

## Virginia Science Standards of Learning Grades 3-6 Vertical Alignment

	<i>Grade 3</i>	<i>Grade 4</i>	<i>Grade 5</i>	<i>Grade 6</i>
<b>Scientific Investigations</b>	<p>3.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</p> <ul style="list-style-type: none"> <li>a) observations are made and are repeated to ensure accuracy;</li> <li>b) predictions are formulated using a variety of sources of information;</li> <li>c) objects with similar characteristics or properties are classified into at least two sets and two subsets;</li> <li>d) natural events are sequenced chronologically;</li> <li>e) length, volume, mass, and temperature are estimated and measured in metric and standard English units using proper tools and techniques;</li> <li>f) time is measured to the nearest minute using proper tools and techniques;</li> <li>g) questions are developed to formulate hypotheses;</li> <li>h) data are gathered, charted, graphed, and analyzed;</li> <li>i) unexpected or unusual quantitative data are recognized;</li> <li>j) inferences are made and conclusions are drawn;</li> <li>k) data are communicated;</li> <li>l) models are designed and built; and</li> <li>m) current applications are used to reinforce science concepts.</li> </ul>	<p>4.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</p> <ul style="list-style-type: none"> <li>a) distinctions are made among observations, conclusions, inferences, and predictions;</li> <li>b) objects or events are classified and arranged according to characteristics or properties;</li> <li>c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units;</li> <li>d) appropriate instruments are selected and used to measure elapsed time;</li> <li>e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;</li> <li>f) independent and dependent variables are identified;</li> <li>g) constants in an experimental situation are identified;</li> <li>h) hypotheses are developed as cause and effect relationships;</li> <li>i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;</li> <li>j) numerical data that are contradictory or unusual in experimental results are recognized;</li> <li>k) data are communicated with simple graphs, pictures, written statements, and numbers;</li> <li>l) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and</li> <li>m) current applications are used to reinforce science concepts.</li> </ul>	<p>5.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</p> <ul style="list-style-type: none"> <li>a) items such as rocks, minerals, and organisms are identified using various classification keys;</li> <li>b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools;</li> <li>c) estimates are made and accurate measurements of elapsed time are made using proper tools;</li> <li>d) hypotheses are formed from testable questions;</li> <li>e) independent and dependent variables are identified;</li> <li>f) constants in an experimental situation are identified;</li> <li>g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements;</li> <li>h) predictions are made using patterns from data collected, and simple graphical data are generated;</li> <li>i) inferences are made and conclusions are drawn;</li> <li>j) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and</li> <li>k) current applications are used to reinforce science concepts.</li> </ul>	<p>6.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</p> <ul style="list-style-type: none"> <li>a) observations are made involving fine discrimination between similar objects and organisms;</li> <li>b) precise and approximate measurements are recorded;</li> <li>c) scale models are used to estimate distance, volume, and quantity;</li> <li>d) hypotheses are stated in ways that identify the independent and dependent variables;</li> <li>e) a method is devised to test the validity of predictions and inferences;</li> <li>f) one variable is manipulated over time, using many repeated trials;</li> <li>g) data are collected, recorded, analyzed, and reported using metric measurements and tools;</li> <li>h) data are analyzed and communicated through graphical representation;</li> <li>i) models and simulations are designed and used to illustrate and explain phenomena and systems; and</li> <li>j) current applications are used to reinforce science concepts.</li> </ul>

