curricula** – taking into account the wide variability of children's learning experiences, pace of learning, learning styles, knowledge, etc. – **to meet the needs of all students no matter where they fall on the continuum**. Educators must start with a very basic interpretation of the indicators which sometimes involves no more than exposure or introduction to a concept. Since **indicators are grade-appropriate and developmental**, a firm foundation is continually formed on which the educator can then build as the children's knowledge grows. The skilled educator adds detail and complexity to building children's knowledge as a higher level of interpretation of the indicators is explored in the curriculum. Through varied learning experiences and opportunities, **educators support individual children's construction of conceptual knowledge and skills along their developmental path of learning from the point of entry into the content toward the point of performance levels in the indicators.**

It is essential for any successful school program that educators work together in an effort to create a comprehensive and fluid curriculum from the standards. The purpose of this document is to assist educators in the design and implementation of meaningful curricula and intentional learning experiences and practices aligned to standards-based indicators. The list of strategies and ideas to support learners is not comprehensive but serves as a starting point for thoughtful curriculum design and teaching practices.

CATHOLIC DIOCESE OF MEMPHIS

SCIENCE STANDARDS for K

Students will	Educator can support the organizer and indicators	Teacher notes

I. Earth and Space Sciences Standard *The Universe* 1. Observe that the sun can be seen only in the daytime, but the moon c n be seen sometimes at night and sometimes during the day	• Providing different sources of light for exploration (e.g., overhead projector, flashlight). • Providing opportunities for shadow play using both natural and artificial light. • Initiating discussions, sorting, and graphing, or charting activities done during night and day. • Providing books, pictures, videos, etc., to explore animals and insects that move at night and day as connected to themes/projects. • Playing recorded sounds commonly heard during the day and night so the children can dance/move or draw to them. Walking to different locations to see how the sun is moving/changing. • Having the children draw the school building and graph sun positions throughout the day. • Providing materials for making star maps: poke holes in black paper and illuminate with flashlight.	
Processes That Shape Earth 2. Explore that animals and plants cause changes to their surroundings 3. Explore that sometimes change is too fast to see and sometimes change is too slow to see. 4. Observe and describe day-to-day weather changes (e.g., today is hot, yesterday we we had rain.) 5. Observe and describe seasonal changes in weather	• Providing opportunities for children to be active explorers of their environment. Give them tools to use: such as nets, small bug holders, magnifying glasses, cardboard tubes as viewers, spray bottles to note changes from water, bottomless paper cups to use as sound catchers against ear. • Providing various classroom pets, such as hamsters and fish so children can observe how they use their environment. • Providing bird feeders to observe daily interactions and how having more bird feeders impacts the environment. • Taking nature walks to observe, explore, and compare changes in environment. Revisit the	

SCIENCE STANDARDS for GRADE 1

Students will	Educators can support organizers & indicators	Teacher notes

I. Earth and Space Sciences Standard *Earth Systems* 1. Identify that resources are things that we get from the living (e.g., forests) and nonliving (e.g., minerals, water) environment and that resources are necessary to meet the needs and wants of a population. 2. Explain that the supply of many resources is limited but the supply can be extended through careful use, decreased use, reusing and/or recycling.	• Draw pictures or cut photographs from old magazines that are examples of natural resources. Draw pictures or clip pictures from magazines that show ways we use natural resources. Display drawings on a bulletin board. • Classify pictures as resources from living things, like forests or non-living, such as water. • List sources of pollution, both big and small. Brainstorm ways to help stop or reduce types of pollution. Share ideas with the class. • Give children some statistics for how much water is used doing various activities like taking a shower, using the dishwasher, washing machine. Have them come up with ways that they can conserve water. • Discuss electricity and ways we can conserve electricity like turning off the lights and TV when not in use. Make the connection that if they are saving electricity they are saving natural resources. • Have a city official in charge of recycling programs come speak to the children about the importance of recycling and what can be recycled in their community. • Visit a landfill and the recycling center so children make the connection between the things that are recycled and thus will not end up in the landfill. • Have TN SWEP (Solid Waste Education Program) representative speak to the class and show them through games and stories about solid waste disposal. • Make a bird feeder or other craft projects using recycled materials.	

Process That Shape Earth 3. Explain that all organisms cause changes in the environment where they live; the changes can be very noticeable or slightly noticeable, fast or slow (e.g., spread of grass cover slowing soil erosion, tree roots slowly breaking sidewalks).	• Make a class list of fast changes and slow changes in the environment. Fast might be hurricanes or tornadoes, fire, flood. Slow might be cracks in a sidewalk. • Have children draw pictures of fast and slow changes.	

II. Life Sciences Standard

Characteristics and Structure of Life 1. Explore that organisms, including people, have basic needs that include air, water, food, living space and shelter.	• Display pictures of animals, and while pointing to body parts on the animals pictured, have children point to the same body parts on themselves; For example, jaws, teeth, claws, etc.. • Have students point out how animal parts help animals survive.(e.g., sharp claws for tearing food). • Have students tell what they would need to take on a trip to the moon to convey the basic needs of humans.	
2. Explain that food comes from sources other than grocery stores (e.g., farm crops, farm animals, oceans, lakes and forests). 3. Explore that humans and other animals have body parts that help to seek, find and take in food when they are hungry (e.g., sharp teeth, flat teeth, good nose and sharp vision).	• Bring in products from the grocery store and ask children where they came from before they bought them in the store. • Display a plant and plastic animals, such as cow or pig. Show the product and pick either the plant or animal depending on where they think the product came from. • Have students draw pictures of their breakfast, lunch and dinner for that day. The next day have them tell what they ate and where they think that food came from. Make sure they know that many foods come from several sources like pizza (crust from plant, pepperoni from a pig, cheese from a cow.)	

Diversity and Interdependence of Life 4. Investigate that animals eat plants and/or other animals for food and may also use plants or other animals for shelter and nesting.	• Have children look at a picture of a coyote, mouse and a grasshopper. Ask what they eat. Children should conclude that grasshoppers eat plants and mice and coyotes are animal eaters. They might also conclude that mice might eat both plants and animals. • Give children several strips of colored paper and glue or tape. Join the paper loops into a chain. Just as they joined paper loops into a chain, animals that feed on each other form a chain. Each is linked to the one before it. Draw pictures of several animals and hook them together in the correct order to make food chains.	
5. Recognize that seasonal changes can influence the health, survival or activities of organisms.	• Make a 4 season's poster drawing what different things humans do or wear for the 4 seasons (bathing suit, fur coat). • Do the same thing for animals. Show how animals change during the 4 seasons like a bear growing thicker fur and hibernating in winter or animals that must migrate to warmer places.	

III. Physical Sciences Standard

Nature of Matter 1. Classify objects according to the materials they are made of and their physical properties.	• Have children take turns choosing something in the classroom without revealing what it is. Have them give clues about it for others to guess it describing it by its properties (color, shape, texture). • Make a list of several materials like wood, metal, rubber and have children find things in the classroom made from those materials. • Cut out pictures of objects made from different materials and paste them under that material.	
2. Investigate that water can change from liquid to solid or solid to liquid.	• Do experiments with water freezing and thawing at certain temperatures. • Do an explanation of freezing and thawing by pretending to be a drop of water and going through the change in state of matter from liquid to solid. • Demonstrate examples of heating and freezing of water. • Show examples of dissolving with various materials and record for them on the board what dissolves quicker, slower or does not dissolve at all.	
3. Explore and observe that things can be done to materials to change their properties (e.g., heating, freezing, mixing, cutting, wetting, dissolving, bending and exposing to light). 4. Explore changes that greatly change the properties of an object (e.g., burning paper) and changes that leave the properties largely unchanged (e.g., tearing paper).	• Have children observe physical changes, such as folding, cutting a piece of paper as opposed to burning (a chemical change) where you end up with paper to ashes. • For mixing, you could make a cake according to directions and look at various ingredients separately like eggs, butter and then look at what they look like when mixed together. • Make a tossed salad and show how	

