



Science Standards of Learning Curriculum Framework

Appendix

Commonwealth of Virginia
Board of Education
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APPENDIX Science Skill Scope and Sequence

OBSERVING:

To perceive, using one or more of the senses

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic” Strand
Kindergarten	a) basic properties of objects are identified by direct observation b) observations are made from multiple positions to achieve different perspectives
1st Grade	a) differences in physical properties are observed using the senses b) simple tools are used to enhance observations
2nd Grade	a) observation is differentiated from personal interpretation, and conclusions are drawn based on observations b) observations are repeated to ensure accuracy
3rd Grade	a) predictions and observations are made [repeated under PREDICTING]
4th Grade	a) distinctions are made among observations, conclusions, inferences, and predictions [repeated under PREDICTING]
5th Grade	
6th Grade	a) observations are made involving fine discrimination between similar objects and organisms
Life Science	
Physical Science	
Earth Science	
Biology	a) observations of living things are recorded in the lab and in the field
Chemistry	
Physics	b) instruments are selected and used to extend observations and measurements of mass, volume, temperature, heat exchange, energy transformations, motion, fields, and electric charge [repeated under MEASURING]

CLASSIFYING AND SEQUENCING:

To arrange or distribute objects, events, or ideas according to some method or system

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic“ Strand
Kindergarten	d) a set of objects is sequenced according to size e) a set of objects is separated into two groups based on a single physical attribute
1st Grade	c) objects or events are classified and arranged according to attributes or properties
2nd Grade	c) two or more attributes are used to classify items
3rd Grade	b) objects with similar characteristics are classified into at least two sets and two subsets k) natural events are sequenced chronologically
4th Grade	
5th Grade	a) rocks, minerals, and organisms are identified using a classification key
6th Grade	b) a classification system is developed based on multiple attributes
Life Science	
Physical Science	
Earth Science	
Biology	
Chemistry	
Physics	

COMMUNICATING:

To gather, record, and transmit qualitative or quantitative information, including defining operationally; using expert, print, and electronic resources; gathering, charting, recording, and graphing data; and presenting information in standard written narrative, oral, audiovisual, and electronic formats

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic” Strand
Kindergarten	c) objects are described both pictorially and verbally h) picture graphs are constructed using 10 or fewer units
1st Grade	d) observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers
2nd Grade	f) picture and bar graphs are constructed using numbered axes
3rd Grade	g) data are gathered, charted, and graphed (line plot, picture graph, and bar graph)
4th Grade	f) data are displayed using bar and basic line graphs
5th Grade	e) data are collected, recorded, and reported using the appropriate graphical representation (graphs, charts, diagrams)
6th Grade	i) data are organized and communicated through graphical representation (graphs, charts, and diagrams)
Life Science	a) data are organized into tables showing repeated trials and means
Physical Science	d) triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and spring scales are used to gather data [repeated under MEASURING] e) numbers are expressed in scientific notation where appropriate f) research skills are utilized using a variety of resources m) experimental results are presented in appropriate written form
Earth Science	c) scales, diagrams, maps, charts, graphs, tables, and profiles are constructed and interpreted [repeated under MODELING]
Biology	i) appropriate technology including computers, graphing calculators, and probeware, is used for gathering and analyzing data and communicating results [repeated under ANALYZING DATA] j) research utilizes scientific literature
Chemistry	
Physics	a) the components of a system are defined c) information is recorded and presented in an organized format .2a) a description of a physical problem is translated into a mathematical statement in order to find a solution (repeated under ANALYZING DATA)

MEASURING:

To develop a comparative or quantitative description of properties such as mass, length, volume, and temperature

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic” Strand
Kindergarten	f) nonstandard units are used to measure common objects
1st Grade	e) length, mass, and volume are measured using standard and nonstandard units
2nd Grade	e) length, volume, mass, and temperature measurements are made in metric units (centimeters, meters, liters, degrees Celsius, grams, kilograms) and standard English units (inches, feet, yards, cups, pints, quarts, gallons, degrees Fahrenheit, ounces, pounds)
3rd Grade	e) length is measured to the nearest centimeter f) mass is measured to the nearest gram d) volume is measured to the nearest milliliter and liter h) temperature is measured to the nearest degree Celsius i) time is measured to the nearest minute
4th Grade	e) appropriate metric measures are used to collect, record, and report data d) appropriate instruments are selected to measure linear distance, volume, mass, and temperature
5th Grade	c) appropriate instruments are selected and used for making quantitative observations of length, mass, volume, and elapsed time d) accurate measurements are made using basic tools (thermometer, meter stick, balance, graduated cylinder)
6th Grade	c) precise and approximate measurements are recorded h) data are collected, recorded, analyzed, and reported using appropriate metric measurement
Life Science	c) metric units (SI — International System of Units) units are used
Physical Science	b) length, mass, volume, density, temperature, weight, and force are accurately measured and reported using metric units (SI — International System of Units) c) conversions are made among metric units, applying appropriate prefixes d) triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and spring scales are used to gather data [repeated under COMMUNICATING]
Earth Science	a) volume, area, mass, elapsed time, direction, temperature, pressure, distance, density, and changes in elevation/depth are calculated utilizing the most appropriate tools
Biology	
Chemistry	g) ...SI units...[are used]

