

Science Curriculum

Grade 4

The Fairfax County Elementary Science Program of Studies is a hands-on, inquiry based curriculum designed to provide students with a basic understanding of scientific investigation as it applies to the concepts of force, motion, and energy; matter; life processes; living systems; resources; Earth patterns, cycles, and change; interrelationships in Earth and space systems. Through science process skills and the practice of experimental design, students will develop abilities to solve problems, communicate, and make connections to science in our everyday world. The program materials include activity-centered units, science trade books, Windows on Science videodiscs, Fresh Science DVDs and specific web sites correlated to each science unit.



SCI.G4

Standard 1

PLAN AND CONDUCT INVESTIGATIONS

The student will plan and conduct investigations.



Benchmark 1.a

Understand Observations, Conclusions, Inferences and Predictions

The student will plan and conduct investigations in which distinctions are made among observations, conclusions, inferences and predictions.



Indicator 1.a.1

Differentiate observations, conclusions, inferences and predictions

Differentiate among simple observations, conclusions, inferences and predictions.



Indicator 1.a.2

Apply the terms observation, conclusion, inference and prediction

Correctly apply the terms observation, conclusion, inference and prediction in oral and written work. Comprehend these terms and apply them in novel situations related to fourth grade SOL concepts.



Benchmark 1.b

Formulate Hypotheses Based on Cause-and-Effect Relationships

The student will plan and conduct investigations in which hypotheses are formulated based on cause-and-effect relationships.



Indicator 1.b.1

Create a plausible hypothesis from a set of testable observations

Create a plausible hypothesis, stated in terms of cause and effect, from a set of basic observations that can be tested.



Indicator 1.b.2

Apply the idea of "cause and effect" to new situations

Comprehend what "cause and effect" is and to be able to apply that idea in new situations. The application should occur in terms of fourth grade SOL-related concepts or other concrete situations.



Indicator 1.b.3

State hypotheses as "If... then" statements

Hypotheses should be stated in terms such as: "If the water temperature is increased, then the amount of sugar that can be dissolved in it will increase."



Benchmark 1.c

Define Which Variables Must be Held Constant in an Experiment

The student will plan and conduct investigations in which variables that must be held constant in an experimental situation are defined.



Indicator 1.c.1

Determine which variables must be held constant in a simple experiment

Analyze the variables in a simple experiment, and decide which must be held constant (not allowed to change) in order for the investigation to represent a fair test.



Indicator 1.c.2

Apply the concept of variables to new situations

Comprehend what "variables" are and apply that idea in new situations related to fourth grade SOL-related concepts.



Indicator 1.c.3

Understand that variables are either manipulated or responding

Understand that variables are either manipulated or responding.



Benchmark 1.d

Select Appropriate Instruments to Measure Distance, Volume, Mass, etc.

The student will plan and conduct investigations in which appropriate instruments are selected to measure linear distance, volume, mass, and temperature.



Indicator 1.d.1

Choose the appropriate instrument for making metric measures

Choose the appropriate instruments, including centimeter rulers, meter sticks, graduated cylinders, beakers, scales and balances, and Celsius thermometers, for making basic metric measures.



Benchmark 1.e

Collect, Record and Report Data Using Appropriate Metric Measures

The student will plan and conduct investigations in which appropriate metric measures are used to collect, record and report data.



Indicator 1.e.1

Use mm, cm, m, km, mL, L, g, and kg appropriately

Use millimeters, centimeters, meters, kilometers, milliliters, liters, grams, and kilograms in measurement.



Benchmark 1.f

Display Data Using Bar and Basic Line Graphs

The student will plan and conduct investigations in which data are displayed using bar and basic line graphs.



Indicator 1.f.1

Classify a set of twenty or fewer objects into basic categories

Analyze a set of twenty or fewer objects, measures, or pictures to classify them into basic categories.



Indicator 1.f.2

Organize data into the basic categories (descriptive or numerical)

Use the basic categories (descriptive or numerical) to organize the data.



Indicator 1.f.3

Construct bar graphs and line graphs

Construct bar graphs and line graphs depicting the distribution of the descriptive or numerical data.

 **Benchmark 1.g**

Recognize Unusual Numerical Data in Experimental Results

The student will plan and conduct investigations in which numerical data that are contradictory or unusual in experimental results are recognized.

 **Indicator 1.g.1**

Judge which data appear to be outside of the expected range

Judge which, if any, data in a simple set of results (generally 10 or fewer in number) appear to be considerably outside the expected range.

