Science Pacing Guide – Third Grade – 2012-2013

Time Frame	SOL Objective	Essential Understandings	Essential Knowledge/Skills
1st 9 wks – 4th 9 wks	3.1 Scientific Investigation, Reasoning, and Logic	The nature of science refers to the foundational concepts that govern the way scientists formulate explanations about the natural world. The nature of science includes the following concepts: a) the natural world is understandable; b) science is based on evidence, both observational and experimental; c) science is a blend of logic and innovation; d) scientific ideas are durable yet subject to change as new data are collected; e) science is a complex social endeavor; and f) scientists try to remain objective and engage in peer review to help avoid bias. In grade three, an emphasis should be placed on concepts a, b, c, and e. Science assumes that the natural world is understandable. Scientific inquiry can provide explanations about nature. This expands students' thinking from just knowledge of facts to understanding how facts are relevant to everyday life. Science demands evidence. Scientists develop their ideas based on evidence and they change their ideas when new evidence becomes available or the old evidence is viewed in a different way. Science uses both logic and innovation. Innovation has always been an important part of science. Scientists draw upon their creativity to visualize how nature works, using analogies, metaphors, and mathematics. Science is a complex social activity. It is a complex social process for producing knowledge about the natural world. Scientific knowledge represents the current consensus as to what is the best explanation for phenomena in the natural world. This consensus does not arise automatically, since scientists	In order to meet this standard, it is expected that students will: • Make and communicate careful observations. • Demonstrate that observations should be repeated to ensure accuracy. • Classify objects into at least two major sets and subsets based on similar characteristics, such as predator/prey and herbivore, carnivore, and omnivore. • Sequence natural events chronologically (Example: 3.8 — plant and animal life cycles, phases of the moon, the water cycle, and tidal change). • Measure length to the nearest centimeter, mass to the nearest gram, volume to the nearest milliliter, temperature to the nearest degree Celsius, and time to the nearest minute, using the appropriate instruments. • Develop hypotheses from simple questions. These questions should be related to the concepts in the third-grade standards. Hypotheses should be stated in terms such as: "If an object is cut into smaller pieces, then the physical properties of the object and its smaller pieces will remain the same." • Analyze data that have been gathered and organized. • Communicate results of investigations by displaying data in the form of tables, charts, and graphs. Students will construct bar and picture graphs and line plots to display data (Example: 3.7 — comparison of types of soil and their effect on plant growth). • Communicate any unexpected or unusual quantitative data that are noted. • Make and communicate predictions about the outcomes of investigations. • Design and build a model to show experimental results.

		with different backgrounds from all over the world may interpret the same data differently. To build a consensus, scientists communicate their findings to other scientists and attempt to replicate one another's findings. In order to model the work of professional scientists, it is essential for third-grade students to engage in frequent discussions with peers about their understanding of their investigations. Questions frequently arise from observations. Hypotheses can be developed from those questions. Data gathered from an investigation may support a hypothesis. A hypothesis is a statement written in a manner that describes the cause and effect relationship between the independent and dependent variables in an experiment. At the third-grade level, a method for helping students understand how to develop a hypothesis is to have them build "if/then" statements (e.g., If heat is added to ice, then the ice will melt.). Complete observations are made using all of the senses. Simple instruments can help extend the senses (e.g., magnifying glass enhances the vision of an item). Predictions are statements of what is expected to happen in the future based on past experiences and observations. In order for data from an investigation to be most useful, it must be organized so that it can be examined more easily. Charts and graphs are powerful tools for reporting and organizing data. It is sometimes useful to organize objects according to similarities and differences. By organizing objects in sets and subsets, it may be easier to determine a specific type of characteristic. An inference is a tentative explanation based on background knowledge and available data. A conclusion is a summary statement based on the results of an investigation. Putting natural events in a sequence	**Example of** **Qualitative Data vs. Quantitative Data** **Third-Grade Class** **Qualitative Data** • Friendly • Like science • Positive about schoolwork **Quantitative Data** • 25 students • 10 girls, 15 boys • 68 % perfect attendance