Forces and Motion 5. Explore the effects some objects have on others even when the two objects might not touch (e.g., magnets).	• Brainstorm ways children can hold a piece of paper to the refrigerator door. Let children share what they know about magnets. • Provide a variety of magnets and steel paper clips. Let children experiment with several different magnets. Let them make chains from the paper clip and see how long a chain each magnet can hold. Review the word force and ask if one magnet has more force than another. • Divide class into groups and give each a magnet fishing pole and bag of items. Let children take turns catching items from the bag. Have them place all the things they catch in a pile. Discuss how things caught are alike and how they are different from those left behind in the bag. • Ask children to use a magnet and a metal paper clip to demonstrate what attract means. Point out even though the objects are not touching, they attract.	
6. Investigate a variety of ways to make things move and what causes them to change speed, direction and/or stop.	• Make a sail boat and sail it by blowing on it or using a fan. • Use something with different speeds to demonstrate how turning the dial. increases the speed (eg. electric mixer, fan, and bicycle). • Have an amusement ride operator come speak to the class about the various rides and what they use to increase speed, change direction and stop. • Use a variety of toys like toy cars that can be put in reverse and roller skates with a rubber stopper on the front to stop to demonstrate moving, changing direction and stopping.	

Nature of Energy 7. Explore how energy makes things work (e.g., batteries in a toy and electricity turning fan blades).	• Use a toy that can run on batteries or a remote to demonstrate the car can move when you push it or blow on it. Then, put the batteries in it and turn it on. Finally, connect it to the remote and make it move. • Experiment with putting batteries in a flashlight and have students discover that a flashlight will not work unless the batteries are touching.	
8. Recognize that the sun is an energy source that warms the land, air and water.	• Before class put a small bowl of water in a sunny place and another in the shade. Have students touch the water in each bowl. Then discuss why they think the Sun is important to us. • Place one ice cube in a sunny and a shady spot. Have children predict which will melt faster. Have children check the ice cubes every 5 minutes to determine which melts faster and why. • Have the children put a thermometer in a jar of water. Place the jar in a sunny spot. Have children predict what will happen to the temperature as the day goes on. Record the temperatures at one-hour intervals throughout the day.	
9. Describe that energy can be obtained from many sources in many ways (e.g., food, gasoline, electricity or batteries).	• Demonstrate that energy comes from many sources. Use an appliance with a cord, such as a shaver, plug it in and determine energy source as electricity. Put batteries in the same shaver and turn it on to determine that batteries are stored electricity. • Make class murals and title them “What Makes Things Go” and have children draw examples of different things and what powers them. Make sure you have	

IV. Science and Technology Standard

Understanding Technology 1. Explore that some kinds of materials are better suited than others for making something new (e.g., the building materials used in the *Three Little Pigs*).	• Provide a variety of material for children to build a house out of, such as paper, clay, legos, blocks and sand. Have them make the same structure out of each different material. Then, use a fan to blow at different speeds to see which holds up the best. • Look at pictures of structures made from various materials from different places around the world. Point out why they would use that material in that part of the world like a wood or grass huts for coolness. • Have a builder come speak to the class or go to a showroom to see the different materials you may use to build a house and point out the advantages and disadvantages of each.	
2. Explain that when trying to build something or get something to work better, it helps to follow directions and ask someone who has done it before.	• Ask a builder to speak to the class about how in building they must follow a blueprint to tell them where to put things. • Use puzzles and models to demonstrate that one piece won't fit in unless they are done in the correct order or steps.	
3. Identify some materials that can be saved for community recycling projects (e.g., newspapers, glass and aluminum).	• Bring in a TN SWEP (Solid Waste Education Program) to speak to the class about recycling. • Visit a recycling center to discover products that can be recycled. • Bring in products from the grocery store to learn to look for the recycling symbols on the bottom to determine if they are recyclable.	
4. Explore ways people use energy to cook their food and warm their homes (e.g., wood, coal, natural gas and electricity).	• Use the T.E.E.N. (Tennessee Energy Education Network) website and	

Abilities To Do Technological Design 6. Investigate that tools are used to help make things and some things cannot be made without tools. 7. Explore that several steps are usually needed to make things (e.g., building with blocks). 8. Investigate that when parts are put together they can do things that they could not do by themselves (e.g., blocks, gears and wheels).	• Have students bring in tools from their dad or mom's workshops. Explore each tool and see what it might be used for like screwdrivers, hammers, etc. • Bring in examples of the 6 simple machines and ways to use them. • Have a construction worker speak to the class and bring some of the tools he uses and explain what they do. • Use models to illustrate how things must be put together in a certain order to work. • Show examples of a simple gear, wheel, etc. Then, show an example of something that uses those parts put together like a clock with interlocking gears, etc.	

V. Scientific Inquiry Standard

Doing Scientific Inquiry 1. Ask "what happens when" questions. 2. Explore and pursue student-generated "what happens when" questions. 3. Use appropriate safety procedures when completing scientific investigations. 4. Work in a small group to complete an investigation and then share findings with others. 5. Create individual conclusions about group findings. 6. Use appropriate tools and simple equipment/instruments to safely gather scientific data (e.g., magnifiers, timers and simple balances and other appropriate tools). 7. Make estimates to compare familiar lengths, weights and time intervals. 8. Use oral, written and pictorial representation to communicate work. 9. Describe things as accurately as possible and compare with the observations of others.		

VI. Scientific Ways of Knowing Standard

Nature of Science 1. Discover that when a science investigation is done the same way multiple times, one can expect to get very similar results each time it is performed. 2. Demonstrate good explanations based on evidence from investigations and observations.		
Science and Society 3. Explain that everybody can do science, invent things and have scientific ideas no matter where they live.		

SCIENCE STANDARDS for GRADE 2

Students will	Educators can support organizers and indicators	Teacher notes
I. Earth and Space Science Standard *The Universe* 1. Recognize that there are more stars in the sky than anyone can easily count.	• Draw a constellation on black paper, using white chalk or crayons. Write at least one sentence about it or constellations in general. • Students write two paragraphs about stars, including information about what stars are, how they can be different from each other, and what constellations are.	
2. Observe and describe how the sun, moon and stars all appear to move slowly across the sky.	• Observe where the sun seems to be at sunrise, at noon, and at sunset. • Create a word map in which sun is the word in the central circle. Students will write facts about the sun in smaller circles around the central one. The word sun would be placed on the word wall.	
3. Observe and describe how the moon appears a little different every day but looks nearly the same again about every four weeks.	• Students share their knowledge of the Man in the Moon • Students share what they see in the night sky. • Students make a clay model of the moon. They roll the clay into balls and use the eraser end of their pencils to make craters in the surface. Students may want to form mountains, valleys, and plains, and add eraser shavings for dusty surfaces. • Students draw a picture of the night sky with the moon in it. They write a sentence about the moon below their drawings. Display the pictures.	

Earth Systems 4. Observe and describe that some weather changes occur throughout the day and some changes occur in a repeating seasonal pattern.	• Student explains the symbols on a weather map and interprets the map for a specific area of the country. • Using past weather reports, students analyze weather and changes that occur over a period of time. • Have student identify weather tools and name what each one measures.	
5. Describe weather by measurable quantities such as temperature and precipitation.	• Students record the temperature, precipitation every day for a week, the number of days with winds over 15 mph and the number of days with temperatures less than 50 degree F. The information is put on a chart. • Take students outside to observe and collect data on the current weather conditions at the school. Groups will write and present a weather report. • Provide students with cups of cold, cool, warm and hot water. Students record the temperature of each. Students use their data to identify an easy to remember temperature on each scale for cold, cool, warm and hot.	

