

Archdiocese of Philadelphia



Science Guidelines

Grade 1

2006

GENERAL SCIENCE OBJECTIVES – Grades 1 to 8

At the conclusion of the science program prescribed for the elementary school in the Archdiocese of Philadelphia, students should have achieved the skills enumerated in the following six categories of objectives:

Knowledge

To read and state the meaning of certain scientific facts and concepts. When a problem situation is stated requiring application of some scientific principles, a child has learned that he/she should be able to apply the principle.

Instrumental Skills

To manipulate basic science equipment, interpret and prepare maps, graphs, charts, and tables appropriate to problems.

Problem-Solving Skills

To demonstrate problem-solving skills such as observing, inferring, sensing and defining problems, making hypotheses, outlining scientific procedures to test hypotheses, carrying out an investigation, controlling and manipulating variables, formulating models, making valid conclusions, recognizing and using space and time relationships, recognizing and using number relationships, classifying, measuring, communicating, and making operational definitions.

Scientific Attitudes

To demonstrate such scientific attitudes as open-mindedness by being willing to consider new facts in making judgments, withholding conclusions until all available facts are in, using controls, generalizing with sufficient evidence.

Appreciation

To describe the uses, benefits, and limitations of science to society.

Interest

To demonstrate interest in science by reading, collecting, studying, or becoming involved in some scientific activity as a leisure time pursuit.

SCIENTIFIC PROCESS SKILLS

Science education involves process as well as content. The content learned helps the students understand and interpret their environment. The process involves using diverse skills to solve different problems. This leads to effective ways of working and provides experience in thinking critically and creatively. The process skills with expectations for each grade are found below. It is hoped that teachers will develop these skills through hands-on experiences.

| Introduce, Reinforce, Master | K | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1. <u>Observing</u> : ability to identify properties, structures, etc. through use of all the senses | I | R | R | M | | | | | |
| 2. <u>Classifying</u> : ability to group, match, compare by commonality | I | R | R | M | | | | | |
| 3. <u>Identifying</u> : ability to describe and interpret sensory and qualitative aspects of learning | | I | R | R | R | M | | | |
| 4. <u>Questioning</u> : ability to ask pertinent questions regarding experiences | | I | R | R | R | M | | | |
| 5. <u>Measuring</u> : ability to find quantitative differences, to estimate, calculate, etc. (metric) | I | R | R | R | R | M | | | |
| 6. <u>Recording</u> : ability to collect, record, and tabulate data meaningfully | | | | I | R | R | R | M | |
| 7. <u>Predicting</u> : ability to guess outcomes on basis of previous experiences | | | | I | R | R | R | M | |
| 8. <u>Formulating Models</u> : ability to represent cognitive data graphically | | | | | I | R | R | M | |
| 9. <u>Formulating a Hypothesis</u> : to predict and generalize from experiences/data; to make an educated assumption as to the possible outcomes of an experiment | | | | | I | R | R | M | |
| 10. <u>Interpreting</u> : ability to analyze data validly (similarities, dissimilarities, cause/effect) | | | | | | I | R | R | M |

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| 11. <u>Designing Investigations</u> : ability to control variables, record and interpret data, summarize data, graph | | | | | | I | R | R | M |
| 12. <u>Inferring</u> : ability to make conclusions referring to causes, effects, etc. | | | | I | R | R | M | | |
| 13. <u>Generalizing</u> : ability to sum up experiences into some kind of conclusion | | | | | | I | R | R | M |
| 14. <u>Experimenting</u> : to try something out to see whether or not it works | | | I | R | R | R | M | | |
| 15. <u>Manipulating Variables</u> : to identify and selectively change experimental conditions such as time, intervals, temperature, distance | | | | | I | R | R | R | M |
| 16. <u>Handling Equipment</u> : to know the purpose for and manner of using lab resources and equipment for the purpose of experimentation | | | I | R | R | R | M | | |
| 17. <u>Using Space-Time Relationships</u> : ability to consider position and motions from vantage points other than the child's own | | | | | | I | R | R | M |
| 18. <u>Communication</u> : ability to verbally relate experiences, information, and procedures with clarity | I | R | R | R | M | | | | |
| 19. <u>Recognizing Problem Areas</u> : ability to be aware of areas where alternative solutions are possibilities | | | | | I | R | R | R | M |
| 20. <u>Researching</u> : ability to seek additional information, sources, conditions, personnel, events | | | I | R | R | R | M | | |
| 21. <u>Interdisciplinary Skills</u> : to be able to identify those areas of science which are interrelated to other disciplines such as math, English, and social studies | I | R | R | R | M | | | | |