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<b>Science Process Skill</b>	<b>Grade 3</b>	<b>Grade 4</b>	<b>Grade 5</b>	<b>Grade 6</b>
<b>Observation</b>	a) observations are made and repeated to ensure accuracy	a) distinctions are made among observations, conclusions, inferences, and predictions		a) Discriminating observations are made similar objects and organisms
<b>Classification</b>	c) objects with similar characteristics or properties are classified into at least two sets and two subsets	b) objects or events are classified and arranged according to characteristics or properties;	a) items such as rocks, minerals, and organisms are identified using various classification keys	
<b>Prediction</b>	b) predictions are formulated using a variety of sources of information	e) predictions and inferences are made,	h) predictions are made using patterns from data collected, and simple graphical data are generated;	e) a method is devised to test the validity of predictions and inferences;
<b>Inference &amp; Conclusions</b>	j) inferences are made and conclusions are drawn;	e) conclusions are drawn based on data from a variety of sources	i) inferences are made and conclusions are drawn;	
<b>Measuring and Estimating using tools</b>	e) length, volume, mass, and temperature are estimated and measured in metric and standard English units using proper tools and techniques	c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units	b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools	b) precise and approximate measurements are recorded c) scale models are used to estimate distance, volume, and quantity
<b>Time</b>	f) time is measured to the nearest minute using proper tools and techniques;	d) appropriate instruments are selected and used to measure elapsed time	c) estimates are made and accurate measurements of elapsed time are made using proper tools	
<b>Hypotheses</b>	g) questions are developed to formulate hypotheses	h) hypotheses are developed as cause and effect relationships	d) hypotheses are formed from testable questions	d) hypotheses are stated in ways that identify the independent and dependent variables
<b>Constants</b>		g) constants in an experimental situation are identified;	f) constants in an experimental situation are identified;	
<b>Data</b>	h) data are gathered, charted, graphed, and analyzed	i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs	g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements	g) data are collected, recorded, analyzed, and reported using metric measurements and tools;
	i) unexpected or unusual quantitative data are recognized	j) numerical data that are contradictory or unusual in experimental results are recognized;		
<b>Communication</b>	k) data are communicated	k) data are communicated with simple graphs, pictures, written statements, and numbers		h) data are analyzed and communicated through graphical representation
<b>Variables</b>		f) independent and dependent variables are identified	e) independent and dependent variables are identified	f) one variable is manipulated over time, using many repeated trials
<b>Models</b>	l) models are designed and built	l) models are constructed to clarify explanations, demonstrate relationships, and solve needs	j) models are constructed to clarify explanations, demonstrate relationships, and solve needs;	j) models and simulations are designed and used to illustrate and explain phenomena and systems; and
<b>Application</b>	m) current applications are used to reinforce science concepts.	m) current applications are used to reinforce science concepts.	k) current applications are used to reinforce science concepts.	k) current applications are used to reinforce science concepts.

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<b>Life Processes</b>	<p>3.4 The student will investigate and understand that adaptations allow animals to satisfy life needs and respond to the environment. Key concepts include</p> <ul style="list-style-type: none"> <li>a) behavioral adaptations; and</li> <li>b) physical adaptations.</li> </ul>	<p>4.4 The student will investigate and understand basic plant anatomy and life processes. Key concepts include</p> <ul style="list-style-type: none"> <li>a) the structures of typical plants and the function of each structure;</li> <li>b) processes and structures involved with plant reproduction;</li> <li>c) photosynthesis; and</li> <li>d) adaptations allow plants to satisfy life needs and respond to the environment.</li> </ul>		

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<b>Living Systems</b>	<p>3.5 The student will investigate and understand relationships among organisms in aquatic and terrestrial food chains. Key concepts include</p> <ul style="list-style-type: none"> <li>a) producer, consumer, decomposer;</li> <li>b) herbivore, carnivore, omnivore; and</li> <li>c) predator and prey.</li> </ul>	<p>4.5 The student will investigate and understand how plants and animals, including humans, in an ecosystem interact with one another and with the nonliving components in the ecosystem. Key concepts include</p> <ul style="list-style-type: none"> <li>a) plant and animal adaptations;</li> <li>b) organization of populations, communities, and ecosystems and how they interrelate;</li> <li>c) flow of energy through food webs;</li> <li>d) habitats and niches;</li> <li>e) changes in an organism's niche at various stages in its life cycle; and</li> <li>f) influences of human activity on ecosystems.</li> </ul>	<p>5.5 The student will investigate and understand that organisms are made of one or more cells and have distinguishing characteristics that play a vital role in the organism's ability to survive and thrive in its environment. Key concepts include</p> <ul style="list-style-type: none"> <li>a) basic cell structures and functions;</li> <li>b) classification of organisms using physical characteristics, body structures, and behavior of the organism; and</li> <li>c) traits of organisms that allow them to survive in their environment.</li> </ul>	<p>6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include</p> <ul style="list-style-type: none"> <li>a) the health of ecosystems and the abiotic factors of a watershed;</li> <li>b) the location and structure of Virginia's regional watershed systems;</li> <li>c) divides, tributaries, river systems, and river and stream processes;</li> <li>d) wetlands;</li> <li>e) estuaries;</li> <li>f) major conservation, health, and safety issues associated with watersheds; and water monitoring and analysis using field equipment including hand-held technology</li> </ul>
	<p>3.6 The student will investigate and understand that ecosystems support a diversity of plants and animals that share limited resources. Key concepts include</p> <ul style="list-style-type: none"> <li>a) aquatic ecosystems;</li> <li>b) terrestrial ecosystems;</li> <li>c) populations and communities; and</li> <li>d) the human role in conserving limited resources.</li> </ul>			

