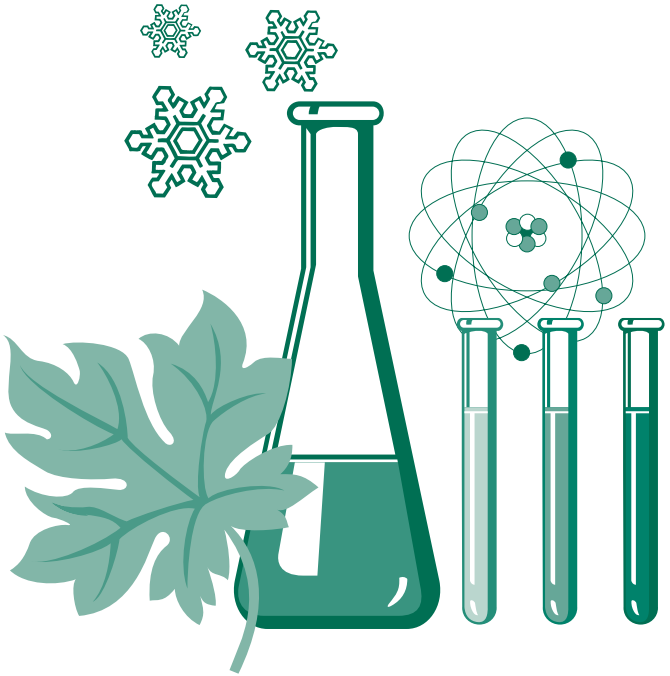

Science Standards of Learning
Curriculum Framework

Commonwealth of Virginia
Department of Education
Richmond, Virginia

Grade Four

Modified to include pacing and resources for instruction by LCPS for School Year 2008-09

Special Thanks to:

Elementary Teachers Serving on the Curriculum Committees

2008-2009 Grade 4 Science
Pacing Guide *At a Glance*

Quarter	Month	Topic	Related SOL	Suggested number of *Lessons	Target Date for Completion
1st	September October	Science Investigation†	4.1†	5 lessons and Integrated Throughout the Year	October 31, 2008
		Virginia's Natural Resources ‡ (Optional inclusion of Earth Science topics – Earthquakes, Volcanoes and Fossils in this unit⌂)	4.8‡, 4.1	12-15 lessons (These standards can be integrated with VA Studies curriculum.)	
		Earth-Moon-Sun System	4.7, 4.1	12-15 lessons	
2nd	November December January	Weather	4.6, 4.1	12-15 lessons	January 22, 2009
		Forces, Motion & Energy	4.2, 4.1	12-15 lessons	
3rd	February March	Electricity & Magnetism	4.3, 4.1	12-15 lessons	April 3, 2009
		Ecosystems ‡	4.5‡, 4.1	12-15 lessons	
4th	April May June	Plant Anatomy and Life Processes	4.4, 4.1	12-15 lessons	June 19, 2009
		Science SOL Review			

*A lesson is approximately 30 minutes
† Scientific Investigation, Reasoning, and Logic (Science SOL 4.1) is reinforced throughout the year in all science lessons
‡Meaningful Watershed Experience Opportunity
⌂ Requirements may be satisfied in isolated science or social science lessons or through a combination of both.

Essential Skills are listed with each SOL in the framework that follows.
All essential skills should be covered with the related SOL.

Introduction to Loudoun County's Science Curriculum

This Curriculum Guide and Framework is a merger of the Virginia Standards of Learning (SOL) and the Science Achievement Standards of Loudoun County Public Schools. Many sections are copies or modifications of Virginia's SOL documents. Suggestions on pacing and resources represent the professional consensus of Loudoun's teachers concerning the implementation of these standards.

Contents

K-12 Safety

In implementing the Science Standards of Learning, students must know how to follow safety guidelines, demonstrate appropriate laboratory safety techniques, and use equipment safely while working individually and in groups.

Safety must be given the highest priority in implementing the K-12 instructional program for science. Correct and safe techniques, as well as wise selection of experiments, resources, materials, and field experiences appropriate to age levels, must be carefully considered with regard to safety precautions for every instructional activity. Safe science classrooms require thorough planning, careful management, and constant monitoring of student activities. Class enrollment should not exceed the designed capacity of the room.

Teachers must be knowledgeable of the properties, use and proper disposal of all chemicals that may be judges as hazardous prior to their use in an instructional activity. Such information is referenced through the MSDS forms (Materials Safety Data Sheets). The identified precautions involving the use of goggles, gloves, aprons, and fume hoods must be followed as prescribed.

While no comprehensive list exists to cover all situations, the following should be reviewed to avoid potential safety problems. Appropriate safety procedures should be used in the following situations:

- Observing wildlife; handling living and preserved organisms; and contact with natural hazards such as poison ivy, ticks, mushrooms, insects, spiders, and snakes
- Field activities in, near, or over bodies of water
- Handling of glass tubing, sharp objects, glassware, and labware
- Natural gas burners, Bunsen burners, and other sources of flame/heat
- Hazards associated with direct sunlight (sunburn and eye damage)
- Use of extreme temperatures and cryogenic materials
- Hazardous chemicals including toxins, carcinogens, flammable and explosive materials
- Acid/base neutralization reactions/dilutions
- Production of toxic gases or situations where high pressures are generated
- Biological cultures, their appropriate disposal, and recombinant DNA
- Power equipment/motors
- High voltage/exposed wiring
- Laser beam, UV, and other radiation

The use of human body fluids or tissues is generally prohibited for classroom lab activities. Further guidance from the following sources may be taken into account:

- OSHA (Occupational Safety and Health Administration)
- ISEF (International Science and Engineering Fair Rules)
- Public health departments and local school division protocols.

For more detailed information about safety in science, consult the *LCPS Science Safety Manual*. http://www.intranet.lcps

The Role of Instructional Technology in Science Education

The use of current and emerging technologies is essential to the K-12 science instructional program.

Specifically, technology must

- Assist in improving every student's functional literacy. This includes improved communication through reading/information retrieval (the use of telecommunications), writing (word processing), organization and analysis of data (databases, spreadsheets, and graphics programs), selling one's idea (presentation software), and resource management (project management software).

- Be readily available and used regularly as an integral and ongoing part in the delivery and assessment of instruction.