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic” Strand
Physics	b) instruments are selected and used to extend observations and measurements of mass, volume, temperature, heat exchange, energy transformations, motion, fields, and electric charge [repeated under OBSERVING] d) metric units are used in all measurements and calculations g) data gathered from non-SI instruments are incorporated through appropriate conversions

PREDICTING:

To forecast a possible result on the basis of information acquired from systematic observations, scientific principles, and laws

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic” Strand
Kindergarten	i) an unseen member in a sequence of objects is predicted
1st Grade	f) predictions are based on patterns of observation rather than random guesses
2nd Grade	
3rd Grade	a) predictions and observations are made
4th Grade	a) distinctions are made among observations, conclusions, inferences, and predictions [repeated under OBSERVING] h) predictions are made based on data from picture graphs, bar graphs, and basic line graphs [repeated under ANALYZING DATA]
5th Grade	f) predictions are made using patterns, and simple graphical data are extrapolated [repeated under ANALYZING DATA] b) estimations of length, mass, and volume are made
6th Grade	f) a method is devised to test the validity of predictions and inferences d) scale models are used to estimate distance, volume, and quantity [repeated under MODELING]
Life Science	h) continuous line graphs are constructed, interpreted, and used to make predictions [repeated under ANALYZING DATA]
Physical Science	
Earth Science	
Biology	
Chemistry	
Physics	.2d) interpolated, extrapolated, and analyzed trends are used to make predictions [repeated under ANALYZING DATA]

HYPOTHESIZING:

To make a testable prediction about the relationship between variables in a system

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic” Strand
Kindergarten	g) a question is developed from one or more observations
1st Grade	
2nd Grade	d) conditions that influence a change are defined
3rd Grade	c) questions are developed to formulate hypotheses
4th Grade	b) hypotheses are formulated based on cause-and-effect relationships
5th Grade	
6th Grade	e) hypotheses are stated in ways that identify the independent (manipulated) and dependent (responding) variables
Life Science	g) variables are controlled to test hypotheses, and trials are repeated [repeated under USING VARIABLES]
Physical Science	
Earth Science	
Biology	b) hypotheses are formulated based on direct observations and information from the scientific literature
Chemistry	
Physics	

INFERRING:

To derive a reasoned conclusion based on verifiable evidence and systematic observations

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic” Strand
Kindergarten	
1st Grade	h) inferences are made and conclusions are drawn about familiar objects and events
2nd Grade	b) observation is differentiated from personal interpretation, and conclusions are drawn based on observations [repeated under OBSERVING]
3rd Grade	j) inferences are made and conclusions are drawn
4th Grade	a) distinctions are made among observations, conclusions, inferences, and predictions [repeated under PREDICTING]
5th Grade	
6th Grade	f) a method is devised to test the validity of predictions and inferences [repeated under USING VARIABLES]
Life Science	
Physical Science	k) valid conclusions are made after analyzing data [repeated under ANALYZING DATA]
Earth Science	
Biology	e) conclusions are formed based on recorded quantitative and qualitative data
Chemistry	
Physics	

USING VARIABLES IN EXPERIMENTATION:

To change one variable intentionally under controlled conditions

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic” Strand
Kindergarten	
1st Grade	g) simple experiments are conducted to answer questions
2nd Grade	
3rd Grade	
4th Grade	c) variables that must be held constant in an experimental situation are defined
5th Grade	g) manipulated and responding variables are identified
6th Grade	g) one variable is manipulated over time, using many repeated trials
Life Science	b) variables are defined e) sources of experimental error are identified f) dependent variables, independent variables, and constants are identified g) variables are controlled to test hypotheses, and trials are repeated
Physical Science	g) independent and dependent variables, constants, controls, and repeated trials are identified l) research methods are used to investigate practical problems and questions
Earth Science	d) variables are manipulated with repeated trials
Biology	c) variables are defined and investigations are designed to test hypotheses
Chemistry	a) designated laboratory techniques d) manipulation of multiple variables, using repeated trials
Physics	e) the limitations of the experimental apparatus and design are recognized f) the limitations of measured quantities are recognized through the appropriate use of significant figures or error ranges