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<b>Matter</b>	<p>3.3 The student will investigate and understand that objects are made of materials that can be described by their physical properties. Key concepts include</p> <ul style="list-style-type: none"> <li>a) objects are made of one or more materials;</li> <li>b) physical properties remain the same as the material is changed in visible size; and</li> <li>c) visible physical changes are identified.</li> </ul>		<p>5.4 The student will investigate and understand that matter is anything that has mass and takes up space; and occurs as a solid, liquid, or gas. Key concepts include</p> <ul style="list-style-type: none"> <li>a) distinguishing properties of each phase of matter;</li> <li>b) the effect of temperature on the phases of matter;</li> <li>c) atoms and elements;</li> <li>d) molecules and compounds; and</li> <li>e) mixtures including solutions.</li> </ul>	<p>6.4 The student will investigate and understand that all matter is made up of atoms. Key concepts include</p> <ul style="list-style-type: none"> <li>a) atoms consist of particles, including electrons, protons, and neutrons;</li> <li>b) atoms of a particular element are alike but are different from atoms of other elements;</li> <li>c) elements may be represented by chemical symbols;</li> <li>d) two or more atoms interact to form new substances, which are held together by electrical forces (bonds);</li> <li>e) compounds may be represented by chemical formulas;</li> <li>f) chemical equations can be used to model chemical changes; and</li> <li>g) a limited number of elements comprise the largest portion of the solid Earth, living matter, the oceans, and the atmosphere.</li> </ul>
				<p>6.5 The student will investigate and understand the unique properties and characteristics of water and its roles in the natural and human-made environment. Key concepts include</p> <ul style="list-style-type: none"> <li>a) water as the universal solvent;</li> <li>b) the properties of water in all three phases.</li> </ul>

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<b>Interrelationships in Earth/Space Systems</b>	<p>3.7 The student will investigate and understand the major components of soil, its origin, and its importance to plants and animals including humans. Key concepts include</p> <ul style="list-style-type: none"> <li>a) soil provides the support and nutrients necessary for plant growth;</li> <li>b) topsoil is a natural product of subsoil and bedrock;</li> <li>c) rock, clay, silt, sand, and humus are components of soils; and</li> <li>d) soil is a natural resource and should be conserved.</li> </ul>	<p>4.6 The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include</p> <ul style="list-style-type: none"> <li>a) weather phenomena;</li> <li>b) weather measurements and meteorological tools; and</li> <li>c) use of weather measurements and weather phenomena to make weather predictions.</li> </ul>	<p>5.6 The student will investigate and understand characteristics of the ocean environment. Key concepts include</p> <ul style="list-style-type: none"> <li>a) geological characteristics;</li> <li>b) physical characteristics; and</li> <li>c) ecological characteristics.</li> </ul>	<p>6.3 The student will investigate and understand the role of solar energy in driving most natural processes within the atmosphere, the hydrosphere, and on Earth's surface. Key concepts include</p> <ul style="list-style-type: none"> <li>a) Earth's energy budget;</li> <li>b) the role of radiation and convection in the distribution of energy;</li> <li>c) the motion of the atmosphere and the oceans;</li> <li>d) cloud formation; and</li> <li>e) the role of thermal energy in weather-related phenomena including thunderstorms and hurricanes.</li> </ul>
		<p>4.8 The student will investigate and understand the relationships among Earth, the moon, and the sun. Key concepts include</p> <ul style="list-style-type: none"> <li>a) the motions of Earth, the moon, and the sun;</li> <li>b) the causes for Earth's seasons;</li> <li>c) the causes for the phases of the moon;</li> <li>d) the relative size, position, age, and makeup of Earth, the moon, and the sun; and</li> <li>e) historical contributions in understanding the Earth-moon-sun system.</li> </ul>		<p>6.5 The student will investigate and understand the unique properties and characteristics of water and its roles in the natural and human-made environment. Key concepts include</p> <ul style="list-style-type: none"> <li>c) the action of water in physical and chemical weathering;</li> <li>d) the ability of large bodies of water to store thermal energy and moderate climate;</li> <li>e) the importance of water for agriculture, power generation, and public health; and</li> <li>f) the importance of protecting and maintaining water resources.</li> </ul>
		<p>4.7 The student will investigate and understand the organization of the solar system. Key concepts include</p> <ul style="list-style-type: none"> <li>a) the planets in the solar system;</li> <li>b) the order of the planets in the solar system; and</li> <li>c) the relative sizes of the planets.</li> </ul>		