II. Life Science Standard *Characteristics and Structure of Life* 1. Explain that animals, including people, need air, water, food, living space and shelter; plants need air, water, nutrients (e.g., minerals), living space and light to survive.	• Students make a plant and animal dictionary by stapling 14 sheets of paper and writing one letter of the alphabet on the front or on back of sheets and using the first sheet as the cover. Students write down new words they learn about, where plants and animals live and record the definitions in words or drawings.	
2. Identify that there are many distinct environments that support different kinds of organisms. 3. Explain why organisms can survive only in environments that meet their needs (e.g., organisms that once lived on Earth have disappeared for different reasons such as natural forces or human-caused effects).	• Students draw posters explaining why people should try to protect the habitat of animals. Each student creates a picture of a habitat and includes the animals that live there. They should make sure that the pictures show how at least two of the animals meet their needs in the habitat. • Have children look for living and nonliving things. Write a giant T on the board to form a T-chart. • Walk outside your classroom to the hall, and then walk back in again. Explain that when animals migrate, they move from one place to another for part of the year and then return to the original place. Add migrate to the word wall • Students create desert diorama in shoeboxes. • Students draw two pictures to show a cold habitat in summer and in winter. They write one sentence about each. • Students create a Venn diagram to compare and contrast a cold habitat in winter and in summer. • Students work in small groups to create a mural of a pond or stream. They write a short report about life in the pond or stream.	

Heredity 4. Compare similarities and differences among individuals of the same kind of plants and animals, including people	• Draw a picture of an ocean food web. Students will draw the different plants and animals in the web and draw arrows between the plants and animals to show what they eat.	
Diversity and Interdependence of Life 5. Explain that food is a basic need of plants and animals (e.g., plants need sunlight to make food and to grow, animals eat plants and/or other animals for food, food chain) and is important because it is a source of energy (e.g., energy used to play, ride bicycles, read, etc.). 6. Investigate the different structures of plants and animals that help them live in different environments (e.g., lungs, gills, leaves and roots). 7. Compare the habitats of many different kinds of TN plants and animals and some of the ways animals depend on plants and each other. 8. Compare the activities of TN's common animals (e.g., squirrels, chipmunks, deer, butterflies, bees, ants, bats and frogs) during the different seasons by describing changes in their behaviors and body covering. 9. Compare TN plants during the different seasons by describing changes in their appearance.	• Students read about different ocean animals to find out what they eat. They use the information to make a food chain or food web. • Students make posters warning others about how water pollution can harm animals, and how it can be prevented. • Visit the library for habitat research. • Make watercolor paintings of rainy or stormy weather.	

III. Physical Sciences Standard *Forces and Motion* 1. Explore how things make sound (e.g., rubber bands, tuning fork and strings). 2. Explore and describe sounds (e.g., high, low, soft and loud) produced by vibrating objects. 3. Explore with flashlights and shadows that light travels in a straight line until it strikes an object.	• Students make their own instruments. Children can show their instruments to the class and play them. Have them explain how they made their instruments and what makes them work. • Work with a partner. Choose an animal sound to make. Stand in different parts of the room. Close your eyes. Your partner will make the animal sound. Walk until you find your partner. Think about different animals and the sounds they make. • Students make a guitar using rubber bands and a shoebox. They pluck the rubber bands to listen for different sounds. • Use three identical cans. Put a handful of seeds into one, dried beans into another, and dried pasta pieces into the third. Seal tops closed. The students shake each can to determine which makes the softest and which makes the loudest sounds. • The students compare the sound that a barking dog makes with the sound that a musical instrument makes. • Students explore light by making shadow puppets using the overhead projector or flashlights.	

IV. Science and Technology Standard *Understanding Technology* 1. Explain that developing and using technology involves benefits and risks. 2. Investigate why people make new products or invent new ways to meet their individual wants and needs. 3. Predict how building or trying something new might affect other people and the environment.	• Students make a model of something that they are familiar with, such as a car, toy, or a room. Then they are paired to discuss the characteristics of something. • Each student is given a square of construction paper and is told to produce one physical change in paper. • Students will make their own musical instruments. They can show to the class. They will explain how they made the instruments and what makes them work. • Students will make a diagram that shows how force can change the direction of something moving. They will use arrows to shows the directions in which the various parts move.	
Abilities To Do Technological Design 4. Communicate orally, pictorially, or in written form the design process used to make something.	• Have the student's think of three different ways to produce sound and the objects that could be used to make sounds. Then, have students present their sounds and tell what caused them.	

V. Scientific Inquiry Standard *Doing Scientific Inquiry* 1. Ask "how can I/we" questions. 2. Ask "how do you know" questions (not "why" questions) in appropriate situations and attempt to give reasonable answers when others ask questions. 3. Explore and pursue student-generated "how" questions. 4. Use appropriate safety procedures when completing scientific investigations. 5. Use evidence to develop explanations of scientific investigations. (What do you think? How do you know?) 6. Recognize that explanations are generated in response to observations, events and phenomena. 7. Use appropriate tools and simple equipment/instruments to safely gather scientific data (e.g., magnifiers, non-breakable thermometers, timers, rulers, balances and calculators and other appropriate tools). 8. Measure properties of objects using tools such as rulers, balances and thermometers. 9. Use whole numbers to order, count, identify, measure and describe things and experiences. 10. Share explanations with others to provide opportunities to ask questions, examine evidence and suggest alternative explanations.	• Present three pencils in different places relative to a book---farther from book, middle, and closer to book. The student is to predict which way might be easier to lift the book. • Prepare six canisters ahead of time, two with small solids, two with liquids, and two with gases, one scented with a fragrance, such as vanilla. The students are to observe each contained without opening it. Guess what is inside each one. How can you tell what it is inside? The student will open each container to see what is inside. What clues did you use to tell what was inside? • Students will observe objects in the room that is made of matter. Question- How are all things alike? How different? • Students identify three or four objects found at school and list the properties of each item. Question-How can you describe matter? • Show a group of three objects to students. Ask them to guess which of the objects has the least mass and which has the most mass. Then, compare the mass of the two objects at a time using a balance. Place the three objects in a row in order of mass. Question—how can you put matter in order? • Students observe measure and sort three leaves. They examine leaves individually, in groups and in relationship to the entire tree. • Students use observational skills and determine the similarities and differences in various samples. • Students use the sense of touch outdoors and record and compare their	

VI. Scientific Ways of Knowing Standard *Nature of Science* 1. Describe that scientific investigations generally work the same way under the same conditions. 2. Explain why scientists review and ask questions about the results of other scientists' work.	• Introduce the students to the idea of scientific experimentation—data collection, hypothesis forming and trial and error. Students know the primary colors—red, blue and yellow; how these colors mix to make other colors and how to use a simple data chart. Students work in small groups to brainstorm as many colors as possible. They may look in crayon boxes, dictionaries, and wallpaper books. Groups share prettiest, ugliest and most unusual colors they made and tell how they made them. Only colors with formulas may be discussed. Ask who might do this task for a living and why. Ask students what they learned today.	

Ethical Practices 3. Describe ways in which using the solution to a problem might affect other people and the environment.	• The purpose of this activity is designed to increase student's skills in observation, recording, and identifying fact and opinion. This activity forces students to use their observation skills and then convert their observations to hard data. As a result of this activity, students observe a peanut, record the facts about the peanuts, use measurements devices to record facts, draw pictures if necessary, use the data to find the peanuts after hiding it, have others use their data to locate the peanut. Divide students into small groups. They will record as many facts about their peanuts as possible. Mix the nuts. Students return to the bowl and then they try to locate their own peanuts. They write their notes and discuss observations. When they finish this activity, they will eat peanuts.	
Science and Society 4. Demonstrate that in science it is helpful to work with a team and share findings with others.	• As a team, student plan how to use clay and pencils to make a shape to hold at least two blocks. After making the shape, they place as many blocks as they each can on top of the shape.	

