# 4th Grade Science Pacing Guide

| Time | Understanding the Standard | Essential Knowledge |
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| 1st Nine Weeks<br><br>4.1 – On-going throughout the year.<br>4.1 – emphasis on a, b, f, g, h<br>4.4<br>4.5 | 4.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which<br>a) distinctions are made among observations, conclusions, inferences, and predictions;<br>b) objects or events are classified and arranged according to characteristics or properties;<br>c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units;<br>d) appropriate instruments are selected and used to measure elapsed time;<br>e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;<br>f) independent and dependent variables are identified;<br>g) constants in an experimental situation are identified;<br>h) hypotheses are developed as cause and effect relationships;<br>i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;<br>j) numerical data that are contradictory or unusual in experimental results are recognized;<br>k) data are communicated with simple graphs, pictures, written statements, and numbers;<br>l) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and<br>m) current applications are used to reinforce science concepts. | In order to meet this standard, it is expected that students will<br> differentiate among simple observations, conclusions, inferences, and predictions, and correctly apply the terminology in oral and written work.<br> analyze a set of 20 or fewer objects or pictures. Sort them into categories to organize the data (qualitative or quantitative); and construct bar graphs and line graphs depicting the distribution of those data based on characteristics or properties.<br> use millimeters, centimeters, meters, kilometers, grams, kilograms, milliliters, liters, and degrees Celsius in measurement.<br> choose the appropriate instruments, including centimeter rulers, meter sticks, scales, balances, graduated cylinders, beakers, and Celsius thermometers, for making basic metric measures.<br> measure elapsed time using a stopwatch or a clock.<br> make predictions, inferences, and draw conclusions using a variety of sources such as picture graphs, bar graphs, and basic line graphs.<br> analyze the variables in a simple experiment. Identify the independent variable and the dependent variable. Decide which other variable(s) must be held constant (not allowed to change) in order for the investigation to represent a fair test.<br> create a plausible hypothesis, stated in terms of cause (if) and effect (then), from a set of basic observations that can be tested. Hypotheses can 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.<br> organize and analyze data from a simple experiment. Construct bar graphs and line graphs depicting the data.<br> judge which, if any, data in a simple set of results (generally 10 or fewer in number) appear to be contradictory or unusual. |

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| | | present results of a simple experiment using graphs, pictures, statements, and numbers.<br>construct a physical model to clarify an explanation, demonstrate a relationship, or solve a need. |
| | 4.4 The student will investigate and understand basic plant anatomy and life processes. Key concepts include<br>a) the structures of typical plants and the function of each structure;<br>b) processes and structures involved with plant reproduction;<br>c) photosynthesis; and<br>d) adaptations allow plants to satisfy life needs and respond to the environment. | In order to meet this standard, it is expected that students will<br>analyze a common plant: identify the roots, stems, leaves, and flowers, and explain the function of each.<br>create a model/diagram illustrating the parts of a flower and its reproductive processes. Explain the model/diagram using the following terminology: pollination, stamen, stigma, pistil, sepal, embryo, spore, seed.<br>compare and contrast different ways plants are pollinated.<br>explain that ferns and mosses reproduce with spores rather than seeds.<br>explain the process of photosynthesis, using the following terminology: sunlight, chlorophyll, water, carbon dioxide, oxygen, and sugar.<br>explain the role of adaptations of common plants to include dormancy, response to light, and response to moisture. |
| | 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<br>a) plant and animal adaptations;<br>b) organization of populations, communities, and ecosystems and how they interrelate<br>c) flow of energy through food webs;<br>d) habitats and niches;<br>e) changes in an organism's niche at various stages in its life cycle; and<br>f) influences of human activity on | In order to meet this standard, it is expected that students will<br>distinguish between structural (physical) and behavioral adaptations.<br>investigate and infer the function of basic adaptations.<br>understand that adaptations allow an organism to succeed in a given environment.<br>explain how different organisms use their unique adaptations to meet their needs.<br>describe why certain communities exist in given habitats.<br>illustrate the food webs in a local |