		allows us to notice change over time. Metric measures, including centimeters, grams, milliliters, and degrees Celsius, are a standard way to record measurements. The metric system is recognized everywhere around the world. When using any standard measurement scale, measure to the marked increment and estimate one more decimal place. Scientists do not round their measurements as this would be inaccurate. A bar graph can be horizontal or vertical, and it compares amounts. Both the X- and Y-axis need to be identified. A line plot shows the spread of data. *(See Grade 3 Mathematics Curriculum Framework, Standard 3.17, page 31.)* A picture graph is similar to a bar graph except that it uses symbols to represent quantities. Scientists use a variety of modes to communicate about their work. Examples of ways they communicate include oral presentations; graphs and charts created to visualize, analyze and present information about their data; and written reports. In science, it is important that experiments and the observations recorded are replicable. There are two different types of data – qualitative and quantitative. Qualitative data deal with descriptions and data that can be observed, but not measured precisely. Quantitative data are data that can be counted or measured and the results can be recorded using numbers. Quantitative data can be represented visually in graphs and charts. Quantitative data define, whereas qualitative data describe. Quantitative data are more valuable in science because they allow direct comparisons between observations made by different people or at different times.	
1st 9wks	3.4 Life Processes	In order to survive, animals act in different ways to gather and store food, find shelter, defend themselves, and rear their young.	In order to meet this standard, it is expected that students will: • Give examples of methods that animals use to gather and store food, find shelter, defend

		Physical adaptations help animals survive in their environment (e.g., camouflage, mimicry). Various animals possess adaptations which help them blend into their environments to protect themselves from enemies (camouflage). Camouflage is the means by which animals escape the notice of predators, usually because of a resemblance to their surroundings using coloration or outer coverage patterns. Mimicry occurs when a species has features similar to another species. Either one or both are protected when a third species cannot tell them apart. (Mimicry happens in both animal and plant species.) Some animals look like other animals to avoid being eaten (mimicry). This adaptation helps protect them from their predators. (For example, the viceroy butterfly tastes good to birds, but the monarch butterfly tastes bad. Because the viceroy looks like the monarch butterfly, it is safer from predators.) Mimicry can also occur as mimicked behaviors, mimicked sounds, or mimicked scents. Behavioral adaptations allow animals to respond to life needs. Examples include hibernation, migration, dormancy, instinct, and learned behavior. Some animals (e.g., groundhogs, black bears) go into a deep sleep in which their body activities slow down due to seasonal changes and they can live off stored food (hibernation). Hibernation is a condition of biological rest or inactivity where growth, development, and metabolic processes slow down. Some animals (e.g., geese, monarch butterflies, tundra swans) go on a long-distance journey from one place to another (migration) in search of a new temporary habitat because of climate, availability of food, season of the year, or reproduction. Dormancy is a state of reduced metabolic activity adopted by many organisms (both plants and animals) under conditions of environmental	themselves, and rear young. • Describe and explain the terms camouflage, mimicry, hibernation, migration, dormancy, instinct, and learned behavior. • Explain how an animal's behavioral adaptations help it live in its specific habitat. • Distinguish between physical and behavioral adaptations of animals. • Compare the physical characteristics of animals, and explain how the animals are adapted to a certain environment. • Compare and contrast instinct and learned behavior. • Create (model) a camouflage pattern for an animal living in a specific dry-land or water-related environment. (Relates to 3.6.) • Design and construct a model of a habitat for an animal with a specific adaptation.