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<b>Force, Motion, Energy</b>	<p>3.2 The student will investigate and understand simple machines and their uses. Key concepts include</p> <ul style="list-style-type: none"> <li>a) purpose and function of simple machines;</li> <li>b) types of simple machines;</li> <li>c) compound machines; and</li> <li>d) examples of simple and compound machines found in the school, home, and work environments.</li> </ul>	<p>4.2 The student will investigate and understand characteristics and interactions of moving objects. Key concepts include</p> <ul style="list-style-type: none"> <li>a) motion is described by an object's direction and speed;</li> <li>b) changes in motion are related to force and mass;</li> <li>c) friction is a force that opposes motion; and</li> <li>d) moving objects have kinetic energy.</li> </ul>	<p>5.2 The student will investigate and understand how sound is created and transmitted, and how it is used. Key concepts include</p> <ul style="list-style-type: none"> <li>a) compression waves;</li> <li>b) vibration, compression, wavelength, frequency, amplitude;</li> <li>c) the ability of different media (solids, liquids, and gases) to transmit sound; and</li> <li>d) uses and applications of sound waves.</li> </ul>	<p>6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include</p> <ul style="list-style-type: none"> <li>a) potential and kinetic energy;</li> <li>b) the role of the sun in the formation of most energy sources on Earth;</li> <li>c) nonrenewable energy sources;</li> <li>d) renewable energy sources; and</li> <li>e) energy transformations.</li> </ul>
	<p>3.11 The student will investigate and understand different sources of energy. Key concepts include</p> <ul style="list-style-type: none"> <li>a) energy from the sun;</li> <li>b) sources of renewable energy; and</li> <li>c) sources of nonrenewable energy.</li> </ul>		<p>5.3 The student will investigate and understand basic characteristics of visible light and how it behaves. Key concepts include</p> <ul style="list-style-type: none"> <li>a) transverse waves;</li> <li>b) the visible spectrum;</li> <li>c) opaque, transparent, and translucent;</li> <li>d) reflection of light from reflective surfaces; and</li> <li>e) refraction of light through water and prisms.</li> </ul>	