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| | ecosystems | area.<br>• compare and contrast the niches of several different organisms within the community.<br>• 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.<br>• differentiate among positive and negative influences of human activity on ecosystems. |
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| 2nd Nine Weeks<br>4.1 – On-going<br>4.5<br>4.8<br>4.7 | 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<br>a) plant and animal adaptations;<br>b) organization of populations, communities, and ecosystems and how they interrelate<br>c) flow of energy through food webs;<br>d) habitats and niches;<br>e) changes in an organism's niche at various stages in its life cycle; and<br>f) influences of human activity on ecosystems | In order to meet this standard, it is expected that students will<br>• distinguish between structural (physical) and behavioral adaptations.<br>• investigate and infer the function of basic adaptations.<br>• understand that adaptations allow an organism to succeed in a given environment.<br>• explain how different organisms use their unique adaptations to meet their needs.<br>• describe why certain communities exist in given habitats.<br>• illustrate the food webs in a local area.<br>• compare and contrast the niches of several different organisms within the community.<br>• 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.<br>• differentiate among positive and negative influences of human activity on ecosystems. |
| | 4.8 The student will investigate and understand the relationships among Earth, the moon, and the sun. Key concepts include<br>a) the motions of Earth, the moon, and the sun;<br>b) the causes for Earth's seasons;<br>c) the causes for the phases of the | In order to meet this standard, it is expected that students will<br>• differentiate between rotation and revolution.<br>• describe how Earth's axial tilt causes the seasons.<br>• model the formation of the eight moon phases, sequence the phases in |

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| | moon;<br>d) the relative size, position, age, and makeup of Earth, the moon, and the sun; and<br>e) historical contributions in understanding the Earth-moon-sun system. | order, and describe how the phases occur.<br>□ describe the major characteristics of the sun, including its approximate size, color, age, and overall composition.<br>□ create and describe a model of the Earth-moon-sun system with approximate scale distances and sizes.<br>□ compare and contrast the surface conditions of Earth, the moon, and the sun.<br>□ compare and contrast an Earth-centered to the sun-centered model of the solar system.<br>□ analyze the differences in what Aristotle, Ptolemy, Copernicus, and Galileo observed and what influenced their conclusions.<br>□ describe a contribution of the NASA Apollo missions to our understanding of our moon. |
| | 4.7 The student will investigate and understand the organization of the solar system. Key concepts include<br>a) the planets in the solar system;<br>b) the order of the planets in the solar system; and<br>c) the relative sizes of the planets | In order to meet this standard, it is expected that students will<br>□ name the eight planets and describe whether they are a terrestrial planet or a gas giant.<br>□ sequence the eight planets in the solar system based on their position from the sun. (Mercury is the first from the sun, Venus is the second, etc.)<br>□ sequence the eight planets in the solar system based on size (Jupiter is the largest, Saturn is next, etc.)<br>□ construct a simple model of the sun and the planets in our solar system. |
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| 3rd Nine Weeks<br>4.1 – Emphasis on c-e, i-m<br>4.6<br>4.9 | 4.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which<br>a) distinctions are made among observations, conclusions, inferences, and predictions;<br>b) objects or events are classified and arranged according to characteristics or properties; | In order to meet this standard, it is expected that students will<br>□ differentiate among simple observations, conclusions, inferences, and predictions, and correctly apply the terminology in oral and written work.<br>□ analyze a set of 20 or fewer objects or pictures. Sort them into categories to organize the data (qualitative or quantitative); and construct bar graphs and line graphs |

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| | c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units;<br>d) appropriate instruments are selected and used to measure elapsed time;<br>e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;<br>f) independent and dependent variables are identified;<br>g) constants in an experimental situation are identified;<br>h) hypotheses are developed as cause and effect relationships;<br>i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;<br>j) numerical data that are contradictory or unusual in experimental results are recognized;<br>k) data are communicated with simple graphs, pictures, written statements, and numbers;<br>l) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and<br>m) current applications are used to reinforce science concepts | depicting the distribution of those data based on characteristics or properties.<br>• use millimeters, centimeters, meters, kilometers, grams, kilograms, milliliters, liters, and degrees Celsius in measurement.<br>• choose the appropriate instruments, including centimeter rulers, meter sticks, scales, balances, graduated cylinders, beakers, and Celsius thermometers, for making basic metric measures.<br>• measure elapsed time using a stopwatch or a clock.<br>• make predictions, inferences, and draw conclusions using a variety of sources such as picture graphs, bar graphs, and basic line graphs.<br>• analyze the variables in a simple experiment. Identify the independent variable and the dependent variable. Decide which other variable(s) must be held constant (not allowed to change) in order for the investigation to represent a fair test.<br>• create a plausible hypothesis, stated in terms of cause (if) and effect (then), from a set of basic observations that can be tested. Hypotheses can 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.<br>• organize and analyze data from a simple experiment. Construct bar graphs and line graphs depicting the data.<br>• judge which, if any, data in a simple set of results (generally 10 or fewer in number) appear to be contradictory or unusual.<br>• present results of a simple experiment using graphs, pictures, statements, and numbers.<br>• construct a physical model to clarify an explanation, demonstrate a relationship, or solve a need. |
| | 4.6 The student will investigate and understand how weather conditions and phenomena occur and can be | In order to meet this standard, it is expected that students will<br>• design an investigation in which a |