		stress or, when such stressful conditions are likely to appear, as in winter. Some animals are born with natural behaviors that they need in order to survive in their environments (instincts). These behaviors are not learned but are instinctive, such as a beaver building a dam or a spider spinning a web. Some behaviors need to be taught in order for the animal to survive, such as a bear cub learning to hunt (learned behavior).	
1st 9wks	3.5 Living Systems	A food chain shows a food relationship among plants and animals in a specific area or environment. Terrestrial organisms are found on land habitats such as deserts, grasslands, and forests. Aquatic organisms are found in water habitats such as ponds, marshes, swamps, rivers, and oceans. A green plant makes its own food using sunlight, air, and water. Green plants are producers. A consumer is an animal that eats living organisms (plant or animal). Certain organisms break down decayed plants and animals into smaller pieces that can be used again by other living organisms. These organisms are decomposers. A food chain, which shows part of a food web, can have an animal that eats only plants (herbivore). It can have an animal that eats only other animals (carnivore). It can also have an animal that eats both plants and animals (omnivore). An animal can hunt other animals to get its food (predator). An animal can be hunted by another animal for food (prey).	In order to meet this standard, it is expected that students will: • Differentiate between predators and prey. • Distinguish among producers, consumers, herbivores, omnivores, carnivores, and decomposers. • Infer that most food chains begin with a green plant. • Identify sequences of feeding relationships in a food chain. • Explain how a change in one part of a food chain might affect the rest of the food chain. • Create and interpret a model of a food chain showing producers and consumers.
1st 9wks	3.6 Living Systems	Water-related ecosystems include those with fresh water or salt water. Examples include ponds, marshes, swamps, streams, rivers, and oceans. Dry-land ecosystems include deserts, grasslands, rain forests, and forests.	In order to meet this standard, it is expected that students will: • Describe major water-related ecosystems and examples of animals and plants that live in each. • Describe major dry-land ecosystems and examples

		There are distinct differences among pond, marshland, swamp, stream, river, ocean, desert, grassland, rainforest, and forest ecosystems. A population is a group of organisms of the same kind that lives in the same place. Examples of a population are a flock of swans in a pond, a school of fish in a river, and a herd of cattle in the grassland. A community is all of the populations that live together in the same place. An example of a dry-land community would be a forest made up of trees, squirrels, worms, rabbits, and hawks. An example of a water-related community would be an ocean made up of fish, crabs, and seaweed. Organisms compete for the limited resources in their specific ecosystem. Humans need to help conserve limited resources.	of animals and plants that live in each. • Compare and contrast water-related and dry-land ecosystems. • Explain how animals and plants use resources in their ecosystem. • Distinguish between a population and a community. • Predict what would occur if a population in a specific ecosystem was to die. • Analyze models or diagrams of different water-related ecosystems in order to describe the community of organisms each contains and interpret how the organisms use the resources in that ecosystem. • Analyze models or diagrams of different dry-land ecosystems in order to describe the community of organisms each contains and interpret how the organisms use the resources in that ecosystem. • List ways that humans can help conserve limited resources.
1st 9wks	3.8 Earth Patterns, Cycles, and Change	Plants and animals undergo life cycles (e.g., Frogs begin as eggs in water. The eggs grow into tadpoles, the tadpoles eventually become frogs, and the adult frogs lay eggs to start a new life cycle over again. In the plant life cycle, a seed grows into a new plant that forms seeds. Then the new seeds repeat the life cycle.).	Explain the pattern of growth and change that organisms, such as the frog and butterfly undergo during their life cycle.
2nd 9 wks	3.2 Force, Motion, and Energy	Simple machines are tools that make work easier. Examples of tasks made easier include lifting a heavy weight, moving a heavy object over a distance, pushing things apart, changing the direction of a force, or holding an object together. The six simple machines are the lever, inclined plane, wedge, wheel and axle, screw, and pulley. The lever is a stiff bar that moves about a fixed point (fulcrum). It is a simple machine that is used to push, pull, or lift things. Examples include a seesaw, crowbar, and shovel. The inclined plane is a flat surface that is raised so one end is higher than the other. The inclined plane helps move heavy objects up or down. An example	In order to meet this standard, it is expected that students will: • Identify and differentiate the six types of simple machines: lever, screw, pulley, wheel and axle, inclined plane, and wedge. • Differentiate and classify specific examples of simple machines found in school and household items. These include a screwdriver, nutcracker, screw, flagpole pulley, ramp, and seesaw. • Analyze the application of and explain the function of each of the six types of simple machines. An example would be that an inclined plane is a ramp to make it easier for a heavy object to be moved up or down. • Identify and classify the simple machines which compose a compound machine, such as scissors, wheelbarrow, and bicycle. • Design and construct an apparatus that contains a