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<b>Earth Patterns, Cycles, and Changes</b>	<p>3.8 The student will investigate and understand basic patterns and cycles occurring in nature. Key concepts include</p> <ul style="list-style-type: none"> <li>a) patterns of natural events such as day and night, seasonal changes, simple phases of the moon, and tides;</li> <li>b) animal life cycles; and</li> <li>c) plant life cycles.</li> </ul>	<p>4.7 The student will investigate and understand the organization of the solar system. Key concepts include</p> <ul style="list-style-type: none"> <li>a) the planets in the solar system;</li> <li>b) the order of the planets in the solar system; and</li> <li>c) the relative sizes of the planets.</li> </ul>	<p>5.7 The student will investigate and understand how Earth's surface is constantly changing. Key concepts include</p> <ul style="list-style-type: none"> <li>a) identification of rock types;</li> <li>b) the rock cycle and how transformations between rocks occur;</li> <li>c) Earth history and fossil evidence;</li> <li>d) the basic structure of Earth's interior;</li> <li>e) changes in Earth's crust due to plate tectonics;</li> <li>f) weathering, erosion, and deposition; and</li> <li>g) human impact.</li> </ul>	<p>6.6 The student will investigate and understand the properties of air and the structure and dynamics of Earth's atmosphere. Key concepts include</p> <ul style="list-style-type: none"> <li>a) air as a mixture of gaseous elements and compounds;</li> <li>b) pressure, temperature, and humidity;</li> <li>c) atmospheric changes with altitude;</li> <li>d) natural and human-caused changes to the atmosphere and the importance of protecting and maintaining air quality;</li> <li>e) the relationship of atmospheric measures and weather conditions; and</li> <li>f) basic information from weather maps, including fronts, systems, and basic measurements.</li> </ul>
	<p>3.9 The student will investigate and understand the water cycle and its relationship to life on Earth. Key concepts include</p> <ul style="list-style-type: none"> <li>a) there are many sources of water on Earth;</li> <li>b) the energy from the sun drives the water cycle;</li> <li>c) the water cycle involves several processes;</li> <li>d) water is essential for living things; and</li> <li>e) water on Earth is limited and needs to be conserved.</li> </ul>	<p>4.8 The student will investigate and understand the relationships among Earth, the moon, and the sun. Key concepts include</p> <ul style="list-style-type: none"> <li>a) the motions of Earth, the moon, and the sun;</li> <li>b) the causes for Earth's seasons;</li> <li>c) the causes for the phases of the moon;</li> <li>d) the relative size, position, age, and makeup of Earth, the moon, and the sun; and</li> <li>e) historical contributions in understanding the Earth-moon-sun system.</li> </ul>		<p>6.8 The student will investigate and understand the organization of the solar system and the interactions among the various bodies that comprise it. Key concepts include</p> <ul style="list-style-type: none"> <li>a) the sun, moon, Earth, other planets and their moons, dwarf planets, meteors, asteroids, and comets;</li> <li>b) relative size of and distance between planets;</li> <li>c) the role of gravity;</li> <li>d) revolution and rotation;</li> <li>e) the mechanics of day and night and the phases of the moon;</li> <li>f) the unique properties of Earth as a planet;</li> <li>g) the relationship of Earth's tilt and the seasons;</li> <li>h) the cause of tides; and</li> <li>i) the history and technology of space exploration.</li> </ul>



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<b>Earth Resources</b>	<p>3.10 The student will investigate and understand that natural events and human influences can affect the survival of species. Key concepts include</p> <ul style="list-style-type: none"> <li>a) the interdependency of plants and animals;</li> <li>b) the effects of human activity on the quality of air, water, and habitat;</li> <li>c) the effects of fire, flood, disease, and erosion on organisms; and</li> <li>d) conservation and resource renewal.</li> </ul>	<p>4.9 The student will investigate and understand important Virginia natural resources. Key concepts include</p> <ul style="list-style-type: none"> <li>a) watersheds and water resources;</li> <li>b) animals and plants;</li> <li>c) minerals, rocks, ores, and energy sources; and</li> <li>d) forests, soil, and land.</li> </ul>		<p>6.9 The student will investigate and understand public policy decisions relating to the environment. Key concepts include</p> <ul style="list-style-type: none"> <li>a) management of renewable resources;</li> <li>b) management of nonrenewable resources;</li> <li>c) the mitigation of land-use and environmental hazards through preventive measures; and</li> <li>d) cost/benefit tradeoffs in conservation policies.</li> </ul>
	<p>3.11 The student will investigate and understand different sources of energy. Key concepts include</p> <ul style="list-style-type: none"> <li>a) energy from the sun;</li> <li>b) sources of renewable energy; and</li> <li>c) sources of nonrenewable energy.</li> </ul>			<p>6.5 The student will investigate and understand the unique properties and characteristics of water and its roles in the natural and human-made environment. Key concepts include</p> <ul style="list-style-type: none"> <li>a) the action of water in physical and chemical weathering;</li> <li>b) the ability of large bodies of water to store thermal energy and moderate climate;</li> <li>c) the importance of water for agriculture, power generation, and public health; and</li> <li>d) the importance of protecting and maintaining water resources.</li> </ul>