SCIENCE STANDARDS for GRADE 3

Students will	Educator can support organizer & indicators	Teacher notes

I. Earth and Space Sciences Standard *Earth Systems* 1. Compare distinct properties of rocks (e.g., color, layering and texture). 2. Observe and investigate that rocks are often found in layers. 3. Describe that smaller rocks come from the breakdown of larger rocks through the actions of plants and weather. 4. Observe and describe the composition of soil (e.g., small pieces of rock and decomposed pieces of plants and animals, and products of plants and animals).	• Provide an assortment of rocks and hand le. Encourage students to handle and look at the rocks. Ask how they could group the rocks (color, texture, etc.). • Explore the hardness of rock (property); introduce Mohr's scale of hardness that arranges 10 minerals from softest to hardest. Tell students the hardness of a mineral can be tested by the mineral that scratches the scale. Provide students with samples of some rocks and have them scratch each rock with the others and arrange their rocks from softest to hardest. • Explore color of rocks (property), use the streak test. Have the student scratch rock on a white tile and compare streak color with what color it looks like. Compare to see if that is the rock's true color. • Provide pictures of, or if possible, go visit a cliff where students can see how rocks are formed in layers. Pictures of the Grand Canyon would work well. • Show students pictures of erosion caused by a tree or have them find examples on a sidewalk of cracks formed by emerging plants or roots. • Show examples of weathering by showing a rock with a large crack that was probably caused by water freezing and thawing. • Have students bring samples of soil from home. Set up a station in the	

II. Life Science Standard *Heredity* 1. Compare the life cycles of different animals including birth to adulthood, reproduction and death (e.g., egg-tadpole-frog, egg-caterpillar-chrysalis-butterfly).	• Students choose a plant or animal and find out about its life cycle. Write a description of how it grows and develops and illustrate the steps. • Draw a picture of the stages in an animals' life cycles by drawing –birth, growth and change, reproduction and death. • Draw a picture for a human being to show how we also go through these stages. • Help students remember that metamorphosis is a change in body form, use the examples of the caterpillar and the tadpole. • Try to find examples of metamorphosis in popular culture. Ask students if any current shows or cartoon show a metamorphosis.	

Diversity and Interdependence of Life 2. Relate animal structures to their specific survival functions (e.g., obtaining food, escaping or hiding from enemies).	• Have students list all the ways moving parts help animals survive. (e.g., sharp teeth for tearing food etc.) • Select an animal and have the students research what part the animal uses for support, protection, movement, collecting information and taking in and getting rid of materials. • Design an imaginary animal and draw a picture of it. Then, make a model of it emphasizing what parts the animal uses to eat, escaping, or when hiding from enemies.	
3. Classify animals according to their characteristics (e.g., body coverings and body structure).	• Give students an assortment of items to be classified in some way. This might include writing instruments (crayons, pens, pencils). Have students group objects and explain their groupings to the class. • Give students a box of buttons in various sizes, shapes and colors. Have students work in pairs to develop a classification system for the buttons and present their groupings to the class describing the characteristics they used to group them. • Classify animals according to their characteristics (e.g., body covering-hair, scales, body structure - backbone or none).	
4. Use examples to explain that extinct organisms may resemble organisms that are alive today.	• Show pictures of extinct animal and have students list animal that resemble them that are alive today. • Draw pictures of the extinct animal next to the animals resembling them.	
5. Observe and explore how fossils provide evidence about animals	• Bring a fossil to class and allow students to handle it and describe how a fossil	

III. Physical Sciences Standard *Forces and Motion* 1. Describe an objects position by locating it relative to another object or the background.	• Ask pairs of volunteers to use props and their bodies to explain position. For example, one student might say, "Stan's position is 3 ft. in front of the board." • Show a map of latitude or longitude to show how objects are located by position. • Have students write a short paragraph describing their present position by describing it in relation to the position of objects and or people in the classroom.	
2. Describe an objects motion by tracing and measuring its position over time.	• Have a student locate a certain object and then go out of the room and have someone move it. When the student returns, ask him/her how they know the object moved (because its position changed). • Students work in groups. Group members use a stopwatch to tell how far each member walks in 5 seconds; then runs in 5 seconds. Make a graph to represent this data.	
3. Identify contact/noncontact forces that affect motion of an object (e.g., gravity, magnetism and collision).	• Measure distance traveled by an object. Then, use a variety of tilted ramps to see how incline and gravity affects motion of an object. • Measure distance of an object on different surfaces to see how friction affects motion. • Use different strength magnets to see how magnetism affects motion of an object.	
4. Predict the changes when an object experiences a force (e.g., a push or pull, weight and friction).	• Use 5 objects of about the same size. Use a spring scale to measure pull. See which object needed the stronger pull to	

IV. Science and Technology Standard *Understanding Technology* 1. Describe how technology can extend human abilities (e.g., to move things and to extend senses). 2. Describe ways that using technology can have helpful and/or harmful results. 3. Investigate ways that the results of technology may affect the individual, family and community.	• Study 6 simple machines to identify ways how each of the machines makes work easier. (e.g., crane for lifting, etc.). • Draw pictures of an imaginary superhero having super powers and see if we have any technology that can do what the superhero can do. (e.g., man with X-ray vision - we have MRI, CAT scans to see inside our bodies). • Identify and research examples of technology being helpful and harmful, such as the Arctic Pipeline being beneficial to transport domestic oil and help our energy needs. But on the other side, it has destroyed the natural beauty of the land and displaced numerous wildlife populations such as the caribou. • Have children draw some examples of the technology they use in everyday life that has made life easier (e.g., refrigeration, automatic dishwashers, computers). • Interview parents and grandparents or other family members about changes in technology in their lifetimes.	

Abilities To Do Technological Design 4. Use a simple design process to solve a problem (e.g., identify a problem, identify possible solutions and design a solution). 5. Describe possible solutions to a design problem (e.g., how to hold down paper in the wind).	• Walk around the school campus. The purpose is for students to identify problems. After they identify the problem, come up with possible solutions and design one they think will work (e.g., traffic problem at dismissal). • Have a city planner with the parks, traffic departments or land use, zoning department come speak to the children about how they solve problems in the city. • Realize that there are many ways to solve a problem. Give students a scenario problem and have them identify several solutions. • Role play a town meeting to discuss a community problem and have children play parts, such as the mayor and citizens holding differing views on the problem and come up with solutions that are satisfactory to all parties.	

V. Scientific Inquiry Standard *Doing Scientific Inquiry* 1. Select the appropriate tools and use relevant safety procedures to measure and record length and weight in metric and English units.	• Design lab experiments that measure length and weight. Use a variety of different objects to weigh and measure. Display different tools of measurement, such as rulers, yardsticks, scales, tape measures etc. and have students select appropriate tools for measuring.	
2. Discuss observations and measurements made by other people.	• Go to an outdoor area or an area, such as the gym. Work in small groups to measure the area. Compare and contrast the measurements.	
3. Read and interpret simple tables and graphs produced by self/ others. 4. Identify and apply science safety procedures. 5. Record and organize observations (e.g., journals, charts and tables).	• Provide a variety of graphs and tables to be read. Some may come from the social studies or math texts. • Have students create their own graph or table. Then, exchange with another student to obtain practice in graphing and table-reading skills. • Write information in a journal, such as wildlife observed in a certain area. Organize data from observations into a chart or graph.	
6. Communicate scientific findings to others through a variety of methods (e.g., pictures, written, oral and recorded observations).	• Have a Science Information Day or Fair. Students communicate projects to others through posters. Have a round robin style of presentation where students move from one table to another to hear presentations. • Give oral reports on scientific findings. • Visit another grade and communicate scientific ideas being studied through a play or skit. • Make a picture book for younger children to communicate scientific	

VI. Scientific Ways of Knowing Standard *Nature of Science* 1. Describe different kinds of investigations that scientists use depending on the questions they are trying to answer.	• Identify an investigation and come up with ways to investigate research supported data, experimentation, deductive and inductive reasoning. • Look at a variety of scientific investigations already done and identify the different way scientists used to investigate the problem and why you think they were successful or unsuccessful.	
Ethical Practices 2. Keep records of investigations and observations and do not change the records that are different from someone else's work.	• Start with a hypothesis (educated guess of how an experiment will come out). Do an investigation that you know will yield different results from each student or groups of students. Compare the results from each group and help students realize all data is important and should always be reported accurately and completely in science whether it supports your hypothesis or not and that many times there are no wrong or right answers in science. • Research some of the great scientists' "wrong" answers, like Copernicus saying the earth was the center of the Universe and how their incorrect conclusions led to more investigations.	

