SCIENCE Grades: 3-5

A school's curriculum will address these outcomes over this 3 year span. In addition to achieving these standards, a student is expected to have developed the grade-level-appropriate skills necessary to do science, i.e. scientific inquiry, including asking and answering questions by conducting investigations or experiments and to have been given the opportunity to experience Technology/Engineering challenges.

As were the original guidelines released in 2006, these revised Diocesan Science Curriculum Guidelines reflect primarily content standards drawn from the *National Science Education Standards* (NSES), the *Benchmarks for Science Literacy* and the Massachusetts *Science and Technology/ Engineering Curriculum Framework*. The outcomes have been left in grade-bands to give a school maximum flexibility when designing its individual science curriculum: allowing it to take advantage of local assets and/or programs or activities already in place; or to seek out and exploit the links to its existing curricula. The outcomes are generally the same as in the original guidelines but have been re-ordered and grouped around essential questions that a school may or may not choose to use when mapping its Science curriculum. A school should also look to include the NSES "Science as Inquiry" standards as it designs its curriculum and develops its teaching/learning strategies. These inquiry standards should not be viewed as secondary to the content standards, but rather, collectively, as a primary goal of science education with the content being the context within which these skills are learned.

NSES: Abilities Necessary to Do Scientific Inquiry

Grades K–4

- Ask a question about objects, organisms, and events in the environment
- Plan and conduct a simple investigation
- Employ simple equipment and tools to gather data and extend the senses
- Use data to construct a reasonable explanation
- Communicate investigations and explanations

Grades 5–8

- Identify questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, explanations, predictions, and models using evidence.
- Think critically and logically to make relationships between evidence and explanations.
- Recognize and analyze alternative explanations and predictions.
- Communicate scientific procedures and explanations.
- Use mathematics in all aspects of scientific inquiry.

NSES Changing Emphases to Promote Inquiry

LESS EMPHASIS ON	MORE EMPHASIS ON
Activities that demonstrate and verify science content	Activities that investigate and analyze science questions
Investigations confined to one class period	Investigations over extended periods of time

Process skills out of context	Process skills in context
Emphasis on individual process skills such as observation or inference	Using multiple process skills— manipulation, cognitive, procedural
Getting an answer	Using evidence and strategies for developing or revising an explanation
Science as exploration and experiment	Science as argument and explanation
Providing answers to questions about science content	Communicating science explanations
Individuals and groups of students analyzing and synthesizing data without defending a conclusion	Groups of students often analyzing and synthesizing data after defending conclusions
Doing few investigations in order to leave time to cover large amounts of content	Doing more investigations in order to develop understanding, ability, values of inquiry and knowledge of science content
Concluding inquiries with the result of the experiment	Applying the results of experiments to scientific arguments and explanations
Management of materials and equipment	Management of ideas and information
Private communication of student ideas and conclusions to teacher	Public communication of student ideas and work to classmates

Although the Massachusetts Technology/Engineering standards are not explicitly included in the Diocesan outcomes, some are integrated within Suggested Teaching/Learning Strategies. Schools are encouraged to include as many of the Technology/Engineering standards as possible.

As has been more consistently recognized in subjects other than K-8 science, it is not possible to learn, beyond a mere recitation of facts and "factoids", without "doing." For example, no one would consider a mathematics class satisfactory if it consisted solely of students reading about other people "doing" math and watching the teacher "doing" math. We fully accept that students must be given the opportunity to "do" math. So too, it is with science. Students must be given the opportunity to "do" science. While gaining a better understanding of the workings of the world around them, students will be able to more fully appreciate the wonders of creation as well as their role as stewards.

Learning Outcomes	**Teaching / Learning Strategies & Assessments**
[Additional outcomes from the Diocesan Health Curriculum Guidelines will also be included unless they are addressed in other courses.] 1. Use basic tools with increasing accuracy & precision (including a ruler, thermometer and balance) to make metric measurements. ***I. How are organisms the same or different ?*** I.1. Sort into the major groups, based on their physical characteristics: plants (flowering vs	➢ Model using a simple dichotomous key.