DESIGNING, CONSTRUCTING, AND INTERPRETING MODELS:

To build a mental or physical representation of an idea for explanation and interpretation

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic” Strand
Kindergarten	
1st Grade	
2nd Grade	h) simple physical models are constructed
3rd Grade	
4th Grade	
5th Grade	
6th Grade	d) scale models are used to estimate distance, volume, and quantity [repeated under PREDICTING] j) models are designed to explain a sequence
Life Science	d) models are constructed to illustrate and explain phenomena
Physical Science	
Earth Science	b) technologies, including computers, probeware, and global positioning systems (GPS), are used to collect analyze, and report data and to demonstrate concepts and simulate experimental conditions [repeated under ANALYZING DATA] c) scales, diagrams, maps, charts, graphs, tables, and profiles are constructed and interpreted [repeated under COMMUNICATING]
Biology	k) differentiation is made between a scientific hypothesis and theory
Chemistry	
Physics	.2a) a description of a physical problem is translated into a mathematical statement in order to find a solution [repeated under ANALYZING DATA]

INTERPRETING, ANALYZING, AND EVALUATING DATA:

To explain information, determine its essential features and meaning, and critically judge which data are meaningful or useful to the matter being studied

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic” Strand
Kindergarten	j) unusual or unexpected results in an activity are recognized
1st Grade	
2nd Grade	g) unexpected or unusual quantitative data are recognized
3rd Grade	
4th Grade	h) predictions are made based on data from picture graphs, bar graphs, and basic line graphs [repeated under PREDICTING] g) numerical data that are contradictory or unusual in experimental results are recognized
5th Grade	f) predictions are made using patterns, and simple graphical data are extrapolated [repeated under PREDICTING]
6th Grade	f) a method is devised to test the validity of predictions and inferences
Life Science	h) continuous line graphs are constructed, interpreted, and used to make predictions [repeated under PREDICTING] i) interpretations from a set of data are evaluated and defended
Physical Science	h) data tables showing the independent and dependent variables, derived quantities, and the number of trials are constructed and interpreted; i) data tables for descriptive statistics showing specific measures of central tendency, the range of the data set, and the number of repeated trials are constructed and interpreted; j) frequency distributions, scattergrams, line plots, and histograms are constructed and interpreted k) valid conclusions are made after analyzing data
Earth Science	b) technologies including computers, probeware, and global positioning systems (GPS), are used to collect, analyze, and report data and to demonstrate concepts and simulate experimental conditions [repeated under MODELING] e) a scientific viewpoint is constructed and defended (the nature of science)

Grade/Subject	Skill statements from the “Scientific Investigation, Reasoning, and Logic” Strand
Biology	<ul style="list-style-type: none"> d) graphing and arithmetic calculations are used as tools in data analysis e) conclusions are formed based on recorded quantitative and qualitative data [repeated under INFERRING] f) sources of error inherent in experimental design are identified and discussed g) validity of data is determined l) alternative scientific explanations and models are recognized and analyzed i) appropriate technology including computers, graphing calculators, and probeware, is used for gathering and analyzing data and communicating results [repeated under COMMUNICATING]
Chemistry	<ul style="list-style-type: none"> e) accurate recording, organizing, and analysis of data through repeated trials f) mathematical and procedural error analysis g) mathematical manipulations (SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, dimensional analysis) h) use of appropriate technology including computers, graphing calculators, and probeware, for gathering data and communicating results i) the use of appropriate technology including computers, graphing calculators, and probeware, for gathering data and communicating results
Physics	<ul style="list-style-type: none"> .2a) a description of a physical problem is translated into a mathematical statement in order to find a solution [repeated under MODELING] .2b) relationships between physical quantities are determined using the shape of a curve passing through experimentally obtained data .2c) the slope of a linear relationship is calculated and includes appropriate units .2d) interpolated, extrapolated, and analyzed trends are used to make predictions .2e) analysis of systems employs vector quantities utilizing trigonometric and graphical methods .1h) appropriate technology including computers, graphing calculators, and probeware, is used for gathering and analyzing data and communicating results