- Include instrumentation oriented toward the instruction and learning of science concepts, skills, and processes. Technology, however, should not be limited to traditional instruments of science such as microscopes, labware, and data-collecting apparatus but should also include computers, robotics, interactive-optical laser discs, video-microscopes, graphing calculators, CD-ROMs, global positioning systems (GPS), probeware, on-line telecommunication, software and appropriate hardware, as well as other emerging technologies.

- Be reflected in the "instructional strategies" generally developed at the local school division level.

In most cases, the application of technology in science should remain "transparent" unless it is the actual focus of the instruction. One must expect students to "do as a scientist does" and not simply hear about science if they are truly expected to explore, explain, and apply scientific concepts, skills, and processes.

As computer/technology skills are essential components of every student's education, it is important that these skills are a shared responsibility of teachers of all disciplines and grade levels.

Internet Safety

The Internet allows students to learn from a wide variety of resources and communicate with people all over the world. Students should develop skills to recognize valid information, misinformation, biases, or propaganda. Students should know how to protect their personal information when interacting with others and about the possible consequences of online activities such as social networking, e-mail, and instant messaging.

- Students need to know that not all Internet information is valid or appropriate.
- Students should be taught specifically how to maximize the Internet's potential while protecting themselves from potential abuse.
- Internet messages and the people who send them are not always what or who they seem.
- Predators and cyberbullies anonymously use the Internet to manipulate students. Students must learn how to avoid dangerous situations and get adult help.

Cybersafety should be addressed when students research online resources or practice other skills through interactive sites. Science teachers should address underlying principles of cybersafety by reminding students that the senses are limited when communicating via the Internet or other electronic devices and that the use of reasoning and logic can extend to evaluating online situations.

Listed below are ways of integrating the teaching of internet safety with the 4th Grade Science Virginia Standards of Learning.

Remind students that the senses cannot be used in many online communications.
Five Senses Lesson
http://www.eduref.org/Virtual/Lessons/Health/Body_Systems_and_Senses/BSS0005.html
Use a blindfold to explain the five senses and point out that many senses are absent when using modern communication devices.

Great Communications Inventions *http://www.cybersmartcurriculum.org/lesson_plans/45_21.asp*
This lesson provides students the opportunity to explore modern communications technologies, including the advantages and disadvantages. Internet safety is a natural component to explore.

Remind students that personal observations and opinions may be communicated on the Internet as if they are fact.
Bias Sampling (Scientific) *http://www.sciencenetlinks.com/lessons.cfm?BenchmarkID=9&DocID=254*
This lesson focuses on techniques that can bias a seemingly scientific poll or data collection. These same techniques can be used on the Web. Students need to be aware that some Web sites may provide misleading information.

Students using graphs and spreadsheets to explore information could examine Internet cybersafety data.

Additional information about Internet safety may be found on the Virginia Department of Education's Website at
http://www.doe.virginia.gov/VDOE/Technology/OET/internet-safety-guidelines.shtml

Meaningful Watershed Educational Experiences

The "Stewardship and Community Engagement" Commitment of the *Chesapeake 2000* agreement clearly focuses on connecting individuals and groups to the Bay through their shared sense of responsibility and action. The goal of this Commitment formally engages schools as integral partners *to undertake initiatives* in helping to meet the Agreement.

Two objectives developed as part of this goal describe more specific outcomes to be achieved by the jurisdictions in promoting stewardship and assisting schools. These are:

> *Beginning with the class of 2005, provide a meaningful Bay or stream outdoor experience for every school student in the watershed before graduation from high school.*
>
> *Provide students and teachers alike with opportunities to directly participate in local restoration and protection projects, and to support stewardship efforts in schools and on school property.*

There is overwhelming consensus that knowledge and commitment build from firsthand experience, especially in the context of one's neighborhood and community. Carefully selected experiences driven by rigorous academic learning standards, engendering discovery and wonder, and nurturing a sense of community will further connect students with the watershed and help reinforce an ethic of responsible citizenship.

Defining *a Meaningful* Bay or Stream Outdoor Experience

A *meaningful* Bay or stream outdoor experience should be defined by the following.

Experiences are investigative or project oriented.

Experiences include activities where questions, problems, and issues are investigated by the collection and analysis of data, both mathematical and qualitative. Electronic technology, such as computers, probeware, and GPS equipment, is a key component of these kinds of activities and should be integrated throughout the instructional process.

The nature of these experiences is based on learning standards and should include the following kinds of activities.

- Investigative or experimental design activities where students or groups of students use equipment, take measurements, and make observations for the purpose of making interpretations and reaching conclusions.
- Project-oriented experiences, such as restoration, monitoring, and protection projects, that are problem solving in nature and involve many investigative skills.

Experiences are richly structured and based on high-quality instructional design.

Experiences are an integral part of the instructional program.

Experiences are part of a sustained activity.

Experiences consider the watershed as a system.

Experiences involve external sharing and communication.

Experiences are enhanced by natural resources personnel.

Experiences are for all students.

Experiences such as tours, gallery visits, simulations, demonstrations, or "nature walks" may be instructionally useful, but alone do not constitute a *meaningful* experience as defined here.

The preceding text contains excerpts from:
Chesapeake Bay Program Education Workgroup
STEWARDSHIP AND MEANINGFULWATERSHED EDUCATIONAL EXPERIENCES
http://www.chesapeakebay.net/pubs/doc-c2k_meaningful_bay_experience.pdf

The link in found in the Virginia Department of Education Instructional Resources for Science:
http://www.doe.virginia.gov/VDOE/Instruction/Science/

Each LCPS K-12 Science Pacing Guide indicates where the Meaningful Watershed Educational Experiences fit into the Virginia Standards of Learning. Resources for these experiences are cited in the *Resources* section of each standard.

Many of the resources are from *Lessons from the Bay* and *Virginia's Water Resources a Toolkit for Teachers*. These and other watershed resources are posted on the LCPS intranet at:
http://www.intranet.lcps

Investigate and Understand

Many of the standards in the Science Standards of Learning begin with the phrase "Students will investigate and understand." This phrase was chosen to communicate the range of rigorous science skills and knowledge levels imbedded in each standard. Limiting a standard to one observable behavior such as "describe" or "explain" would have narrowed the interpretation of what was intended to be a rich, highly rigorous, and inclusive content standard.