Science and Society 3. Explore through stories how men and women have contributed to the development of science.	• Group students and assign each group a different area of science, such as medicine or astronomy. Have them identify some great men or women scientists in that field. Then, present their findings to the group in a variety of ways, such as posters, orally pretending to be that person, skits, songs, etc.	
4. Identify various careers in science.	• Have speaker (both men and women) speak to the class about their careers. • Have speakers from each area of science, medicine, biologists, chemists, engineers, etc.	
5. Discuss how both men and women find science rewarding as a career and in their everyday lives.	• Have a college professor speak to class about careers in science. • Have a guidance counselor speak about careers in science and what background or courses are needed for that particular job.	

SCIENCE STANDARDS for GRADE 4

Students will	Educator can support organizers & indictors	Teacher notes
I. Earth and Space Sciences Standard *Earth Systems* 1. Explain that air surrounds us, takes up space, moves around us as wind, and may be measured using barometric pressure.	• Create visual board that shows weather changes over a time period. • http://www.sciencenetlinks.com/lessons.cfm?DocID=156 Science activity to show that air takes up space, and puts pressure, or pushes, on everything around it.	
2. Identify how water exists in the air in different forms (e.g., in clouds, fog, rain, snow and hail).	• Explore water cycle. • http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/cld/home.rxml This content resource is part of Weather World 2010's earth sciences web server program produced by the University of Illinois. The purpose of the module is to introduce a number of cloud classifications, different types of precipitation, and the mechanisms responsible for producing them. There are three sections: Development, Cloud Types, and Precipitation. The module includes many images and animations.	
3. Investigate how water changes from one state to another (e.g., freezing, melting, condensation and evaporation).	• Using hot plate to melt ice and evaporate water.	
4. Describe weather by measurable quantities such as temperature, wind direction, wind speed, precipitation and barometric pressure.	• Student select appropriate graphs of wind speed, wind direction, temperature, precipitation. • http://butterfly.ctl.sri.com/pals/tasks/k-4/Interdisciplinary/ The series of activities presented here are thematically related to the weather and require skills in science, reading, writing, and language arts. Students' abilities to observe scientific phenomena, communicate findings, synthesize multiple ideas,	

II. Life Sciences Standard *Heredity* 1. Compare the life cycles of different plants including germination, maturity, reproduction and death. *Diversity and Interdependence of Life* 2. Relate plant structures to their specific functions (e.g., growth, survival and reproduction). 3. Classify common plants according to their characteristics (e.g., tree leaves, flowers, seeds, roots and stems). 4. Observe and explore that fossils provide evidence about plants that lived long ago and the nature of the environment at that time. 5. Describe how organisms interact with one another in various ways (e.g., many plants depend on animals for carrying pollen or dispersing seeds).	• Plant seeds, bulbs, tubers, buddings to compare life cycles • http://www.urbanext.uiuc.edu/gpe/index.html Detective Leplant and his partners Bud and Sprout unlock the mysteries of plant life in this content resource. Each of the six cases examines a different aspect of plant life. Each case includes a case brief, facts, mysteries, and activities. • http://www.ohiohistorycentral.org/ohc/nature/geology/fossils/index.shtml Information about invertebrate, vertebrate, and plant fossils is available on this site. Fossils are grouped by type. Information provided for each fossil group includes habitat, modern forms, geologic span, and where in TN similar fossils can be found. Photographs of specimens for each type and specific locations where they were found are also included. • Make fossils using glue, Vaseline, clay, and shell. • Make a diorama of a habitat. • Thematic Unit can be on Tropical Rain Forest, Coral Reefs, and/or Salt Water Communities. • http://www.pbs.org/safarchive/4_class/44_guides/guide_801/4481_bee.html Bee Lines provides information on honeybee communication and insect trapping techniques. Two different types of insect traps are detailed. The objective of the lesson is for students to study biodiversity by collecting insects from different locations. The *Expedition Panama* video clip that accompanies this activity is accessible at the Scientific American Frontier's archives.	

III. Physical Sciences Standard *Nature of Matter* 1. Identify characteristics of a simple physical change (e.g., heating or cooling can change water from one state to another and the change is reversible).	• Activities from AIMS (activities integrating math and science) http://www.aimsedu.org/ , such as Crazy Colloid, or from book Chemistry Matters. • http://www.sciencenetlinks.com/lessons.cfm?BenchmarkID=4&DocID=160 Using this resource, students understand that particle movement changes as a substance changes from one phase to another. This lesson is designed to give students the opportunity to observe a phenomenon created by particle movement. • http://ga.water.usgs.gov/edu/watercycle.html This USGS site provides a comprehensive look at the water cycle. The information is conveniently divided into the following topics: Storage in ice and snow, Precipitation, Snowmelt runoff to streams, Infiltration, Ground-water discharge, Ground-water storage, Water storage in oceans, Evaporation, Condensation, Water storage in the atmosphere, Transpiration, Surface runoff, Streamflow, Springs, and Freshwater storage. • http://www.sciencenetlinks.com/Lessons.cfm?DocID=117 This lesson uses a technique called paper chromatography to separate the ink colors in water soluble markers. The core activity of the lesson will help children gain experience in conducting simple investigations of their own while working in small groups. Student investigations should be followed up with presentations to the entire class to emphasize the importance of clear communication in science.	
2. Identify characteristics of a simple chemical change. When a new material is made by combining two or more materials, it has chemical properties that are different from the original materials (e.g., burning paper, vinegar and baking soda).	• Show changes in a penny using paper clips, foam cups, vinegar, and plastic wrap by putting vinegar in bottom of coke bottle, fill balloon with baking soda, cover top of bottle with bottom of balloon to form a seal over the top of the bottle. Allow the vinegar and baking soda to mix. Carbon dioxide will fill the balloon. • http://www.uen.org/Lessonplan/preview.cgi?LPid=2686 In this lesson, students engage in activities that demonstrate chemical reactions and the conservation of mass. The reactions require commonly available and safe materials. Students record their findings and offer explanations in journal entries.	
3. Describe objects by the properties of the materials from which they are made and show that these properties can be used to separate or sort a group of objects (e.g.,	• http://www.sciencenetlinks.com/lessons.cfm?DocID=175 Students gain an understanding that certain materials are attracted to magnets and some are not. In this lesson, students look at	

IV. Science and Technology Standard *Understanding Technology* 1. Explain how technology from different areas (e.g., transportation, communication, nutrition, healthcare, agriculture, entertainment and manufacturing) has improved human lives.	• Water Treatments plants. • Tracking hurricanes. • Research and write a report of a living scientist who has made advancements in science and technology.	
2. Investigate how technology and inventions change to meet peoples' needs and wants.	• http://butterfly.ctl.sri.com/pals/tasks/5-8/ME122/index.html Draw circuits and switches, explain how they work, then change their design for someone without hands to turn the switch on and off. The task assesses students' abilities to follow simple instructions to build a circuit, modify the design, and describe and diagram the changes made. • http://www.mos.org/sln/Leonardo/ This resource has four main content sections that considers Leonardo's futuristic inventions. This web site has four pages with interesting interactive elements, lesson plans for hands-on classroom activities to extend learning, and opportunities for students to communicate their ideas electronically. The close-up photographs of simple machines provide clear and helpful illustrations. Although this site was designed to be most appropriate for students in grades four through eight, many of the activities can be adapted for younger or older students as needed.	
Abilities To Do Technological Design 3. Describe, illustrate and evaluate the design	• Create a power point presentation or slide show	

V. Scientific Inquiry Standard *Doing Scientific Inquiry* 1. Select the appropriate tools and use relevant safety procedures to measure and record length, weight, volume, temperature and area in metric and English units. 2. Analyze a series of events and/or simple daily or seasonal cycles, describe the patterns and infer the next likely occurrence. 3. Develop, design and conduct safe, simple investigations or experiments to answer questions. 4. Explain the importance of keeping conditions the same in an experiment. 5. Describe how comparisons may not be fair when some conditions are not kept the same between experiments. 6. Formulate instructions and communicate data in a manner that allows others to understand and repeat an investigation or experiment.	• Conduct a variety of experiments that relate to the science indicators that can involve science inquiry that can be found in your science book.	