		is a ramp. The wedge is wide at one end and pointed at the other to help cut or split other objects. Examples include a knife or ax. The wheel and axle consists of a rod attached to a wheel. A wheel and axle makes it easier to move or turn things. Examples include bicycle wheels, roller skates, and a door knob. The screw is an inclined plane wrapped around a cylinder or cone. A common use of the screw is to hold objects together. Examples include a jar lid and wood screw. The pulley is a wheel that has a rope wrapped around it. Pulleys can be used to lift heavy objects by changing the direction or amount of the force. Examples include a flagpole. A compound machine is a combination of two or more simple machines. Examples include scissors, wheelbarrow, and bicycle.	simple machine.
2nd 9 wks	3.3 Matter	Objects are made of one or more materials (e.g., toys, shoes, and furniture). Physical properties (e.g., color, texture, phase, temperature, ability to dissolve in water) remain the same even if the visible material (e.g., plastic, paper, metal, ice) is reduced in size. Nanotechnology is the study of materials at the molecular (atomic) scale. Items at this scale are so small they are no longer visible with the naked eye. Nanotechnology has shown that the behavior and properties of some substances at the nanoscale (a nanometer is one-billionth of a meter) contradict how they behave and what their properties are at the visible scale.	In order to meet this standard, it is expected that students will: • Explain that physical properties are observable characteristics that enable one to differentiate objects. • Infer that objects are made of one or more materials based on observations of the physical properties that are common to each individual object. • Compare the physical properties of smaller, visible pieces of a material to those physical properties of the entire material. • Conclude that materials have their own set of physical properties that are observable. • Design an investigation to determine if the physical properties of a material will remain the same if the material is reduced in size.

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2nd 9 wks	3.9 Earth Patterns, Cycles, and Change	The water cycle is the movement of water from the ground to the air and back to the ground by evaporation, condensation, and precipitation. The energy that drives this cycle comes from the sun. During the water cycle, liquid water is heated and changed to a gas (water vapor). This process is called evaporation. The gas (water vapor) is cooled and changed back to a liquid. This process is called condensation. Water as a liquid or a solid falls to the ground as precipitation. Our water supply on Earth is limited. Pollution reduces the amount of usable water; therefore, the supply should be conserved carefully. Water is a simple compound essential for life on Earth. Living cells are mostly water. In each cell, the chemicals necessary for life are dissolved in water.	In order to meet this standard, it is expected that students will: • Identify the sun as the origin of energy that drives the water cycle. • Describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle. • Construct and interpret a model of the water cycle. • Identify the different ways that organisms get water from the environment. • Identify major water sources for a community, including rivers, reservoirs, and wells. Describe the major water sources for the local community. • Explain methods of water conservation in the home and school. • Identify and communicate the importance of water to people and to other living organisms. • Analyze possible sources of water pollution in their neighborhoods, at school, and in the local community. This includes runoff from over-fertilized lawns and fields, oil from parking lots, eroding soil, and animal waste.
3rd 9 wks	3.8 Earth Patterns, Cycles, and Change	A cycle is a repeated pattern. A sequence is a series of events that occur in a natural order. The pattern of day and night is caused by the rotation of Earth. One complete rotation occurs every 24 hours. The part of Earth toward the sun has daylight while the part of Earth away from the sun has night. The pattern of seasonal changes takes place because Earth's axis is tilted toward or away from the sun during its revolution around the sun. Because the tilt of Earth on its axis is 23.5°, the sun's energy is not equally intense at different latitudes. Rays striking Earth near the equator do so at close to a 90° angle. Rays striking Earth near the poles do so at a much smaller angle and thus the same amount of sunlight is spread over a larger area. For this reason, the same amount of energy from the sun will be less intense nearer the poles and these areas will have a colder climate. Earth takes 365¼ days, or one year, to make one revolution.	In order to meet this standard, it is expected that students will: • Explain how some events in nature occur in a pattern or cycle, such as the seasons, day and night, phases of the moon (first quarter, full, last [third] quarter, new), tides, and life cycles. • Recognize that the relationships that exist between and among Earth, the sun, and the moon result in day and night, seasonal changes, phases of the moon, and the tides. • Model and describe how Earth's rotation causes day and night. • Model and describe how the sun's rays strike Earth to cause seasons. • Observe, chart, and illustrate phases of the moon (first quarter, full, last [third] quarter, new), and describe the changing pattern of the moon as it revolves around Earth. • Collect and analyze data from simple tide tables to determine a pattern of high and low tides.