SCIENTIFIC PROCESS SKILLS

Science education involves process as well as content. The content learned helps the students understand and interpret their environment. The process involves using diverse skills to solve different problems. This leads to effective ways of working and provides experience in thinking critically and creatively. A blank process skills chart has been provided for teachers to use as a work in progress: identify which skills your students should have mastered, record dates of when skills were introduced or used. Feel free to duplicate this form.

| <u>I</u>ntr<u>o</u>duce, <u>R</u>einforce, <u>M</u>aster | | | | | | | | | |
|---|--|--|--|--|--|--|--|--|--|
| 1. <u>O</u> bserving: ability to identify properties, structures, etc. through use of all the senses | | | | | | | | | |
| 2. <u>C</u> lassifying: ability to group, match, compare by commonality | | | | | | | | | |
| 3. <u>I</u> dentifying: ability to describe and interpret sensory and qualitative aspects of learning | | | | | | | | | |
| 4. <u>Q</u> uestioning: ability to ask pertinent questions regarding experiences | | | | | | | | | |
| 5. <u>M</u> easuring: ability to find quantitative differences, to estimate, calculate, etc. (metric) | | | | | | | | | |
| 6. <u>R</u> ecording: ability to collect, record, and tabulate data meaningfully | | | | | | | | | |
| 7. <u>P</u> redicting: ability to guess outcomes on basis of previous experiences | | | | | | | | | |
| 8. <u>F</u> ormulating Models: ability to represent cognitive data graphically | | | | | | | | | |
| 9. <u>F</u> ormulating a Hypothesis: to predict and generalize from experiences/data; to make an educated assumption as to the possible outcomes of an experiment | | | | | | | | | |

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|---|--|--|--|--|--|--|--|--|--|
| 10. <u>Interpreting</u> : ability to analyze data validly (similarities, dissimilarities, cause/effect) | | | | | | | | | |
| 11. <u>Designing Investigations</u> : ability to control variables, record and interpret data, summarize data, graph | | | | | | | | | |
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| 20. <u>Researching</u> : ability to seek additional information, sources, conditions, personnel, events | | | | | | | | | |
| 21. <u>Interdisciplinary Skills</u> : to be able to identify those areas of science which are interrelated to other disciplines such as math, English, and social studies | | | | | | | | | |

SCIENTIFIC METHOD

(Expectations by Grade Level)

Primary – Observe and Inquire: Grades One to Three

1. Ask questions and make observations.
2. State the problem.
3. Identify the materials.
4. Follow the procedures to conduct the investigation.
5. Tell what was learned as a result of the investigation.

Elementary – Hypothesize and Experiment: Grades Four to Six

1. Ask questions and make observations.
2. Recognize and state the problem.
3. Formulate a hypothesis based on content, research and previous experience.
4. Identify the materials.
5. Follow the procedures to conduct the investigation.
6. Collect data and record the results.
7. State a conclusion based on the data collected; include applications to everyday life.

Middle School – Analyze and Extend: Grades Seven and Eight

1. Ask questions and make observations.
2. Recognize and state the problem.
3. Formulate a hypothesis based on content, research and previous experience.
4. Identify the materials.
5. Follow and/or design the procedures to conduct the investigation.
6. Collect data and record the results making use of maps, charts, and graphs as well as tables and drawings.
7. State a conclusion based on the data collected; include applications to everyday life as well as suggestions for extended investigations.