VI. Scientific Ways of Knowing Standard *Nature of Science* 1. Differentiate fact from opinion and explain that scientists do not rely on claims or conclusions unless they are backed by observations that can be confirmed. 2. Record the results and data from an investigation and make a reasonable explanation. 3. Explain discrepancies in an investigation using evidence to support findings. *Ethical Practices* 4. Explain why keeping records of observations and investigations are important.	• Participate in the school Science Fair or create a classroom science fair.	

SCIENCE STANDARDS for GRADE 5

Students will	Educator can support organizer & indicators	Teacher notes
I. Earth and Space Sciences Standard *The Universe* 1. Describe how night and day are caused by Earth's rotation.	• http://www.sciencemonster.com/worldwatch/index.html This Mercado projection of the world shows the current areas of day and night. The map is updated every five minutes as long as this page remains loaded.	
2. Explain that Earth is one of several planets to orbit the sun, and that the moon orbits Earth.	• Discuss and order the phases of the moon. • http://www.learner.org/teacherslab/pup/moonjrnl_print.html •	
3. Describe the characteristics of Earth and its orbit about the sun (e.g., three-fourths of Earth's surface is covered by a layer of water [some of it frozen], the entire planet surrounded by a thin blanket of air, elliptical orbit, tilted axis and spherical planet).	• http://www.uen.org/Lessonplan/preview.cgi?LPid=2499 Students explore the relationship between the tilt of Earth's axis and its yearly orbit around the sun through this promising practice resource. This would be a very good lesson to incorporate into a larger unit on seasons. Since the data collection occurs over a long period of time the activities suggested here could be started at the beginning of the unit, carried out throughout the unit, and then be part of a culminating activity at the end of the unit.	
4. Explain that stars are like the sun, some being smaller and some larger, but so far away that they look like points of light.		

Earth Systems 5. Explain how the supply of many non-renewable resources is limited and can be extended through reducing, reusing and recycling but cannot be extended indefinitely. 6. Investigate ways Earth's renewable resources (e.g., fresh water, air, wildlife and trees) can be maintained.	• http://pals.sri.com/tasks/k-4/SolidWaste/ Students examine and sort waste items in a garbage can, categorizing and charting the items on a graph, and proposing a solution to reduce the amount of solid waste in the garbage can. This task assesses students' abilities to observe, classify, collect data, organize data, interpret data, graph, and hypothesize. • http://library.thinkquest.org/20331/intro/ This Think Quest site takes a comprehensive look at energy. The resource includes a history of our use of energy from prehistoric through modern times, fundamental concepts of physics related to energy, types of energy, and data on energy use. • Create a recycle program at your school. • http://www.epa.gov/safewater/kids/watertreatmentplant/index.html This content resource allows students to follow a drop of water from the source through the water treatment process. The information provided here could be incorporated into a lesson or unit on the availability of fresh consumable drinking water. It could also be used as a way to illustrate how the technology of water treatment improves lives by making safe drinking water available.	

II. Life Sciences Standard *Diversity and Interdependence of Life*		
1. Describe the role of producers in the transfer of energy entering ecosystems as sunlight to chemical energy through photosynthesis.	• http://www.nhptv.org/natureworks/nwep9.htm Students are introduced to the process of photosynthesis and the connection between producers (plants) and consumers (herbivores) through this resource. The introductory material introduces photosynthesis and herbivores. Embedded links take the reader to more detailed information about each of these topics.	
2. Explain how almost all kinds of animals' food can be traced back to plants.	• http://pals.sri.com/tasks/k-4/Follow1/ Students will observe a picture containing patterns of animal tracks, infer what might have happened based upon the pattern of tracks, and write a story describing what might have happened. The task assesses students' abilities to make simple observations and make generalized inferences from their observations. • http://pals.sri.com/tasks/k-4/Run/ After reading a story about a predatory event between a fox and a rabbit, the student will draw a picture to show the pattern of animal tracks a scientist might find in the area after the event. The task assesses students' abilities to make generalized inferences from their reading, and apply their understanding.	
3. Trace the organization of simple food chains and food webs (e.g., producers, herbivores, carnivores, omnivores and decomposers).	• http://www.sciencenetlinks.com/lessons.cfm?DocID=90 To introduce students to the idea that energy is passed from one organism to the next in a food chain. • Identify two predators that might feed on	

III. Physical Sciences Standard *Nature of Energy* 1. Define temperature as the measure of thermal energy and describe the way it is measured. 2. Trace how thermal energy can transfer from one object to another by conduction.	• http://hyperphysics.phy-astr.gsu.edu/hbase/heacon.html#heacon HyperPhysics is an exploration environment for concepts in physics which employs concept maps and other linking strategies to facilitate smooth navigation. The entire environment is interconnected with thousands of links, reminiscent of a neural network. The rationale for such concept maps is to provide a visual survey of conceptually connected material, with the hope that they will provide some answers to the question "Where do I go from here?" This particular portion of the HyperPhysics website provides information about topics related to heat and thermodynamics. • Describe one feature other than a heating system that would help a person live in a cold, wet climate and one feature other than an air-conditioning system that would help a person live in a hot, dry climate. Students are also asked to explain how the features help. • http://nces.ed.gov/nationsreportcard/itmrls/qtab.asp Record the apparent changes seen in a picture of two buckets of water that have sat outside on a hot, sunny day. The picture includes the buckets of water with thermometers in them both before sitting in the sun and after sitting in the sun. Students are also asked to tell why the changes happened. • http://nces.ed.gov/nationsreportcard/itmrls/qtab.asp Explain why people choose to wear white clothes in hot weather after examining a picture of two buckets of water that have sat outside on a hot, sunny day.	

IV. Science and Technology Standard *Understanding Technology* 1. Investigate positive and negative impacts of human activity and technology on the environment.	• http://www.sciencenetlinks.com/lessons.cfm?DocID=71 Students make and evaluate decisions by weighing the benefits and drawbacks of each alternative. Students practice the skill of decision-making through role-playing. Students are presented with a scenario in which they, along with their brothers and sisters, have just inherited a section of forestland. They must attempt to balance their interests with those of their siblings in order to reach a fair settlement on the use and management of the land. Students work as a class to evaluate the benefits, drawbacks, and potential risks associated with each alternative before making a final decision. • http://www.omsi.edu/visit/life/forestpuzzles/management/Four Views This link takes you to "Four Views of the Forest." "Nurse Log", "Road", "Standing Snag", "Stand of Trees", and "Stream" are at the bottom of this page. "Promote Tree Growth", "Water Ways", Sheltering Soil", "Time Treasures", "Forest Fun", and "Home is Where the Habitat Is" are also found on the "Four Views" page. • http://www.omsi.edu/visit/life/forestpuzzles/cycles/Find the Forests This link takes you to "West Side" and "East Side Time Machine", and "Vole's Eye View."	