"Investigate" refers to scientific methodology and implies systematic use of the following inquiry skills:

- Observing
- Classifying and sequencing
- Communicating
- Measuring
- Predicting
- Hypothesizing
- Inferring
- Defining, controlling, and manipulating variables in experimentation
- Designing, constructing, and interpreting models
- Interpreting, analyzing, and evaluating data

"Understand" refers to various levels of knowledge application. In the Science Standards of Learning these knowledge levels include the ability to

- Recall or recognize important information, key definitions, terminology, and facts
- Explain the information in one's own words, comprehend how the information is related to other key facts, and suggest additional interpretations of its meaning or importance
- Apply the facts and principles to new problems or situations, recognizing what information is required for a particular situation, explaining new phenomena with the information, and determining when there are exceptions
- Analyze the underlying details of important facts and principles, recognizing the key relations and patterns that are not always readily visible
- Arrange and combine important information, facts, and principles to produce a new idea, plan, procedure, or product
- Make judgments about information in terms of accuracy, precision, consistency, or effectiveness.

Therefore, the use of "investigate and understand" allows each content standard to become the basis for a broad range of teaching objectives, which the local school division will develop and refine to meet the intent of the Science Standards of Learning.

Science
Standards of Learning

Goals
The purpose of scientific investigation and discovery are to satisfy humankind's quest for knowledge and understanding and to preserve and enhance the quality of the human experience. Therefore, as a result of science instruction, students will be able to:

1. Develop and use an experimental design in scientific inquiry

2. Use the language of science to communicate understanding

3. Investigate phenomena using technology

4. Apply scientific concepts, skills, and processes to everyday experiences

5. Experience the richness and excitement of scientific discovery of the natural world through the historical and collaborative quest for knowledge and understanding.

6. Make informed decisions regarding contemporary issues taking into account the following:
   - public policy and legislation
   - economic costs/benefits
   - validation from scientific data and the use of scientific reasoning and logic
   - respect for living things
   - personal responsibility
   - history of scientific discovery

7. Develop scientific dispositions and habits of mind including:
   - curiosity
   - demand for verification
   - respect for logic and rational thinking
   - consideration of premises and consequences
   - respect for historical contributions
   - attention to accuracy and precision
   - patience and persistence

8. Explore science-related careers and interest.

The Science Standards of Learning are listed successively in the pages that follow. See the pacing guide for teaching sequence.

Scientific Investigation, Reasoning, and Logic
This strand represents a set of systematic inquiry skills that defines what a student should be able to do when conducting activities and investigations.

Standard 4.1

The student will plan and conduct investigations in which

a) distinctions are made among observations, conclusions, inferences, and predictions;
b) hypotheses are formulated based on cause and effect relationships;
c) variables that must be held constant in an experimental situation are defined;
d) appropriate instruments are selected to measure linear distance, volume, mass, and temperature;
e) appropriate metric measures are used to collect, record, and report data;
f) data are displayed using bar and basic line graphs;
g) numerical data that are contradictory or unusual in experimental results are recognized; and
h) predictions are made based on data from picture graphs, bar graphs, and basic line graphs.

Understanding the Standard

The skills described in standard 4.1 are intended to define the "investigate" component of all of the other fourth grade standards (4.2 – 4.8). The intent of standard 4.1 is that students will continue to develop a range of inquiry skills and achieve proficiency with those skills in the context of the concepts developed at the fourth grade. Standard 4.1 does not require a discrete unit on scientific investigation because the inquiry skills that make up the standard should be incorporated in all the other fourth grade standards. It is also intended that by developing these skills, students will achieve greater understanding of scientific inquiry and the nature of science, as well as more fully grasp the content-related concepts.

Standard 4.1

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • To communicate an observation accurately, one must provide a clear description of exactly what is observed, and nothing more. Those conducting investigations need to understand the difference between *what is seen* and what inferences, conclusions, or interpretations can be drawn from the observation. • An inference is a conclusion based on evidence about events that *have already occurred*. Accurate observations and evidence are necessary to draw realistic and plausible conclusions. • A scientific prediction is a forecast about what *may happen* in some future situation. It is based on the application of scientific principles and factual information. • Systematic investigations require standard measures (metric), consistent and reliable tools, and organized reporting of data. The way the data are displayed can make it easier to uncover important information. This can assist in making reliable scientific forecasts of future events.	In order to meet this standard, it is expected that students should be able to: • differentiate among simple observations, conclusions, inferences, and predictions, and correctly apply the terminology in oral and written work. This requires students to comprehend the basic terminology and apply it in novel situations related to 4th grade SOL concepts. • analyze a set of twenty or fewer objects, measures, or pictures; classify into basic categories to organize the data (descriptive or numerical); and construct bar graphs and line graphs depicting the distribution of those data. • use millimeters, centimeters, meters, kilometers, milliliters, liters, grams, and kilograms in measurement. • choose the appropriate instruments including centimeter rulers, meter sticks, graduated cylinders, beakers, scales and balances, and Celsius thermometers for making basic metric measures. • make predictions based on picture graphs, bar graphs and basic line graphs.

Standard 4.1 (continued)

Overview	Essential Knowledge, Skills, and Processes
• An experiment is a fair test driven by a hypothesis. A fair test is one in which only one variable is compared. A hypothesis is a prediction about the relationship between variables. • In order to conduct an experiment, one must recognize all of the potential variables or changes that can affect its outcome. • A manipulated variable is the factor in an experiment that is altered by the experimenter. • A responding variable is the factor in an experiment that changes as a result of the manipulated variable.	• create a plausible hypothesis from a set of basic observations, stated in terms of cause and effect that can be tested. This requires a student to comprehend what "cause and effect" is, and be able to apply that idea in new situations. The application should occur in terms of 4th grade SOL-related concepts or other concrete situations. 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." • 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. This requires students to comprehend what "variables" are, and apply that idea in new situations related to 4th grade SOL concepts. Variables are either manipulated or responding. • judge which, if any, data in a simple set of results (generally ten or fewer numbers) appear to be considerably outside the expected range. Students should be able to determine the significance of unusual data.