| P.S.S | CONTENT | STRATEGIES AND ASSESSMENTS |
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| | <p>Unit One – Weather – <i>Teachers, the information given here is for your support. The students in grade one do not need to “copy” notes.</i></p> | <p>CLASSIFY: Organize activities into seasons: when can you play baseball, etc.</p> |
| | <p>I. Features of Weather – The features of weather are temperature, moisture, winds, and clouds.</p> | <p>DISCUSS: How do you know the difference between fall, winter, spring, and summer?</p> |
| | <p>A. <u>Temperature</u> – how hot or cold is it?</p> <ol style="list-style-type: none"> 1. Can you tell the temperature just by looking at the sky? 2. Do you know how to use a thermometer? | |
| | <p>B. <u>Moisture</u> – how wet or dry is it?</p> <ol style="list-style-type: none"> 1. Sweating keeps the body cool. 2. Humidity makes it harder to keep your body cool. | <p>INVESTIGATE: Place wet towels in three different areas and see how long it takes for them to dry.</p> <p>MODEL: Use a flashlight, a mirror, and a glass of water to model a rainbow.</p> |
| | <p>C. <u>Wind</u> – how does the air move?</p> <ol style="list-style-type: none"> 1. Warm air rises into the atmosphere. 2. Cooler air moves in to take its place. | |
| | <p>D. <u>Clouds</u> – why do clouds look different?</p> <ol style="list-style-type: none"> 1. Some white puffy clouds indicate warm, sunny days. 2. Gray sheets of clouds indicate rainy weather. | <p>WRITE: Write a poem about something that has happened during different types of weather.</p> |

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| | II. <u>Types of Weather</u> | PREPARE: How should you prepare to go outside during various types of weather? |
| | A. <u>Rain</u> – droplets of water in the clouds that are heavy enough to fall out of the sky. What are hurricanes? Why does flooding happen? | |
| | B. <u>Snow</u> forms if it is freezing in the clouds and the ice crystals don't have time to melt before they reach the Earth. What is sleet? What is a blizzard? | |
| | C. <u>Hail</u> happens when ice crystals are repeatedly pushed up into colder air before reaching the Earth. Hail usually happens during thunderstorms and can cause damage. | |
| | III. <u>Measuring Weather</u> | ORAL: Take turns presenting the weather of the day as well as a prediction for the next day's weather. |
| | A. <u>Temperature</u> – use a thermometer; record the temperature each day and graph it. | INVESTIGATE: How does hot and cold water affect a balloon that has been stretched over the opening of a plastic soda bottle? |
| | B. <u>Moisture</u> – create a rain gauge. Practice using a ruler to measure the rain or snow collected. | MEASURE: Attach a ruler to a jar to collect rainwater. Record the height of the water. |
| | C. <u>Wind</u> – set up a wind sock or flag and describe how it is affected by the wind – direction and speed. | CLASSIFY: Create a system to identify how hard the wind is blowing |
| | D. <u>Narrative</u> – students should record the look of the sky and how the weather “feels” along with the quantitative measurements; they should be able to draw conclusions once a month throughout the school year. | |

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| | IV. <u>Weather Safety</u> | |
| | A. <u>Tornadoes</u> | |
| | B. <u>Thunderstorms</u> | |
| | C. <u>Hurricanes</u> | |
| | D. <u>Snowstorms</u> | |
| | E. <u>Floods and Droughts</u> | |
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| | Unit Two – Matter | |
| | I. <u>Matter</u> is what makes up all things. | |
| | <p>A. <u>Properties</u> can be observed using the senses (size, shape, color)</p> <ol style="list-style-type: none"> 1. Mass is the amount of matter in an object. <ol style="list-style-type: none"> a. Does the object feel heavy or light? b. Can you measure the mass using a scale? 2. Volume is the amount of space that an object takes up. | <p>COMPARE AND CONTRAST: Give small groups of students a set of similar objects and ask them to write a list of how the objects are alike and different.</p> <p>INVESTIGATE: Discuss what is in fruit. Find the mass of pieces of fruit such as pineapple (an apple will work as well). Put the fruit into the sun for a few days and determine the mass again. Why has it changed?</p> <p>MEASURE AND CLASSIFY: Take 3 to 5 common classroom objects and organize them from smallest to largest. Explain to a classmate why this is the best organization.</p> |
| | <p>B. <u>Types of Matter</u></p> <ol style="list-style-type: none"> 1. Solid has mass and a definite shape; examples: beads, chalk, books 2. Liquid has mass and has the shape of its container; examples: milk, soda, juice 3. Gas has mass but no definite shape; examples: oxygen, helium, carbon dioxide | <p>MEASUREMENT: Practice using a scale to record the mass of various classroom objects (ask the students to predict which ones will have the greatest mass prior to the measurement.)</p> <p>INVESTIGATE: Use a beaker (or measuring cup) to measure colored water to be sure that</p> |