		The cycle of moon phases occurs as the moon makes one revolution around Earth. The visible portion of the moon that we see each night follows a pattern. The tides follow a pattern of two high and two low tides every 24 hours. This pattern is caused for the most part by the gravitational attraction between Earth and the moon.	
3rd 9 wks	3.7 Interrelation-ships in Earth/Space Systems	Soil is important because many plants grow in soil, and it provides support and nutrients for the plants. Over many years, weather, water, and living organisms help break down rocks and create soil (weathering). Nutrients are materials that plants and animals need to live and grow. Rock, clay, silt, sand, and humus are components of soil. Topsoil is the upper soil surface and a natural product of subsoil and bedrock. Topsoil is best for plant growth. Subsoil and bedrock are layers of soil under the topsoil that are formed over a long period of time by the action of water. Subsoil and bedrock are not as good for growing plants as is topsoil. Humus is decayed matter in soil. It adds nutrients to the soil. It is located in the topsoil. Clay contains tiny particles of soil that hold water well and provides nutrients. Sand is made up of small grains of worn-down rock, has few nutrients, and does not hold water well. Silt is made up of very small broken pieces of rock. Its particles are larger than clay and smaller than sand. Since soil takes a long time to form, it should be conserved, not wasted.	In order to meet this standard, it is expected that students will: • Observe and recognize that soil, as a natural resource, provides the support and nutrients necessary for plant growth. • Understand the key terminology related to soil, including humus, nutrients, topsoil, and bedrock. • Interpret and illustrate a basic diagram showing major soil layers, including bedrock, subsoil, and topsoil. • Analyze and describe the different components of soil, including rock fragments, clay, silt, sand, and humus. • Explain how soil forms over time. • Design an investigation to compare how different types of soil affect plant growth. This includes organizing data in tables and constructing simple graphs. • Collect, chart, and analyze data on soil conservation on the school grounds. • Evaluate the importance of soil to people. • Describe how soil can be conserved.
4th 9 wks	3.10 Earth Resources	Every organism depends on other organisms to survive. This is called interdependency. Human actions, such as polluting, can affect the survival of plants and animals.	In order to meet this standard, it is expected that students will: • Explain how organisms in an area are dependent on each other. • Compare and contrast human influences on the

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		Natural events, such as fires, floods, diseases, and erosion, can also affect the survival of plant and animal species. Conservation is the careful use and preservation of our natural resources. Resource renewal is a conservation practice in which species are protected. An example would be protecting endangered plants by saving their seeds, growing the seeds indoors, and later putting the new plants back in their natural habitats.	quality of air, water, and habitats. • Analyze the effects of fire, flood, disease, and erosion on organisms and habitats. • Describe how conservation practices can affect the survival of a species. • Describe a conservation practice in the local community.
4th 9 wks	3.11 Earth Resources	The sun is the source of almost all energy on Earth. The sun is the direct source of light and thermal energy. Sunlight, water, and wind are sources of energy. The force of flowing water and moving air (wind) can also be used to generate electricity. Wood comes from trees. It has many important uses, including its use as a fuel. Some energy sources are renewable. That means that they can be replaced. Some energy sources are nonrenewable. That means that once they are used up, they are gone and cannot be replaced. Coal, oil, and natural gas are nonrenewable resources. Fossil fuels, such as coal, oil, and natural gas, are formed from decayed plants and animals. The formation of fossil fuels takes millions of years.	In order to meet this standard, it is expected that students will: • Explain that the sun is the major source of energy for Earth. • Identify sources of energy and their uses. • Describe how solar energy, wind, and moving water can be used to produce electricity. • Describe how fossil fuels are used as an energy source. • Compare and contrast renewable and nonrenewable energy sources. • Analyze the advantages and disadvantages of using different naturally occurring energy sources. • Design a basic investigation to determine the effects of sunlight on warming various objects and materials, including water.