Standard 4.1

Resources	Teacher Notes
Kramer, Stephen and Bond, Felicia. (1987). *How to Think Like a Scientist*. The pitfalls of not using all the available information are presented with how the scientific methods can be used as a tool. ISBN: 0-690-04565-4. Montgomery, Sy. (1999). *Snake Scientist*. The reader can see how scientists formulate hypotheses. ISBN: 0395871697. Simon, Seymour. (1998). *Einstein Anderson Science Detective Series*. The one-minute mysteries are solved by Einstein using scientific investigation and reasoning. ISBN: 0-688-1447-0, 0-688-14433-0, 0-688-14443-8, 0-688-14445-1. Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Grade 4. **http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml** VA Department of Education **Lessons from the Bay**. Correlated to VA Science, Math, Language Arts, and Social Studies SOL. **http://www.pen.k12.va.us/VDOE/watershed/index.html** Correlations to VA Science SOL (AIMS and Children's Literature) found on the LCPS intranet at: http://www.intranet.lcps Standards of Learning Literature Correlation searchable database "Connections" can be found at: http://www.fcps.k12.va.us/cpsapps/connections/	

Force, Motion, and Energy
This strand focuses on students understanding of what force, motion, and energy are and how the concepts are connected.

Standard 4.2

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

a) motion is described by an object's direction and speed;
b) forces cause changes in motion;
c) friction is a force that opposes motion; and
d) moving objects have kinetic energy.

Understanding the Standard

This standard is introduced in first grade and prepares students for a more in-depth study of energy in eighth grade. This standard focuses on the characteristics of moving objects. Key concepts include the effect of forces, such as friction, on moving objects. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.

Standard 4.2

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • The position of an object can be described by locating it relative to another object or the background. • Tracing and measuring its position over time can describe an object's motion. • Speed describes how fast an object is moving. • Energy may exist in two states: kinetic or potential. • Kinetic energy is the energy of motion. • A force is any push or pull that causes an object to move, stop, or change speed or direction. • The greater the force, the greater the change in motion will be. The more massive an object, the less effect a given force will have on the object. • Friction is the resistance to motion created by two objects moving against each other. Friction creates heat. • Unless acted on by a force, objects in motion tend to stay in motion and objects at rest remain at rest.	In order to meet this standard, it is expected that students should be able to: • describe the position of an object. • collect and display time and position data for a moving object in a table and line graph. • explain that speed is a measure of motion. • interpret data to determine if the speed of an object is increasing, decreasing, or remaining the same. • identify the forces that cause an object's motion. • describe the direction of an object's motion: up, down, forward, backward. • infer that objects have kinetic energy. • design an investigation to determine the effect of friction on moving objects.

Standard 4.2

Resources	Teacher Notes
Harcourt Science. Text Pages: F38-F59 AIMS Education Foundation Book *Popping with Power* Arnold, Nick and De Saulles, Tony (I). (1999). *Horrible Science: Fatal Forces*. Explores Newton's Laws of Motion by appealing to readers' sense of "sick science". ISBN: 0439043638. Mole, Karen Bryant. *Forces*. Explains the basic principles of forces and movement through direct observation and looking at everyday experiences. ISBN: 1575721082. ***Where Am I?*** ***Investigating Motion, Using the Inclined Plane*** ***On Your Mark!/ Start Your Engines!*** ***May the Force Be With You!*** Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Grade 4. **http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml** Correlations to VA Science SOL (AIMS and Children's Literature) found on the LCPS intranet at: http://www.intranet.lcps Standards of Learning Literature Correlation searchable database "Connections" can be found at: http://www.fcps.k12.va.us/cpsapps/connections/	

Force, Motion, and Energy
This strand focuses on students understanding of what force, motion, and energy are and how the concepts are connected.

Standard 4.3

The student will investigate and understand the characteristics of electricity. Key concepts include

a) conductors and insulators;
b) basic circuits (open/closed, parallel/series);
c) static electricity;
d) the ability of electrical energy to be transformed into heat, light, and mechanical energy;
e) simple electromagnets and magnetism: and
f) historical contributions in understanding electricity.

Understanding the Standard

This standard focuses on the characteristics of electricity as related to circuits and circuit components, magnetism, static charges, and historical contributions important to its understanding. As electrical energy is an integral part of modern civilization - powering our computers; lighting, heating and cooling our homes and businesses; and making the information age possible, it is critical that students begin to understand basic electricity concepts. This standard will be the basis for a more in-depth study in the eighth grade. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.

Standard 4.3

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • A continuous flow of negative charges (electrons) creates an electric current. The pathway taken by an electric current is a circuit. Closed circuits allow the movement of electrical energy. Open circuits prevent the movement of electrical energy. • Electrical energy moves through materials that are conductors (metals). Insulators (rubber, plastic, wood) do not conduct electricity well. • Among conducting materials, energy passes more or less easily because of the material's resistance. • In a series circuit there is only one pathway for the current, but in a parallel circuit there are two or more pathways for it. • Rubbing certain materials together creates static electricity. • Lightning is the discharge of static electricity in the atmosphere. • Electrical energy can be transformed into heat, light, or mechanical energy.	In order to meet this standard, it is expected that students should be able to: • apply the terms insulators, conductors, open and closed in describing electrical circuits. • differentiate between an open and closed electric circuit. • use the dry cell symbols (-) and (+). • create and diagram a functioning series circuit using dry cells, wires, switches, bulbs, and bulb holders. • create and diagram a functioning parallel circuit using dry cells, wires, switches, bulbs, and bulb holders. • differentiate between a parallel and series circuit. • create a diagram of a magnetic field using a magnet. • compare and contrast a permanent magnet and an electromagnet.

Standard 4.3 (continued)

Overview	Essential Knowledge, Skills, and Processes
• Certain iron-bearing metals attract other such metals (also nickel and cobalt). • Lines of force extend from the poles of a magnet in an arched pattern defining the area over which magnetic force is exerted. • An electric current creates a magnetic field, and a moving magnetic field creates an electric current. • A current flowing through a wire creates a magnetic field. Wrapping a wire around certain iron-bearing metals (iron nail) and creating a closed circuit is an example of a simple electromagnet. • Benjamin Franklin, Michael Faraday, and Thomas Edison made important discoveries about electricity.	• explain how electricity is generated by a moving magnetic field. • design an investigation using static electricity to attract or repel a variety of materials. • explain how static electricity is created and occurs in nature. • construct a simple electromagnet using a wire, nail or other iron-bearing object, and a dry cell. • design and perform an investigation to determine the strength of an electromagnet. (The manipulated variable could be the number of coils of wire and the responding variable could be the number of paperclips the magnet can attract.) • describe the contributions of Ben Franklin, Michael Faraday, and Thomas Edison to the understanding and harnessing of electricity.