 **Indicator 1.g.2**

Determine the significance of unusual data

Determine the significance of unusual data.

 **Benchmark 1.h**

Make Predictions Using Data From Picture, Bar & Basic Line Graphs

The student will plan and conduct investigations in which predictions are made based on data from picture graphs, bar graphs, and basic line graphs.

 **Indicator 1.h.1**

Make predictions based on picture graphs, bar graphs and line graphs

Make predictions based on picture graphs, bar graphs, and basic line graphs.



SCI.G4

Standard 2

UNDERSTAND CHARACTERISTICS AND INTERACTION OF MOVING OBJECTS

The student will investigate and understand characteristics and interaction of moving objects.

 **Benchmark 2.a**

Understand that Motion is Described by an Object's Direction and Speed

The student will understand that motion is described by an object's direction and speed.

 **Indicator 2.a.1**

Describe the position of an object

Describe the position of an object.

 **Indicator 2.a.2**

Collect time & position data for a moving object; Create a table/graph

Collect time and position data for a moving object. Display this information in a table and line graph.

 **Indicator 2.a.3**

Explain that speed is a measure of motion

Explain that speed is a measure of motion.

 **Indicator 2.a.4**

Use data to determine if speed is increasing, decreasing or constant

Interpret data to determine if the speed of an object is increasing, decreasing, or remaining the same.



Indicator 2.a.5

Describe direction of an object's motion: up, down, forward, backward

Describe the direction of an object's motion: up, down, forward, backward.



Benchmark 2.b

Understand that Forces Cause Changes in Motion

The student will understand that forces cause changes in motion.



Indicator 2.b.1

Identify the forces that cause an object's motion

Identify the forces that cause an object's motion.



Benchmark 2.c

Understand that Friction is a Force that Opposes Motion

The student will understand that friction is a force that opposes motion.



Indicator 2.c.1

Explain that friction is a force that opposes motion

Explain that friction is a force that opposes motion.



Indicator 2.c.2

Design an investigation of the effect of friction on moving objects

Design an investigation to determine the effect of friction on moving objects.



Benchmark 2.d

Understand that Moving Objects have Kinetic Energy

The student will understand that moving objects have kinetic energy.



Indicator 2.d.1

Infer that objects have kinetic energy

Infer that objects have kinetic energy.



SCI.G4

Standard 3

UNDERSTAND THE CHARACTERISTICS OF ELECTRICITY

The student will investigate and understand the characteristics of electricity.



Benchmark 3.a

Understand Conductors and Insulators

The student will understand conductors and insulators.



Indicator 3.a.1

Apply the terms insulators and conductors to describe materials

Apply the terms *insulators* and *conductors* to describe how well materials conduct electricity.

Benchmark 3.b

Understand Basic Circuits (Open/Closed, Parallel/Series)

The student will understand basic circuits (open/closed, parallel/series).



Indicator 3.b.1

Apply the terms open and closed in describing electrical currents

Apply the terms *open* and *closed* in describing electrical currents.



Indicator 3.b.2

Differentiate between an open and closed electric circuit

Differentiate between an open and closed electric circuit.



Indicator 3.b.3

Use the dry cell symbols (–) and (+)

Use the dry cell symbols (–) and (+).



Indicator 3.b.4

Create and diagram a functioning series circuit

Create and diagram a functioning series circuit using dry cells, wires, switches, bulbs and bulb holders.



Indicator 3.b.5

Create and diagram a functioning parallel circuit

Create and diagram a functioning parallel circuit using dry cells, wires, switches, bulbs and bulb holders.



Indicator 3.b.6

Differentiate between a parallel and series circuit

Differentiate between a parallel and series circuit.

Benchmark 3.c

Understand Static Electricity

The student will understand static electricity.



Indicator 3.c.1

Design an investigation using static electricity

Design an investigation using static electricity to attract or repel a variety of materials.



Indicator 3.c.2

Explain how static electricity is created and occurs in nature

Explain how static electricity is created and occurs in nature.

Benchmark 3.d

Understand that Electrical Energy Can Be Transformed Into Other Forms

The student will understand the ability of electrical energy to be transformed into heat, light and mechanical energy.



Indicator 3.d.1


Recognize examples of electrical energy transforming into other types


Recognize examples of electrical energy being transformed into heat, light and mechanical energy.


Benchmark 3.e

Understand Simple Electromagnets and Magnetism


The student will understand simple electromagnets and magnetism.