Abilities To Do Technological Design 2. Revise an existing design used to solve a problem based on peer review. 3. Explain how the solution to one problem may create other problems.	• http://www.sciencenetlinks.com/lessons.cfm?BenchmarkID=12&DocID=20 Students plan, build, and test a ramp that allows objects to roll far. It is recommended that students have experience with ramps before they attempt to build their own. The Science NetLinks lesson entitled Let it Roll! • http://www.sciencenetlinks.com/lessons.cfm?DocID=21 Students explore and measure the rate of spherical objects rolling down a ramp. In Let it Roll!, students explore ramps, discuss why different ramps work better than others, and practice procedures for testing designs and recording results. • http://www.sciencenetlinks.com/lessons.cfm?DocID=21 This resource contains eight of the nearly three dozen activities found in the publication, "The Exploratorium's Guide to Scale and Structure". Students are actively involved in building and analyzing structures. All activities have been tested in elementary school classrooms. Great exercises for students to explore conditions necessary for constructing usable, stable structures are included. Clear instructions and guiding questions are provided for the instructor to use as the student experimentation progresses. Information is offered on where similar structures are found in nature and our man-made surroundings	

V. Scientific Inquiry Standard *Doing Scientific Inquiry* 1. Select and safely use the appropriate tools to collect data when conducting investigations and communicating findings to others (e.g., thermometers, timers, balances, spring scales, magnifiers, microscopes and other appropriate tools).	• http://pals.sri.com/tasks/5-8/Seedgrowth/ Students will investigate how different variables affect seed growth. Variables include type of seed, medium (paper towels, various types of soil), amount of water, amount of light, temperature. The task assesses students' understanding of scientific inquiry including the following skills: observation, data collection, measurement, graphing, scientific questions. • Select the appropriate tool for observing the stars, planets, and moon.	
2. Evaluate observations and measurements made by other people and identify reasons for any discrepancies.	• http://www.sciencenetlinks.com/lessons.cfm?DocID=169 Students explore the effect of heating and cooling on the dispersal of food coloring in water. The primary purpose of this activity is to allow students to observe that hotter conditions can speed up changes in materials. Students will predict whether food coloring disperses more quickly in hot, cold, or room temperature water, and then carry out a short activity to explore their predictions.	
3. Use evidence and observations to explain and communicate the results of investigations.	• http://www.sciencenetlinks.com/Lessons.cfm?DocID=117 This lesson uses a technique called paper chromatography to separate the ink colors in water soluble markers. The core activity of the lesson will help children gain experience in conducting simple investigations of their own while working in small groups. Throughout the lesson children make observations, measure things carefully, record	

VI. Scientific Ways of Knowing Standard *Nature of Science* 1. Summarize how conclusions and ideas change as new knowledge is gained.	• http://www.sciencenetlinks.com/lessons.cfm?DocID=156 Three simple explorations help students develop the concepts that air has mass, takes up space and exerts pressure. • http://www.learner.org/teacherslab/pup/act_moonjrnl.html Students explore the role of gravity in falling. This lesson introduces students to gravity as a force, focusing on the concept of falling.	
2. Develop descriptions, explanations and models using evidence to defend/support findings.	• http://pals.sri.com/tasks/k-4/InsectsSpiders/ Students construct an insect or a spider, then justify their design. The task assesses primary students' abilities to perform process skills, such as classification by using observable differences and similarities.	
3. Explain why an experiment must be repeated by different people or at different times or places and yield consistent results before the results are accepted.	• http://www.units.muohio.edu/dragonfly/houses/ "Houses" is the theme of this edition of the Dragonfly Web Pages. Information is provided about the homes of hermit crabs, bats, and birds. A description of the scientific investigations that increased the featured scientists' understanding of each animal's home is also included.	
4. Identify how scientists use different kinds of ongoing investigations depending on the questions they are trying to answer (e.g., observations of things or		

Ethical Practices 5. Keep records of investigations and observations that are understandable weeks or months later.		
Science and Society 6. Identify a variety of scientific and technological work that people of all ages, backgrounds and groups perform.	• http://www.sciencenetlinks.com/lessons.cfm?Grade=3-5&BenchmarkID=1&DocID=118 This lesson is designed to help students understand the diversity of the scientific enterprise, and provides a series of activities, which can be completed as a unit or individually. • http://crux.astr.ua.edu/4000ws/4000WS.html 4000 Years of Women in Science highlights the contributions of 125 female scientists. Teachers will find the information contained in this resource to be very helpful in planning lessons that meet the needs of diverse groups of students. • http://www.princeton.edu/~mcbrown/display/faces.html The Faces of Science highlights the contributions of African American men and women to science and engineering.	

SCIENCE STANDARDS for GRADE 6

I. Earth and Space Sciences Standard *Earth Systems* 1. Describe the rock cycle and explain that there are sedimentary, igneous and metamorphic rocks that have distinct properties (e.g., color, texture) and are formed in different ways. 2. Explain that rocks are made of one or more minerals. 3. Identify minerals by their characteristic properties.		

II. Life Sciences Standard *Characteristics and Structure of Life* 1. Explain that many of the basic functions of organisms are carried out by or within cells and are similar in all organisms. 2. Explain that multicellular organisms have a variety of specialized cells, tissues, organs and organ systems that perform specialized functions. 3. Identify how plant cells differ from animal cells (e.g., cell wall and chloroplasts).		
Heredity 4. Recognize that an individual organism does not live forever; therefore reproduction is necessary for the continuation of every species and traits are passed on to the next generation through reproduction. 5. Describe that in asexual reproduction all the inherited traits come from a single parent. 6. Describe that in sexual reproduction an egg and sperm unite and some traits come from each parent, so the offspring is never identical to either of its parents. 7. Recognize that likenesses between parents and offspring (e.g., eye color, flower color) are inherited. Other likenesses, such as table manners are learned.		

Diversity and Interdependence of Life 8. Describe how organisms may interact with one another.		

III. Physical Sciences Standard *Nature of Matter* 1. Explain that equal volumes of different substances usually have different masses. 2. Describe that in a chemical change new substances are formed with different properties than the original substance (e.g., rusting, burning). 3. Describe that in a physical change (e.g., state, shape and size) the chemical properties of a substance remain unchanged. 4. Describe that chemical and physical changes occur all around us (e.g., in the human body, cooking and industry).		

Nature of Energy 5. Explain that the energy found in nonrenewable resources such as fossil fuels (e.g., oil, coal and natural gas) originally came from the sun and may renew slowly over millions of years. 6. Explain that energy derived from renewable resources such as wind and water is assumed to be available indefinitely. 7. Describe how electric energy can be produced from a variety of sources (e.g., sun, wind and coal). 8. Describe how renewable and nonrenewable energy resources can be managed (e.g., fossil fuels, trees and water).		

IV. Science and Technology Standard *Understanding Technology* 1. Explain how technology influences the quality of life. 2. Explain how decisions about the use of products and systems can result in desirable or undesirable consequences (e.g., social and environmental). 3. Describe how automation (e.g., robots) has changed manufacturing including manual labor being replaced by highly-skilled jobs. 4. Explain how the usefulness of manufactured parts of an object depend on how well their properties allow them to fit and interact with other materials	.	
Abilities To Do Technological Design 5. Design and build a product or create a solution to a problem given one constraint (e.g., limits of cost and time for design and production, supply of materials and environmental effects).		

V. Scientific Inquiry Standard *Doing Scientific Inquiry* 1. Explain that there are not fixed procedures for guiding scientific investigations; however, the nature of an investigation determines the procedures needed. 2. Choose the appropriate tools or instruments and use relevant safety procedures to complete scientific investigations. 3. Distinguish between observation and inference. 4. Explain that a single example can never prove that something is always correct, but sometimes a single example can disprove something		
VI. Scientific Ways of Knowing Standard *Nature of Science* 1. Identify that hypotheses are valuable even when they are not supported.		
Ethical Practices 2. Describe why it is important to keep clear, thorough and accurate records.		

Science and Society 3. Identify ways scientific thinking is helpful in a variety of everyday settings. 4. Describe how the pursuit of scientific knowledge is beneficial for any career and for daily life. 5. Research how men and women of all countries and cultures have contributed to the development of science.		