Standard 4.3

Resources	Teacher Notes
Harcourt Science. Text Pages F4-F29 AIMS Education Foundation Book *Electrical Connections* Parker, Steve. (1992). *Thomas Edison and Electricity*. Biography of Thomas Edison and explanation of his work and its impact from the pre-electric lighting to modern day technology and electronics. ISBN: 0-7910-3012-1. ***Inventors*** ***Circuits, Batteries, and Bulbs*** ***Electromagnets*** ***Static Electricity*** Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Grade 4. **http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml** Correlations to VA Science SOL (AIMS and Children's Literature) found on the LCPS intranet at: http://www.intranet.lcps Standards of Learning Literature Correlation searchable database "Connections" can be found at: http://www.fcps.k12.va.us/cpsapps/connections/	

Life Processes
This strand focuses on the life processes of plants and animals and the specific needs of each.

Standard 4.4

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

a) the structures of typical plants (leaves, stems, roots, and flowers);
b) processes and structures involved with reproduction (pollination, stamen, pistil, sepal, embryo, spore, and seed);
c) photosynthesis (sunlight, chlorophyll, water, carbon dioxide, oxygen, and sugar); and
d) dormancy.

Understanding the Standard

This standard focuses on the basic life processes and anatomy of plants. It represents a more in-depth treatment of the structures and processes associated with reproduction. Photosynthesis is introduced ~~to~~ in this standard. Closely related standards from previous grades include K.6, 1.4, and 2.4. This standard also is closely connected with concepts presented in science standard 4.5. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.

Standard 4.4

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • For many typical green plants there are anatomical structures that perform certain basic functions. For example, roots anchor the plants and take water and nutrients from the soil. Plant stems provide support and allow movement of water and nutrients. • The plant kingdom can be divided into two general groups, those that produce seeds and those that produce spores. • Many seed producing plants have roots, stems, leaves, and flowers. The stamen and pistil are reproductive parts of the flower. The sepals are the small leaves that form the housing of the developing flower. • Pollination is part of the reproductive process for flowering plants. Pollination is the process by which pollen is transferred from the stamens to the stigma. • Some plants reproduce with spores. These include ferns and mosses.	In order to meet this standard, it is expected that students should be able to: • create a model/diagram illustrating the parts of a flower (stamen, pistil, sepal, ovary, ovuole, seed) and explain the functions of those parts. • analyze a common plant: identify the roots, stems, leaves, and flowers; and explain the function of each. • create a model/diagram illustrating the reproductive processes in typical flowering plants and explain the processes. • compare and contrast different ways plants are pollinated. • explain that ferns and mosses reproduce with spores rather than seeds. • explain the process of photosynthesis using the following terminology: sunlight, chlorophyll, water, carbon dioxide, oxygen, and sugar. • design an investigation to determine the relationship between the presence of sunlight and plant growth. • explain the role of dormancy for common plants.

Standard 4.4 (continued)

Overview	Essential Knowledge, Skills, and Processes
• Green plants produce their own food through the process of photosynthesis. Green plants use chlorophyll to produce food (sugar) using carbon dioxide, water, nutrients, and sunlight. Leaves are the primary food producing part of these plants. • Oxygen is produced during photosynthesis. • Dormancy is a period of suspended life processes brought on by changes in the environment.	

Standard 4.4

Resources	Teacher Notes
Harcourt Science. Text Pages: A18-A23; A26-A29; A70-A87 AIMS Education Foundation Book *The Budding Botanist Investigations with Plants* Burton, J. and Taylor, K. (1997). *The Nature and Science of Leaves*. Discusses different kinds of leaves, the forms and colors they may have and their features. ISBN: 083681942x. Ross, Bill. (1995). *Straight from the Bear's Mouth: A Story of Photosynthesis*. Story of photosynthesis using scientific investigation, vocabulary, and diagrams. ISBN: 0-689-31726-3. Use QX3 Computer Microscope to investigate plants, plant parts, and flower parts. Ag in the Classroom Lessons and Resources http://www.intranet.lcps ***Little Sprouts*** ***Let There Be Light!*** ***Photosynthesis*** ***Flower Dissection*** Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Grade 4. **http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml**	

Grasses, Grasses Everywhere VA Department of Education **Lessons from the Bay**. Correlated to VA Science, Math, Language Arts, and Social Studies SOL. **http://www.pen.k12.va.us/VDOE/watershed/index.html** Correlations to VA Science SOL (AIMS and Children's Literature) found on the LCPS intranet at: http://www.intranet.lcps Standards of Learning Literature Correlation searchable database "Connections" can be found at: http://www.fcps.k12.va.us/cpsapps/connections/	

Living Systems
This strand "Living Systems" begins in second grade and builds from basic to more complex understandings of a system, both at the ecosystem level and at the level of the cell.

Standard 4.5

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

a) behavioral and structural adaptations;
b) organization of communities;
c) flow of energy through food webs;
d) habitats and niches;
e) life cycles; and
f) influence of human activity on ecosystems.

Meaningful Watershed Experience Opportunity

Understanding the Standard

This standard focuses on the relationships among plants, animals, and the non-living environment and brings together several elements of both Life Processes and Living Systems. This standard assumes students have a basic understanding that all living things are interrelated and dependent in some way on other living things and their environment. Plants and animals in ecological systems live in a web of interdependence in which each species contributes to the functioning of the overall system. Organisms live in a habitat to which they are structurally and behaviorally adapted. Certain conditions within environments determine which organisms and communities succeed there. This standard builds upon several previous standards (1.5, 2.4, 2.5. 3.4, 3.5 and 3.6). It is intended that students will actively develop scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.

Standard 4.5

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • Organisms have structural adaptations or physical attributes that help them meet a life need. • Organisms also have behavioral adaptations, or certain types of activities they perform, which help them meet a life need. • The organization of communities is based on the utilization of the energy from the sun within a given ecosystem. The greatest amount of energy in a community is in the producers. • Within a community, organisms are dependent on the survival of other organisms. Energy is passed from one organism to another. • The organization of a community is defined by the interrelated niches within it. • The sun's energy cycles through ecosystems from producers through consumers and back into the nutrient pool through decomposers. • An organism's habitat provides food, water, shelter, and space. The size of the habitat depends on the organism's needs.	In order to meet this standard, it is expected that students will be able to: • distinguish between structural and behavioral adaptations. • investigate and infer the function of basic adaptations and provide evidence for the conclusion. • understand that adaptations allow an organism to succeed in a given environment. • explain how different organisms use their unique adaptations to meet their needs. • describe why certain communities exist in given habitats. • illustrate the food webs in a local area and compare and contrast the niches of several different organisms within the community. • compare and contrast the differing ways an organism interacts with its surroundings at various stages of its life cycle. Specific examples include a frog and a butterfly.