 **Indicator 3.e.1**
Create a diagram of a magnetic field using a magnet
Create a diagram of a magnetic field using a magnet.

 **Indicator 3.e.2**
Compare and contrast a permanent magnet and an electromagnet
Compare and contrast a permanent magnet and an electromagnet.


 **Indicator 3.e.3**
Explain how electricity is generated by a moving magnetic field
Explain how electricity is generated by a moving magnetic field.

 **Indicator 3.e.4**
Construct a simple electromagnet
Construct a simple electromagnet using a wire, nail, or other iron-bearing object, and a dry cell.

 **Indicator 3.e.5**
Investigate to determine the strength of an electromagnet
Design and perform an investigation to determine the strength of an electromagnet.

Benchmark 3.f **Describe Historical Contributions in Understanding Electricity**

The student will understand historical contributions in understanding electricity.

 **Indicator 3.f.1**
Describe the contributions of Franklin, Faraday and Edison
Describe the contributions of Ben Franklin, Michael Faraday, and Thomas Edison to the understanding and harnessing of electricity.


SCI.G4 **Standard 4**


UNDERSTAND BASIC PLANT ANATOMY AND LIFE PROCESSES

The student will investigate and understand basic plant anatomy and life processes.

Benchmark 4.a **Understand the Structures of Typical Plants**

The student will understand the structures of typical plants (leaves, stems, roots and flowers.)

 **Indicator 4.a.1**
Create a model or diagram illustrating the parts of a flower
Create a model/diagram illustrating the parts of a flower (stamen, pistil, sepal, ovary, ovule, seed).

 **Indicator 4.a.2**
Explain the functions of the parts of a flower
Explain the functions of the parts of a flower (stamen, pistil, sepal, ovary, ovule, seed).

Indicator 4.a.3

**Identify the roots, stems, leaves and flowers of a common plant**

Identify the roots, stems, leaves and flowers of a common plant.

**Indicator 4.a.4****Explain the functions of the parts of a common plant**

Explain the functions of the parts of a common plant (roots, stems, leaves and flowers).

**Benchmark 4.b****Understand Processes and Structures Involved with Plant Reproduction**

The student will understand processes and structures involved with reproduction (pollination, stamen, pistil, sepal, embryo, spore, and seed).

**Indicator 4.b.1****Create a diagram illustrating the reproductive processes in flowers**

Create a model/diagram illustrating the reproductive processes in typical flowering plants, and explain the processes.

**Indicator 4.b.2****Compare and contrast different ways plants are pollinated**

Compare and contrast different ways plants are pollinated.

**Indicator 4.b.3****Explain that ferns and mosses reproduce with spores rather than seeds**

Explain that ferns and mosses reproduce with spores rather than seeds.

**Benchmark 4.c****Understand Photosynthesis**

The student will understand photosynthesis (sunlight, chlorophyll, water, carbon dioxide, oxygen, and sugar).

**Indicator 4.c.1****Explain the process of photosynthesis**

Explain the process of photosynthesis, using the following terminology: sunlight, chlorophyll, water, carbon dioxide, oxygen, and sugar.

**Indicator 4.c.2****Investigate to determine the relationship of sunlight to plant growth**

Design an investigation to determine the relationship between the presence of sunlight and plant growth.

**Benchmark 4.d****Understand Dormancy**


The student will understand dormancy.

**Indicator 4.d.1****Explain the role of dormancy for common plants**


Explain the role of dormancy for common plants.


**SCI.G4****Standard 5****UNDERSTAND INTERACTIONS WITHIN AN ECOSYSTEM**


The student will investigate and understand how plants and animals in an ecosystem interact with one another and the nonliving environment.


 **Benchmark 5.a**
Understand Behavioral and Structural Adaptations

The student will understand behavioral and structural adaptations.

 **Indicator 5.a.1**
Distinguish between structural and behavioral adaptations
Distinguish between structural and behavioral adaptations.


 **Indicator 5.a.2**
Infer the function of basic adaptations and provide evidence
Investigate and infer the function of basic adaptations and provide evidence for the conclusion.


 **Indicator 5.a.3**
Understand that adaptations allow an organism to succeed
Understand that adaptations allow an organism to succeed in a given environment.

 **Indicator 5.a.4**
Explain how different organisms use their unique adaptations
Explain how different organisms use their unique adaptations to meet their needs.

 **Benchmark 5.b**
Understand the Organization of Communities


The student will understand the organization of communities.


 **Indicator 5.b.1**
Recognize that a community is made of all the organisms in an area
Recognize that a community is made of all the organisms in an area.