SCIENCE STANDARDS for GRADE 7

I. Earth and Space Sciences Standard *Earth Systems* 1. Explain the biogeochemical cycles which move materials between the lithosphere (land), hydrosphere (water) and atmosphere (air). 2. Explain that Earth's capacity to absorb and recycle materials naturally (e.g., smoke, smog and sewage) can change the environmental quality depending on the length of time involved (e.g. global warming). 3. Describe the water cycle and explain the transfer of energy between the atmosphere and hydrosphere. 4. Analyze data on the availability of fresh water that is essential for life and for most industrial and agricultural processes. Describe how rivers, lakes and groundwater can be depleted or polluted becoming less hospitable to life and even becoming unavailable or unsuitable for life. 5. Make simple weather predictions based on the changing cloud types associated with frontal systems. 6. Determine how weather observations and measurements are combined to produce weather maps and that data for a specific location at one point in time can be displayed in a station model. 7. Read a weather map to interpret local, regional and national weather. 8. Describe how temperature and precipitation determine climatic zones (biomes) (e.g., desert, grasslands, forests, tundra and alpine). 9. Describe the connection between the water cycle and weather-related phenomenon (e.g., tornadoes, floods, droughts and hurricanes).	:	

II. Life Sciences Standard *Characteristics and Structure of Life* 1. Investigate the great variety of body plans and internal structures found in multicellular organisms.		

Diversity and Interdependence of Life 2. Investigate how organisms or populations may interact with one another through symbiotic relationships and how some species have become so adapted to each other that neither could survive without the other (e.g., predator-prey, parasitism, mutualism and commensalism). 3. Explain how the number of organisms an ecosystem can support depends on adequate biotic (living) resources (e.g., plants, animals) and abiotic (non-living) resources (e.g., light, water and soil). 4. Investigate how overpopulation impacts an ecosystem. 5. Explain that some environmental changes occur slowly while others occur rapidly (e.g., forest and pond succession, fires and decomposition). 6. Summarize the ways that natural occurrences and human activity affect the transfer of energy in Earth's ecosystems (e.g., fire, hurricanes, roads and oil spills). 7. Explain that photosynthetic cells convert solar energy into chemical energy that is used to carry on life functions or is transferred to consumers and used to carry on their life functions.		
Evolutionary Theory 8. Investigate the great diversity among organisms.		

III. Physical Sciences Standard *Nature of Matter* 1. Investigate how matter can change forms but the total amount of matter remains constant.		
2. Describe how an object can have potential energy due to its position or chemical composition and can have kinetic energy due to its motion. 3. Identify different forms of energy (e.g., electrical, mechanical, chemical, thermal, nuclear, radiant and acoustic). 4. Explain how energy can change forms but the total amount of energy remains constant. 5. Trace energy transformation in a simple closed system (e.g., a flashlight).		

IV. Science and Technology Standard *Understanding Technology* 1. Explain how needs, attitudes and values influence the direction of technological development in various cultures. 2. Describe how decisions to develop and use technologies often put environmental and economic concerns in direct competition with each other. 3. Recognize that science can only answer some questions and technology can only solve some human problems. *Abilities To Do Technological Design* 4. Design and build a product or create a solution to a problem given two constraints (e.g., limits of cost and time for design and production or supply of materials and environmental effects).		

V. Scientific Inquiry Standard *Doing Scientific Inquiry* 1. Explain that variables and controls can affect the results of an investigation and that ideally one variable should be tested at a time; however it is not always possible to control all variables. 2. Identify simple independent and dependent variables. 3. Formulate and identify questions to guide scientific investigations that connect to science concepts and can be answered through scientific investigations. 4. Choose the appropriate tools and instruments and use relevant safety procedures to complete scientific investigations. 5. Analyze alternative scientific explanations and predictions and recognize that there may be more than one good way to interpret a given set of data. 6. Identify faulty reasoning and statements that go beyond the evidence or misinterpret the evidence. 7. Use graphs, tables and charts to study physical phenomena and infer mathematical relationships between variables (e.g., speed and density).		

VI. Scientific Ways of Knowing Standard *Ethical Practices* 1. Show that the reproducibility of results is essential to reduce bias in scientific investigations. 2. Describe how repetition of an experiment may reduce bias.		
Science and Society 3. Describe how the work of science requires a variety of human abilities and qualities that are helpful in daily life (e.g., reasoning, creativity, skepticism and openness).		

SCIENCE STANDARDS for GRADE 8

I. Earth and Space Sciences Standard *The Universe* 1. Describe how objects in the solar system are in regular and predictable motions that explain such phenomena as days, years, seasons, eclipses, tides and moon cycles. 2. Explain that gravitational force is the dominant force determining motions in the solar system and in particular keeps the planets in orbit around the sun. 3. Compare the orbits and composition of comets and asteroids with that of Earth. 4. Describe the effect that asteroids or meteoroids have when moving through space and sometimes entering planetary atmospheres (e.g., meteor-"shooting star" and meteorite). 5. Explain that the universe consists of billions of galaxies that are classified by shape. 6. Explain interstellar distances are measured in light years (e.g., the nearest star beyond the sun is 4.3 light years away). 7. Examine the life cycle of a star and predict the next likely stage of a star. 8. Name and describe tools used to study the universe (e.g., telescopes, probes, satellites and spacecraft).		

Earth Systems 9. Describe the interior structure of Earth and Earth's crust as divided into tectonic plates riding on top of the slow moving currents of magma in the mantle. 10. Explain that most major geological events (e.g., earthquakes, volcanic eruptions, hot spots and mountain building) result from plate motion. 11. Use models to analyze the size and shape of Earth, its surface and its interior (e.g., globes, topographic maps, satellite images). 12. Explain that some processes involved in the rock cycle are directly related to thermal energy and forces in the mantle that drive plate motions. 13. Describe how landforms are created through a combination of destructive (e.g., weathering and erosion) and constructive processes (e.g., crustal deformation, volcanic eruptions and deposition of sediment). 14. Explain that folding, faulting and uplifting can rearrange the rock layers so the youngest is not always found on top. 15. Illustrate how the three primary types of plate boundaries (transform, divergent and convergent) cause different landforms (e.g., mountains, volcanoes and ocean trenches).		

II. Life Sciences Standard *Heredity* 1. Describe that asexual reproduction limits the spread of detrimental characteristics through a species and allows for genetic continuity. 2. Recognize that in sexual reproduction new combinations of traits are produced which may increase or decrease an organism's chances for survival.		
Evolutionary Theory 3. Explain how variations in structure, behavior or physiology allow some organisms to enhance their reproductive success and survival in a particular environment. 4. Explain that diversity of species is developed through gradual processes over many generations (e.g., fossil record). 5. Investigate how an organism adapted to a particular environment may become extinct if the environment, as shown by the fossil record, changes.		

III. Physical Sciences Standard *Forces and Motion* 1. Describe how the change in the position (motion) of an object is always judged and described in comparison to a reference point. 2. Explain that motion describes the change in the position of an object (characterized by a speed and direction) as time changes. 3. Explain that an unbalanced force acting on an object changes that object's speed and/or direction.		
Nature of Energy 4. Demonstrate that waves transfer energy. 5. Demonstrate that vibrations in materials may produce waves that spread away from the source in all directions (e.g., earthquake waves and sound waves).		

IV. Science and Technology Standard *Understanding Technology* 1. Examine how science and technology have advanced through the contributions of many different people, cultures and times in history. 2. Examine how choices regarding the use of technology are influenced by constraints caused by various unavoidable factors (e.g., geographic location, limited resources, social, political and economic considerations).		
Abilities To Do Technological Design 3. Design and build a product or create a solution to a problem given more than two constraints (e.g., limits of cost and time for design and production, supply of materials and environmental effects). 4. Evaluate the overall effectiveness of a product design or solution.		

V. Scientific Inquiry Standard *Doing Scientific Inquiry* 1. Choose the appropriate tools or instruments and use relevant safety procedures to complete scientific investigations. 2. Describe the concepts of sample size and control and explain how these affect scientific investigations. 3. Read, construct and interpret data in various forms produced by self and others in both written and oral form (e.g., tables, charts, maps, graphs, diagrams and symbols). 4. Apply appropriate math skills to interpret quantitative data (e.g., mean, median and mode).		

VI. Scientific Ways of Knowing Standard *Nature of Science* 1. Identify the difference between description (e.g., observation and summary) and explanation (e.g., inference, prediction, significance and importance).		
Ethical Practices 2. Explain why it is important to examine data objectively and not let bias affect observations.		