Standard 4.5 (continued)

Overview	Essential Knowledge, Skills, and Processes
• A **niche** is the function that an organism performs in the food web of that community. A niche also includes everything else the organism does and needs in its environment. No two types of organisms occupy the exact same niche in a community. • During its life cycle, an organism's role in the community, its niche, may change. For example, what an animal eats, what eats it, and other relationships will change. • Humans can have a major impact on ecosystems. • Habitat is the place or kind of place in which an animal or plant naturally lives.	• differentiate among positive and negative influences of human activity on ecosystems.

Standard 4.5

Resources	Teacher Notes
Harcourt Science. Text Pages: A38-61; B10-25 AIMS Education Foundation Books *Overhead and Underfoot* *Critters* *Field Detectives* *Our Wonderful World* Alvin, Laura and Silverstein, Virginia. (1998). *Food Chains*. ISBN: 0-7613-3002-x. Dunbar, Joyce and Majewska, Maria. (1990). *Ten Little Mice*. ISBN: 0-15-284614-x. Fisher, Aileen and Edison, Susan. (1990). *Under the Open Sky*. ISBN: 1-55924-330-9. Gibbons, Gail. (1994). *Frogs*. ISBN: 082341346. Korman, Susan and Marchesi, Stephen. (2000). *Box Turtle at Silver Pond*. ISBN: 1-56899-860-9. *Darner Dragonfly*. ISBN: 0-531-30315-2. Leatherwood, Stephen and Randal Reeves. (1987). *The Sea World Book of Dolphins*. ISBN: 0512719571.	

North Carolina Museum. (1993). *Life Cycles: How Living Things Change*. ISBN: 0590261169. Rogers, Sally and Mathis, Melissa Bay. (1998). *Earthsong*. ISBN: ISBN: 0525456735. Silverstein, Alvin, Silverstein, Virginia, and Silverstein, Laura Nunn (1998). *Food Chains*. ISBN: 076133002x. Wexler, Jerome. (1995). *Sundew Stranglers: Plants That Eat Insects*. ISBN: 0-525-45208-7. Yolen, Jane and Schoenherr, John. (1987). *Owl Moon*. ISBN: 0399214577. ***Hello from My Habitat!*** ***Life in the Web*** ***The Best Beak for the Job*** ***Change is Good!*** ***What Can We Do?*** Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Grade 4. **http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml** ***A River Runs Through It*** ***Captain John Smith's Chesapeake Bay*** ***Succession & Forest Habitats*** ***Bay and Pond Food Webs*** ***Native vs. Non-native Species: Who Will Win?*** ***Does It Soak Right In?*** ***Wetlands: Here All Year?***	

Types of Pollution ***Stream Creatures: Clues to Stream Health*** ***Muddying the Waters*** ***Grasses, Grasses Everywhere*** VA Department of Education **Lessons from the Bay**. Correlated to VA Science, Math, Language Arts, and Social Studies SOL. http://www.pen.k12.va.us/VDOE/watershed/index.html Correlations to VA Science SOL (AIMS and Children's Literature) found on the LCPS intranet at: http://www.intranet.lcps Standards of Learning Literature Correlation searchable database "Connections" can be found at: http://www.fcps.k12.va.us/cpsapps/connections/	

Interrelationships in Earth/Space Systems
This strand focuses on student understanding of how Earth systems are connected, and how the Earth interacts with other members of the solar system.

Standard 4.6

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

a) weather measurements and meteorological tools (air pressure-barometer, wind speed-anemometer, rainfall-rain gauge, and temperature-thermometer); and
b) weather phenomena (fronts, clouds, and storms).

Understanding the Standard

This standard focuses on weather conditions and a more technical understanding of the tools and methods used to forecast future atmospheric conditions. Weather is introduced in science standard 2.6. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.

Standard 4.6

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • Temperature is the measure of the amount of heat energy in the atmosphere. • Air pressure is due to the weight of the air and is determined by several factors including the temperature of the air. • A front is the boundary between air masses of different temperature and humidity. • Cirrus, stratus, cumulus, and cumulo-nimbus clouds are associated with certain weather conditions. • Cumulus clouds are fluffy and white with flat bottoms. They usually indicate fair weather. However, when they get larger and darker on the bottom, they produce thunderstorms. • Stratus clouds are smooth, gray clouds that cover the whole sky (block out direct sunlight). Light rain and drizzle are usually associated with stratus clouds.	In order to meet this standard, it is expected that students will be able to: • use a thermometer to compare air temperatures over a period of time. • analyze the changes in air pressure occurring over time using a barometer, and predict what the changes mean in terms of changing weather patterns. • differentiate between the types of weather associated with high and low pressure air masses. Illustrate and label high and low pressure air masses and warm and cold fronts. • differentiate between cloud types (cirrus, stratus, cumulus, and cumulo-nimbus clouds) and associated weather. • compare and contrast the formation of different types of precipitation (rain, snow, sleet, and hail).

Standard 4.6 (continued)

Overview	Essential Knowledge, Skills, and Processes
• Cirrus clouds are feathery and fibrous clouds. They are associated with fair weather. Cirrus clouds often indicate that rain or snow will fall within several hours. • Extreme atmospheric conditions create various kinds of storms such as thunderstorms, hurricanes, and tornadoes. • Different atmospheric conditions create different types of precipitation. • Meteorologists gather data by using a variety of instruments • Meteorologists use data to predict weather patterns. • A barometer measures air pressure. • An anemometer measures wind speed. • A rain gauge measures precipitation. • A thermometer measures the temperature of the air.	• recognize a variety of storm types, describe the weather conditions associated with each, and when they occur (thunderstorms, hurricanes, and tornadoes). • analyze and report information about temperature and precipitation on weather maps. • measure wind speed using an anemometer. • measure precipitation with a rain gauge. • design an investigation where weather data are gathered using meteorological tools and charted to make weather predictions.