 **Indicator 5.b.2**
Compare and contrast the niches of several different organisms
Compare and contrast the niches of several different organisms within the community.

 **Benchmark 5.c**
Understand the Flow of Energy Through Food Webs

The student will understand the flow of energy through food webs.

 **Indicator 5.c.1**
Describe the flow of energy from producers to consumers in a food web
Describe the flow of energy from producers to consumers in a food web.

 **Indicator 5.c.2**
Illustrate the food webs in a local area
Illustrate the food webs in a local area.

 **Benchmark 5.d**
Understand Habitats and Niches

The student will understand habitats and niches.

**Indicator 5.d.1****Identify a habitat as the place in which an animal or plant lives**

Identify a habitat as the place or kind of place in which an animal or plant naturally lives.

**Indicator 5.d.2****Identify a niche as the function an organism performs in the food web**

Identify a niche as the function an organism performs in the food web.

**Indicator 5.d.3****Describe why certain communities exist in given habitats**

Describe why certain communities exist in given habitats.

**Benchmark 5.e****Understand Life Cycles**

The student will understand life cycles.

**Indicator 5.e.1****Compare and contrast interactions at various life cycle stages**

Compare and contrast the differing ways an organism interacts with its surroundings at various stages of its life cycle.

**Indicator 5.e.2****Compare & contrast how frogs & butterflies interact with surroundings**

Compare and contrast the ways frogs and butterflies interact with their surroundings at various stages of their life cycles.

**Benchmark 5.f****Understand the Influence of Human Activity on Ecosystems**

The student will understand the influence of human activity on ecosystems.

**Indicator 5.f.1****Describe how human activities influence ecosystems**

Describe how human activities influence ecosystems.

**Indicator 5.f.2****Differentiate among positive & negative human influences on ecosystems**

Differentiate among positive and negative influences of human activity on ecosystems.

**SCI.G4****Standard 6****UNDERSTAND HOW WEATHER OCCURS AND IS PREDICTED**

The student will investigate and understand how weather conditions and phenomena occur and can be predicted.

**Benchmark 6.a****Understand Weather Measurements and Meteorological Tools**

The student will understand weather measurements and meteorological tools (air pressure – barometer, wind speed – anemometer, rainfall – rain gauge, and temperature – thermometer).

**Indicator 6.a.1****Use a thermometer to compare air temperatures over a period of time**

Use a thermometer to compare air temperatures over a period of time.



Indicator 6.a.2

Analyze the changes in air pressure over time using a barometer

Analyze the changes in air pressure occurring over time, using a barometer, and predict what the changes mean in terms of changing weather patterns.



Indicator 6.a.3

Use weather maps to analyze temperature and precipitation information

Analyze and report information about temperature and precipitation on weather maps.



Indicator 6.a.4

Measure wind speed using an anemometer

Measure wind speed using an anemometer.



Indicator 6.a.5

Measure precipitation with a rain gauge

Measure precipitation with a rain gauge.



Indicator 6.a.6

Design an investigation to gather weather data and make predictions

Design an investigation in which weather data are gathered using meteorological tools and charted to make weather predictions.



Benchmark 6.b

Understand Weather Phenomena (Fronts, Clouds and Storms)

The student will understand weather phenomena (fronts, clouds and storms).



Indicator 6.b.1

Differentiate weather types caused by high and low pressure air masses

Differentiate between the types of weather associated with high and low pressure air masses.



Indicator 6.b.2

Illustrate/label air masses (high/low pressure) and fronts (warm/cold)

Illustrate and label high and low pressure air masses and warm and cold fronts.



Indicator 6.b.3

Differentiate between cloud types and the associated weather

Differentiate between cloud types (cirrus, stratus, cumulus, and cumulo-nimbus clouds) and the associated weather.



Indicator 6.b.4

Compare and contrast the formation of different types of precipitation

Compare and contrast the formation of different types of precipitation (rain, snow, sleet, and hail).



Indicator 6.b.5

Recognize a variety of storm types and their weather conditions

Recognize a variety of storm types (thunderstorms, hurricanes, and tornadoes), describe the weather conditions associated with each, and explain when they occur.



SCI.G4

Standard 7

UNDERSTAND THE RELATIONSHIPS AMONG THE EARTH, MOON AND SUN

The student will investigate and understand the relationships among the Earth, moon and sun.



Benchmark 7.a

Understand the Motions of the Earth, Moon and Sun

The student will understand the motions of the Earth, moon, and sun (revolution and rotation).