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| | | <p>each cup has the same amount. Pour water into different containers.</p> <p>OBSERVE: Put a paper towel into a cup, turn the cup upside down in a container of water and then pull it straight out. Examine the paper towel. Discuss why water didn't go into the cup and wet the towel?</p> <p>PREDICT AND MEASURE: Ask students to determine the difference in the sizes of a set of round objects. (Offer some string as a way of quantitatively measuring.)</p> |
| | II. <u>Changes</u> | |
| | <p>A. <u>Floating or Sinking</u></p> <ol style="list-style-type: none"> 1. Floating is the ability of an object to stay on top of the liquid or partly on top of the liquid. 2. Sinking is the property of falling under the liquid; the object can be completely under and/or all the way on the bottom of the container | <p>PREDICT: Play "Will it Float?" Present so objects for the students to observe qualitatively as well as quantitatively. Have each child make a chart of the items and predict whether it will float, sink, or suspend in the water. Once each child has made the predictions, test each item and record results.</p> |
| | <p>B. <u>Freezing or Melting</u></p> <ol style="list-style-type: none"> 1. Freezing occurs when an liquid loses heat; for example, water becomes ice. 2. Melting occurs when a solid gains heat; for example, ice becomes water. | <p>INVESTIGATE: Use evaporation to demonstrate that water can change from a liquid to a gas. Condensation can also be observed.</p> <p>INVESTIGATE: Put a small container of water and a similar sized solid into a freezer overnight. Make some conclusions about the results.</p> |
| | | <p>INVESTIGATE: Create a mixture of cornstarch and water (4 parts to 2 parts). Pick</p> |

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| | | <p>it up and observe its characteristics. How is it like a liquid? How is it like a solid?</p> <p>COMMUNICATE: How has an object changed if you cut it or break it? Is it something new?</p> |
| | | <p>PREDICT: Which will melt faster: an ice cube on a plate on a table or an ice cube on a plate under a lamp? Why do you think this is so?</p> |
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| | Unit Three – Human Body | |
| | <p>Senses are the parts of the body that deliver information to the brain so that we can understand what is going on around us.</p> | <p>SAFETY POSTERS: Assign each group of students one of the senses. Ask them to create a poster that will tell others how to take care of these sensory organs.</p> |
| | <p>I. <u>Sight</u> – two-thirds of the brain’s attention is taken up by what the eye sees.</p> | |
| | <p>A. <u>Eye</u></p> <ol style="list-style-type: none"> 1. Pupil – appears black and opens and closes as the amount of light changes. 2. Iris – colored part that is a muscle that controls the pupil. 3. Lens – focuses the image (like a camera) so the retina can send it to the brain. | |

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| | <p>B. <u>Activities</u></p> <ol style="list-style-type: none"> 1. Wear eye patches to record what can be seen. 2. Hold a mirror in front of face to watch the pupil as it changes with classroom lighting. 3. Use “I Spy” type activities to get students to focus. 4. Peel an onion and see how long it takes to activate tear ducts. | |
| | <p>II. <u>Sound</u> – vibrations or waves that travel through the air is heard by the ear.</p> | <p>MODEL: Make a musical instrument using glasses and water. Discuss which sounds are more pleasant.</p> |
| | <p>A. <u>Ear</u> – <i>these notes are for the teacher not the students necessarily</i></p> <ol style="list-style-type: none"> 1. Outer ear – ear flap with ear lobe and auditory canal. 2. Middle ear – eardrum and the three tiny bones: hammer, anvil, and stirrup (tiniest bones in the human body). 3. Inner ear – sends nerve signals to the brain. | <p>INVESTIGATE: Does a noise sound the same if you hear it through a solid (such as a desk) as it does through the air?</p> |
| | <p>B. <u>Activities</u></p> <ol style="list-style-type: none"> 1. Identify sounds without seeing the objects making the noise. 2. Push “q-tips” through tissues to demonstrate how delicate the eardrum is. 3. Discuss experiences of “ear popping.” | |