non-flowering) and animals (mammal / bird / fish / reptile / insect) I.2. Use a key to sort organisms into their major group. I.3. Identify the basic structures of plants (roots, stem, leaves,) the major functions of each, and how plants grow. I.4. Describe how the sun's energy is used by plants [to produce sugars (via photosynthesis) and is transferred within a food chain.] I.5. Recognize that all living things have a predictable life cycle that may or may not include dramatic changes in form. I.6. Give examples of inherited characteristics I.7. Describe how the needs of an organism must be met by its environment in order for it to survive. I.8. Describe how plants and animals respond to changes in their environment. I.9. Give examples of how organisms can change their environments and/or impact their ecosystems. I.10. Distinguish between learned and instinctive behaviors	➢ Keep a journal of the development of an organism (e.g. plant, tadpole, ladybug, butterfly.)
II. How are non-living things the same or different ? II.1. Recognize that matter has many observable properties, such as weight, shape, color, temperature; and that these properties can be measured and/or used to sort things. II.2. Compare and contrast the basic properties of solids, liquids and gases [definite shape or not, takes up certain amount of space or not.] II.3. Describe how water can change from one state to another II.4. Categorize minerals based on their physical properties II.5. Distinguish between the 3 categories of rocks (igneous, metamorphic & sedimentary.) II.6. Explain what soil is and how it is formed.	➢ Given a collection of objects: describe physical characteristics that could be used to distinguish the items. ➢ Students design & conduct simple investigations of freezing, melting, evaporation etc. ➢ Use an identification guide/key to distinguish among types of minerals ➢ Given rock samples, students sort them into appropriate groups ➢ Maintain a worm-composting bin. ➢ Look at sand using a magnifier & note different types of grains. Compare/contrast different types of sand.
III. How do we use different types of energy ? III.1. Identify the basic forms of energy (light, sound, heat, electrical, magnetic) III.2. Give examples of how one form of energy can be changed to another form III.3. Construct an electrical circuit using a battery with a light bulb or bell and explain the requirements for a working circuit. III.4. Test materials and determine if they are conductors or insulators III.5. Construct and use an electromagnet	➢ Describe ways we use energy in classroom (or home.) ➢ Given needed materials (battery, wires or foil strips, bulb or bell), students work in pairs to make it work while keeping track of arrangements that did not work.

III.6. Recognize that magnets have poles that attract or repel each other. III.7. Test materials and formulate conclusions about what type(s) of materials are magnetic III.8. Recognize that sound is produced by vibrating objects and requires a medium through which to travel. Relate the rate of vibration to the pitch of the sound III.9. Recognize that light travels in a straight line until it strikes an object or travels from one medium to another, and that light can be reflected, refracted, or absorbed.	➢ Using iron filings (sealed in plastic or suspended in oil) students demonstrate magnetic fields showing attraction & repulsion ➢ Students design experiment to determine how one factor (e.g. the number of coils, size of nail) affects the strength of an electromagnet (e.g. measured by number of paper clips arranged in a line that it picks up.)
IV. How does the weather affect us ? IV.1. Describe the weather in terms of measurable quantities such as air temperature, wind speed and direction, and precipitation. IV.2. Describe how global patterns such as the jet stream and water currents influence local weather. IV.3. Differentiate between weather and climate. IV.4. Describe/illustrate the water cycle.	➢ Maintain daily log of weather data: measuring temperature and precipitation and using instruments or observation scale for wind speed. Compare to published weather forecasts to identify patterns. Make own forecast & note accuracy. ➢ Students measure and add equal amounts of water to least two cups on a windowsill (adding food coloring makes viewing easier.) Students cover one with clear plastic wrap and make periodic observations of both cups (drawing, measuring, graphing).
V. How does our Earth & Moon relate to the Solar System ? V.1. Give examples of how the surface of the earth changes by such processes as erosion and weathering; landslides, volcanoes and earthquakes. V.2. Describe the solar system in the most basic terms. V.3. Describe the movements of the earth and relate its rotation to day/night and the apparent movement of objects in the sky. V.4. Describe the changes in the observable shape of the moon over the course of a month.	➢ Use a light source & globe to demonstrate day/night. ➢ Have students keep a journal of moon observations for a month or longer. Students should observe, draw their observations, and add the date and time of day for each observation. Students could also use a protractor with an attached straw and weighted pendulum to measure its angle. During the observation time, daily discussion should include moon facts.

Resources

Rulers, thermometers, magnifiers, balances (commercial or home-made); electricity materials; magnets; rock & mineral specimens

NSTA Elementary Resources: http://www.nsta.org/elementaryschool/?lid=hp

Elementary Science Links (all levels): http://interconnect.tamucc.edu/elementaryscience/

Backyard by Donald M. Silver, Patricia Wynne ("One Small Square" series; ages 7-12) ; *Waiting for Wings* by Lois Ehlert; *Magic School Bus* (series including: *Lost in the Solar System*,) by Joanna Cole *Science Is...: A source book of fascinating facts, projects and activities* by Susan V. Bosak *Teaching Science With Favorite Picture Books: Grades 1-3* by Ann Flagg, Mary Ory, Teri Ory *The Everything Kids' Science Experiments Book: Boil Ice, Float Water, Measure Gravity-Challenge the World Around You!* (Everything Kids Series) by Tom Robinson
Suppliers to consider: hatchearlychildhood.com lakeshorelearning.com deltaeducation.com scientificsonline.com YoungExplorers.com basicsciencesupplies.com enasco.com/science etacuisenaire.com insectlore.com flinnsci.com