Standard 4.6

Resources	Teacher Notes
Harcourt Science. Text Pages: D2-D29 AIMS Education Foundation Books *Down to Earth* *Overhead and Underfoot* *Weather Sense: Temperature, Air Pressure, and Wind* *Weather Sense: Moisture* Berger, Melvin, Berger, Gilda, and Tull, Bobbi (I). (1995). *Water, Water Everywhere*. ISBN: 1-57102-056. de Paola, Tomie. (1985). *The Cloud Book*. ISBN: 0823705311. Lauber, Patricia. (1996). *Hurricanes: Earth's Mightiest Storms*. ISBN: 059047406. Locker, Thomas. (2000). *Cloud Dance*. ISBN: 152022317. McMillan, Bruce. (1991). *The Weather Sky*. ISBN: 0-374-38261-1. Simon, Seymour. (1993). *Weather*. ISBN: 0688105467. ***Precipitation and Temperature*** ***Name That Cloud*** ***Air Pressure*** ***Storm Warning***	

Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Grade 4. **http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml** Correlations to VA Science SOL (AIMS and Children's Literature) found on the LCPS intranet at: http://www.intranet.lcps Standards of Learning Literature Correlation searchable database "Connections" can be found at: http://www.fcps.k12.va.us/cpsapps/connections/	

Earth Patterns, Cycles, and Change
This strand focuses on student understanding of patterns in nature, natural cycles, and changes that occur, both quickly and over time.

Standard 4.7

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

a) the motions of the Earth, moon, and sun (revolution and rotation);
b) the causes for the Earth's seasons and phases of the moon;
c) the relative size, position, age, and makeup of the Earth, moon, and sun; and
d) historical contributions in understanding the Earth-moon-sun system.

Understanding the Standard

This standard focuses on the Earth-moon-sun system and includes knowledge related to the motions of this system and the results of our unique position in it. This includes the presence of an atmosphere, liquid water, and life. The standard is built on concepts developed in science standard K.7, 1.6, and 3.8 and will be further expanded in 6.8. A more in-depth study of the Earth's make-up is in standard 5.7. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.

Standard 4.7

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • The Earth completes one revolution around the sun every 365 days. The moon revolves around the Earth about once every month. • Due to its axial tilt, the Earth experiences seasons during its revolution around the sun. • The phases of the moon are caused by its position relative to the Earth and the sun. The phases of the moon include the new, waxing crescent, first quarter, waxing gibbous, full, waning gibbous, last quarter, and waning crescent. • The sun is an average-sized yellow star, about 110 times the diameter of the Earth. The sun is approximately 4.6 billion years old.	In order to meet this standard, the student will need to be able to: • differentiate between rotation and revolution. • describe how the Earth's axial tilt causes the seasons. • model the formation of the eight moon phases, sequence the phases in order, and describe how the phases occur. • describe the major characteristics of the sun, including approximate size, color, age, and overall composition. • create and describe a model of the Earth-moon-sun system with approximate scale distances and sizes. • compare and contrast the Earth-centered to the sun-centered model of the solar system. • analyze the differences in what Aristotle, Ptolemy, Copernicus, and Galileo observed and what influenced their conclusions. • compare and contrast the surface conditions of the Earth, moon, and sun.

Standard 4.7 (continued)

Overview	Essential Knowledge, Skills, and Processes
• Our moon is a small rocky satellite, having about one-quarter the diameter of the Earth and one-eightieth its mass. It has extremes of temperature, (virtually) no atmosphere, no water, and no life. • The Earth is one of nine planets that revolve around the Sun and comprise the solar system. The Earth, third planet from the sun, is one of the four rocky inner planets. It is about 150 million kilometers from the sun. • The Earth is a geologically active planet with a surface that is constantly changing. Unlike the other four inner planets, it has large amounts of life-supporting water and an oxygen-rich atmosphere. The Earth's protective atmosphere blocks out most of the sun's damaging rays. • Our understanding of the solar system has changed from an Earth-centered model (Aristotle and Ptolemy) to the sun-centered model (Copernicus and Galileo). • The NASA Apollo missions added a great deal to our understanding of the moon. • Our understanding of the sun, moon, and the solar system continues to change with new scientific discoveries.	• describe a contribution of the NASA Apollo missions to our understanding of the moon.

Standard 4.7

Resources	Teacher Notes
Harcourt Science. Text Pages: D60-D95 AIMS Education Foundation Books *Out of this World* Cole, Joanna and Degen, Bruce (I). (1990). *The Magic School Bus Lost in the Solar System*.. ISBN: 0590414283. Gibbons, Gail. (1996). *The Reason for the Seasons*. ISBN: 0823411745. Lasky, Kathryn and Hawkes, Kevin. (1994). *The Librarian Who Measured the Earth*. ISBN: 0-316-51526-4. Lauber, Patricia. (1993). *Journey to the Planets*. ISBN: 0-517-59029-8. Leedy, Loreen. (1993). *Postcards from Pluto: A Tour of the Solar System*. ISBN: 0823412377. Sis, Peter. (1996). *Starry Messenger: Galileo Galilei*. ISBN: 0374371911. Wilson, Lynn and Billin-Frye, Paige. (1993). *What's Out There? A Book About Space.* ISBN: 0448405172. Wollard, Kathy and Soloman, Debra (I). (1993). *How Come? Planet Earth.* ISBN: 1563053241.	

What's the Difference? ***The Play's the Thing*** ***Sun-Earth-Moon Model*** ***Moon Phases*** Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Grade 4. **http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml** Correlations to VA Science SOL (AIMS and Children's Literature) found on the LCPS intranet at: http://www.intranet.lcps Standards of Learning Literature Correlation searchable database "Connections" can be found at: http://www.fcps.k12.va.us/cpsapps/connections/	

Resources
This strand focuses on student understanding the role of resources in the natural world and how people can utilize those resources in a sustainable way.

Standard 4.8

The student will investigate and understand important Virginia natural resources. Key concepts include

a) watershed and water resources;
b) animals and plants;
c) minerals, rocks, ores, and energy sources; and
d) forests, soil, and land.

Meaningful Watershed Experience Opportunity

Understanding the Standard

Virginia has a rich variety of resources. These provide the raw materials for our daily lives and sustain our economy. Natural resources are finite and must be used wisely to insure their continued availability. This concept of natural resources is introduced in 1.8 and extended in 6.9. It is intended that students will actively develop scientific investigation, reasoning, and logic skills (4.1) in the context of the key concepts presented in this standard.