Indicator 7.a.1

Understand the motions of the Earth, moon and sun

Understand the motions of the Earth, moon, and sun.



Indicator 7.a.2

Differentiate between rotation and revolution

Differentiate between rotation and revolution.



Benchmark 7.b

Understand the Causes for the Earth's Seasons and Moon Phases

The student will understand the causes for the Earth's seasons and phases of the moon.



Indicator 7.b.1

Describe how the Earth's axial tilt causes the seasons

Describe how the Earth's axial tilt causes the seasons.



Indicator 7.b.2

Model the formation of the eight moon phases

Model the formation of the eight moon phases.



Indicator 7.b.3

Sequence the eight moon phases in order

Sequence the eight moon phases in order.



Indicator 7.b.4

Describe how the moon phases occur

Describe how the moon phases occur.



Benchmark 7.c

Understand Characteristics of the Earth, Moon and Sun

The student will understand the relative size, position, age, and makeup of the Earth, moon and sun.



Indicator 7.c.1

Describe the sun's size, color, age and overall composition

Describe the major characteristics of the sun, including its approximate size, color, age, and overall composition.



Indicator 7.c.2

Describe a model of the Earth-moon-sun system with distances and sizes

Create and describe a model of the Earth-moon-sun system with approximate scale distances and sizes.



Indicator 7.c.3

Compare and contrast the surface conditions of the Earth, moon and sun

Compare and contrast the surface conditions of the Earth, moon and sun.



Benchmark 7.d

Understand Historical Contributions to the Earth-Moon-Sun System

The student will understand historical contributions in understanding the Earth-moon-sun system.



Indicator 7.d.1

Compare & contrast Earth-centered to sun-centered solar system models

Compare and contrast an Earth-centered to the sun-centered model of the solar system.



Indicator 7.d.2

Compare the conclusions of Aristotle, Ptolemy, Copernicus and Galileo

Analyze the differences in what Aristotle, Ptolemy, Copernicus, and Galileo observed and what influenced their conclusions.



Indicator 7.d.3

Describe a contribution of the NASA Apollo missions to our knowledge

Describe a contribution of the NASA Apollo missions to our understanding of the moon.



SCI.G4

Standard 8

UNDERSTAND IMPORTANT VIRGINIA NATURAL RESOURCES

The student will investigate and understand important Virginia natural resources.



Benchmark 8.a

Understand that Virginia Has Many Watersheds and Water Resources

The student will understand that Virginia has a great variety of watersheds and water resources.



Indicator 8.a.1

Distinguish among rivers, lakes and bays

Distinguish among rivers, lakes and bays.



Indicator 8.a.2

Describe characteristics of rivers, lakes and bays

Describe characteristics of rivers, lakes and bays.



Indicator 8.a.3

Name an example of a river, lake and bay in Virginia

Name an example of a river, lake and bay in Virginia.



Indicator 8.a.4

Create and interpret a model of a watershed

Create and interpret a model of a watershed.



Indicator 8.a.5

Evaluate the statement: "We all live downstream"

Evaluate the statement: "We all live downstream."



Indicator 8.a.6

Identify watershed addresses

Identify watershed addresses.

Indicator 8.a.7



Compare and contrast natural and man-made water resources

Compare and contrast natural and man-made water resources.



Benchmark 8.b

Understand that Virginia has a Great Variety of Animals and Plants

The student will understand that Virginia has a great variety of animals and plants.



Indicator 8.b.1

Recognize that Virginia has a great variety of animals and plants

Recognize that Virginia has a great variety of animals and plants.



Benchmark 8.c

Understand that Virginia has Minerals, Rocks, Ores and Energy Sources

The student will understand that Virginia has a great variety of minerals, rocks, ores, and energy sources.



Indicator 8.c.1

Recognize the importance of Virginia's resources

Recognize the importance of Virginia's mineral resources, including coal, limestone, granite, and sand and gravel.



Indicator 8.c.2

Compare and contrast natural and man-made resources

Compare and contrast natural and man-made resources.



Benchmark 8.d

Recognize that Virginia has a Great Variety of Forests, Soil and Land

The student will recognize that Virginia has a great variety of forests, soil and land.



Indicator 8.d.1

Appraise the importance of natural and cultivated forests in Virginia

Appraise the importance of natural and cultivated forests in Virginia.



Indicator 8.d.2

Describe a variety of soil and land uses important in Virginia

Describe a variety of soil and land uses important in Virginia.