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| | <p>III. <u>Smell and Taste</u> are connected. These senses detect odors and flavors, good and bad.</p> | |
| | <p>A. <u>Nose</u> is the organ used for the sense of smell.</p> <ol style="list-style-type: none"> 1. Nostrils bring in air and odors. 2. Cilia are tiny hairs in the nose that filter germs and collect signals for the olfactory nerve. | |
| | <p>B. <u>Teeth</u> are considered to be part of the digestive system, but in order to taste, we must sometimes need to chew.</p> | |
| | <p>C. <u>Tongue</u></p> <ol style="list-style-type: none"> 1. Saliva – liquid that aids in dissolving food. 2. Taste buds – the tongue recognizes bitter, sweet, sour, and salty on different parts of the tongue; taste buds are replaced as you grow older so you should try foods again about every 7 to 10 years if you don't think you like them. | |
| | <p>IV. <u>Touch</u> is sensed through your skin and some of your muscles such as your tongue.</p> <p>A. <u>Skin</u> has various thicknesses throughout the body depending upon its location.</p> <ol style="list-style-type: none"> 1. Skin on the foot needs to be thick to prevent it from being penetrated by sharp objects. 2. Skin on the fingertips is very sensitive and allows you to recognize objects through the sense of touch. Lips are also sensitive. | |
| | <p>B. Skin is sensitive to sunlight depending upon the amount of exposure, the color of the skin, and the amount of hair covering the skin.</p> | |

ROLE OF THE SCHOOL SCIENCE COORDINATOR

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| | Unit Four - Plants | KINESTHETIC: Act out or create a dance to show the life cycle of a flowering plant. |
| | I. <u>Plants</u> are living organisms that provide oxygen and take in the carbon dioxide that humans give off. | ART: Create a collage of pictures to show how people use plants. |
| | A. What does a plant need to grow? B. Growth of plants is a cycle. | CLASSIFY: Divide plants into groups and explain why you organized them that way. |
| | II. <u>Parts of Plants</u> – A seed is made up of stored food and a tiny plant. The tiny plant uses the stored food when it begins to grow. | INVESTIGATE: What do you think plants need? Create an experiment with easy to grow plants that will allow students to explore what plants need. |
| | A. <u>Roots</u> take in water and nutrients from the soil. | MODEL: As each part of the plant is introduced, have students add to a picture and label the part. DEMONSTRATE: Demonstrate to the students that soil has water that plants need by placing some soil on a paper towel, cover it with another paper towel and then examine the second paper towel. |
| | B. <u>Stems</u> hold up the plant and move water and nutrients through it. | WRITE: Place a potato in a jar so that it has some access to water. Put the jar in a sunny place, record what you notice for a month. MODEL: Put carnations into colored water and observe how the water is carried up to the flower. |
| | C. <u>Leaves</u> use light, air, water, and nutrients to make food for the plant. | OBSERVE: Take all the leaves off a small plant and put it in the sun. Keep it watered. Observe the plant every day. CLASSIFY: Collect leaves from home and around school. Create a classification system to show how they are alike and different. MEASURE: Using the leaves from the previous activity, measure the length and create a graph to show the differences. |
| | D. <u>Flowers</u> make fruits that hold seeds. | READ: Find a library book that gives you some information about plants. OBSERVE: Use a hand lens to observe how the flowers of various plants protect the seeds. |

In order to provide for articulation in the science curriculum and to make science an important and functional learning situation, the principal should appoint a science coordinator. This coordinator should be an experienced teacher (if possible), but above all one who is interested in science and is familiar with the latest books and programs. The coordinator must be aware of innovations and new methods and be willing to implement them.

Responsibilities of the Science Coordinator

1. To work with the principal and teachers to define the curriculum for each grade level and to make sure that the archdiocesan curriculum guidelines are adapted for the school.
2. To be responsible for keeping the texts or programs up to date and to prepare orders for additional texts and workbooks to be used for the next school year.
3. To consult with the principal about providing equipment and materials so that investigative science can be performed in the school.
4. To inform teachers of the availability of materials and equipment for their level.
5. To hold periodic meetings with the teachers to discuss the implementation of the science program and to provide for a sharing of ideas and methods.
6. To assist the teacher whenever needed and to encourage science experimentation.
7. To acquaint new staff members with curriculum guidelines and to see that the teachers have a copy; to offer any help needed by teachers in the implementation of the science program.
8. To present interesting articles and new ideas in the field of science through periodicals, books, workshops, etc.
9. To attend workshops or meetings provided by the archdiocese or any other seminars provided by professionals.
10. To plan and organize a science fair.
11. To keep the principal informed of meetings and any new developments in classroom science.