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| | predicted. Key concepts include<br>a) weather phenomena;<br>b) weather measurements and meteorological tools; and<br>c) use of weather measurements and weather phenomena to make weather predictions. | thermometer is used to compare air temperatures over a period of time.<br>□ analyze the changes in air pressure occurring over time, using a barometer, and predict what the changes mean in terms of changing weather patterns.<br>□ illustrate and label high and low pressures on a map.<br>□ 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.<br>□ differentiate between cloud types (i.e., cirrus, stratus, cumulus, and cumulo-nimbus clouds) and the associated weather.<br>□ compare and contrast the formation of different types of precipitation (e.g., rain, snow, sleet, and hail).<br>□ recognize a variety of storm types, describe the weather conditions associated with each, and explain when they occur (e.g., thunderstorms, hurricanes, and tornadoes).<br>□ analyze and report information about temperature and precipitation on weather maps.<br>□ measure wind speed, using an anemometer.<br>□ measure precipitation with a rain gauge.<br>□ design an investigation in which weather data are gathered using meteorological tools and charted to make weather predictions. |
| | 4.9 The student will investigate and understand important Virginia natural resources. Key concepts include<br>a) watersheds and water resources;<br>b) animals and plants;<br>c) minerals, rocks, ores, and energy sources; and<br>d) forests, soil, and land. | In order to meet this standard, it is expected that students will<br>□ compare and contrast natural and human-made resources.<br>□ distinguish among rivers, lakes, and bays; describe characteristics of each; and name an example of each in Virginia.<br>□ create and interpret a model of a watershed. Evaluate the statement: ―We all live downstream.‖<br>□ identify watershed addresses.<br>□ recognize the importance of Virginia's mineral resources, |

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| | | including coal, limestone, granite, and sand and gravel.<br> appraise the importance of natural and cultivated forests in Virginia.<br> describe a variety of soil and land uses important in Virginia. |
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| 4th Nine Weeks<br>4.1 – On-going<br>4.2<br>4.3<br>Review 4.1-4.9 | 4.2 The student will investigate and understand characteristics and interactions of moving objects. Key concepts include<br>a) motion is described by an object's direction and speed;<br>b) changes in motion are related to force and mass;<br>c) friction is a force that opposes motion; and<br>d) moving objects have kinetic energy. | In order to meet this standard, it is expected that students will<br> describe the position of an object.<br> collect and display in a table and line graph time and position data for a moving object.<br> explain that speed is a measure of motion.<br> interpret data to determine if the speed of an object is increasing, decreasing, or remaining the same.<br> identify the forces that cause an object's motion.<br> describe the direction of an object's motion: up, down, forward, backward.<br> infer that objects have kinetic energy.<br> design an investigation to test the following hypothesis: ―If the mass of an object increases, then the force needed to move it will increase.‖<br> design an investigation to determine the effect of friction on moving objects. Write a testable hypothesis and identify the dependent variable, the independent variable, and the constants. Conduct a fair test, collect and record the data, analyze the data, and report the results of the data. |
| | 4.3 The student will investigate and understand the characteristics of electricity. Key concepts include<br>a) conductors and insulators;<br>b) basic circuits;<br>c) static electricity;<br>d) the ability of electrical energy to be transformed into light and motion, and to produce heat;<br>e) simple electromagnets and magnetism; and<br>f) historical contributions in understanding electricity. | In order to meet this standard, it is expected that students will<br> apply the terms insulators, conductors, open and closed in describing electrical circuits.<br> differentiate between an open and closed electric circuit.<br> use the dry cell symbols (–) and (+).<br> create and diagram a functioning series circuit using dry cells, wires, switches, bulbs, and bulb holders.<br> create and diagram a functioning |

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| | | parallel circuit using dry cells, wires, switches, bulbs, and bulb holders.<br>□ differentiate between a parallel and series circuit.<br>□ describe the types of energies (i.e., thermal, radiant, and mechanical) that are transformed by various household appliances (e.g., lamp, toaster, fan).<br>□ create a diagram of a magnetic field using a magnet.<br>□ compare and contrast a permanent magnet and an electromagnet.<br>□ explain how electricity is generated by a moving magnetic field.<br>□ design an investigation using static electricity to attract or repel a variety of materials.<br>□ explain how static electricity is created and occurs in nature.<br>□ construct a simple electromagnet using a wire, nail, or other iron-bearing object, and a dry cell.<br>□ design and perform an investigation to determine the strength of an electromagnet. (The independent variable could be the number of coils of wire and the dependent variable could be the number of paperclips the magnet can attract.)<br>□ describe the contributions of Ben Franklin, Michael Faraday, and Thomas Edison to the understanding and harnessing of electricity |
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