Standard 4.8

Overview	Essential Knowledge, Skills, and Processes
The concepts developed in this standard include the following: • Virginia is rich in a wide variety of natural resources including forests, arable (farmable) land, coal, sand and aggregates (rocks), wildlife and aquatic organisms, clean water and air, and beautiful scenery. • A watershed is an area over which surface water (and the materials it carries) flows to a single collection place. The Chesapeake Bay watershed covers approximately half of Virginia's land area. The other two major watershed systems are the Gulf of Mexico and the North Carolina Sounds. • Virginia's water resources include groundwater, lakes, reservoirs, rivers, bays, and the Atlantic Ocean. • Virginia has a great variety of plant and animal resources. • Natural and cultivated forests are a widespread resource in Virginia.	In order to meet this standard, the student will need to be able to: • compare and contrast natural and man-made resources. • distinguish among rivers, lakes, and bays; describe characteristics of each; and name an example of each in Virginia. • create and interpret a model of a watershed. Evaluate the statement: "We all live downstream." • identify watershed addresses. • recognize the importance of Virginia's mineral resources including coal, limestone, granite, and sand and gravel. • appraise the importance of natural and cultivated forests in Virginia. • describe a variety of soil and land uses important in Virginia.

Standard 4.8 (continued)

Overview	Essential Knowledge, Skills, and Processes
• Virginia's soil and land support a great variety of life, provide space for many economic activities, and offer a variety of recreational opportunities.	
Additional LCPS content (optional): Earthquakes, volcanoes, and fossils correlates with: Social Studies VS 2a, 2b, 2c Geography of Virginia Text pages: 10-65 Harcourt Science Text: Unit C Earth's Surface Pages C4-C63	The 5 regions of Virginia were formed by the action of earthquakes and volcanoes. Coal is an important fossil fuel found in the Appalachian Plateau Region.

Standard 4.8

Resources	Teacher Notes
Resources for Optional material: Earthquakes, volcanoes, and fossils correlates with: Social Studies VS 2a, 2b, 2c Geography of Virginia Text pages: 10-65 Harcourt Science Text: Unit C Earth's Surface Pages C4-C63 Harcourt Science. Text Pages: D60-D95 **Resources for Science SOL 4.8:** AIMS Education Foundation Books *Primarily Earth* *Overhead and Underfoot* *Our Wonderful World* AIMS: "Where is Water ", Primarily Earth AIMS: "Water Clock - Shower Timer", Water Precious Water AIMS: "Were You Aware", Water Precious Water Burton, Jane and Taylor, Kim. (1998). *Nature and Science of Rocks*. ISBN: 0836819454. Cole, Joanna. (1987). *The Magic School Bus Inside the Earth*. ISBN: 0590407597. Russell, William. (1994). *Gold and Silver*. ISBN: 0865933596. Telford, Carole and Theodore, Rod. (1998). *Down a River*. ISBN: 157721538. ***Watersheds*** ***A River Runs Through It***	

Journey of a Raindrop ***Forests*** ***Virginia's Mineral Resources*** Investigations from the VA Department of Education Science Enhanced Scope and Sequence – Grade 4. **http://www.doe.virginia.gov/VDOE/EnhancedSandS/science.shtml** ***A River Runs Through It*** ***Riparian Buffers*** ***Captain John Smith's Chesapeake Bay*** ***Succession & Forest Habitats*** ***Bay and Pond Food Webs*** ***Native vs. Non-native Species: Who Will Win?*** ***Wasting Water*** ***Going for Water*** ***Journey of a Raindrop to the Chesapeake Bay*** ***Types of Pollution*** ***Stream Creatures: Clues to Stream Health*** ***Muddying the Waters*** ***Grasses, Grasses Everywhere*** VA Department of Education **Lessons from the Bay**. Correlated to VA Science, Math, Language Arts, and Social Studies SOL. **http://www.pen.k12.va.us/VDOE/watershed/index.html** Correlations to VA Science SOL (AIMS and Children's Literature) found on the LCPS intranet at: http://www.intranet.lcps Standards of Learning Literature Correlation searchable database "Connections" can be found at: http://www.fcps.k12.va.us/cpsapps/connections/	

4th grade Science - Focal Points

Scientific Investigation – 4.1

- Observations, conclusions, inferences and predictions
- Experimental design – hypothesis and variables
- Classify and analyze objects, measurements, data
- Measurements of distance, volume, mass and temperature
- Display data, interpret and make predictions from graphs, charts, tables
- Identify contradictory experimental results

VA Natural Resources – 4.8

- Watershed and water resources
- Chesapeake Bay
- Mineral & energy resources
- Importance of forests
- Plant and animal resources
- Soil and land use in Virginia

Earth, Moon & Sun System– 4.7

- Revolution (years)
- Rotation (days)
- Seasons – tilt of the earth
- Phases of the moon
- Sun, Moon, Earth system (relative size, position, age & makeup)
- NASA Apollo Missions
- Contributions of Aristotle, Ptolemy, Copernicus, Galileo

Weather – 4.6

- Meteorological tools & measurements
  Air pressure – barometer
  Wind speed – anemometer
  Rainfall – rain gauge
  Temperature – thermometer
- Fronts (warm, cold, stationary)
- Clouds (cirrus, cumulus, stratus, nimbus)
- Storms (thunderstorms, tornadoes, hurricanes)

Forces, Motion & Energy – 4.2

- Motion – speed and direction
- Measurement of an object's position over time
- Force – causes a change of motion
- Friction
- Kinetic and potential energy

Electricity & Magnetism – 4.3

- Conductors and insulators
- Circuits (open/closed; parallel/series)
- Static electricity
- Transformation of electrical energy into heat, light, and mechanical energy
- Electromagnets and magnetism
- Historical contributions (Faraday, Edison, Franklin)

Ecosystems – 4.5

- Structural adaptations
- Behavioral adaptations
- Organization of communities
- Flow of energy through food webs
- Habitats and niches
- Life Cycles
- Influence of human activity

Plant Anatomy and Life Processes– 4.4

- Plant structures (leaves, stems, roots, flowers)
- Processes and structures involved with reproduction (pollination, stamen, pistil, sepal, embryo, spore, seed)
- Photosynthesis (sunlight, chlorophyll, water, carbon dioxide, oxygen and sugar)
- Dormancy