



Test Framework

General Curriculum (827/828)

December 2024

SUBTEST 1: LANGUAGE ARTS AND HISTORY/SOCIAL SCIENCE

Multiple Choice

Subarea	Range of Objectives	Approximate Percentage of Test Score
I. Language Arts	0001–0004	30%
II. History/Social Science	0005–0009	60%
Total	0001–0009	90%

Open Response

Subarea	Range of Objectives	Approximate Percentage of Test Score
III. Integration of Knowledge and Understanding	0010	10%

SUBTEST 2: MATHEMATICS, SCIENCE, AND TECHNOLOGY/ENGINEERING
Multiple Choice

Subarea	Range of Objectives	Approximate Percentage of Test Score
IV. Mathematics	0011–0015	48%
V. Science and Technology/Engineering	0016–0019	42%
Total	0011–0019	90%

Open Response

Subarea	Range of Objectives	Approximate Percentage of Test Score
VI. Integration of Knowledge and Understanding	0020	10%

SUBTEST 1: LANGUAGE ARTS AND HISTORY/SOCIAL SCIENCE**LANGUAGE ARTS**

0001: Apply knowledge of major genres and works of literature, including literature written for children, that represent a range of perspectives, with regard to gender; race; ethnicity; diversity of ability; sexual orientation; nation of origin; religion; age; and cultural, economic, and geographic backgrounds.

- Demonstrate knowledge of the characteristics of different genres and types of literature (e.g., poetry, drama, folktales, myths, fables) and their characteristic elements (e.g., plot, character, setting, theme, voice, point of view, repetition, rhyme, meter) and structural elements (e.g., paragraph, sentence, stanza, verse, scene, act, cast of characters, stage directions, soliloquy, dialogue, script).
- Apply knowledge of the theme or central idea of a text and how it develops over the course of the text.
- Apply knowledge of how and why individuals, events, and ideas develop and interact over the course of a text.
- Apply knowledge of how to interpret the meaning of words and phrases as they are used in grade-specific texts and content.
- Apply knowledge of figurative language (e.g., similes and metaphors in context), word relationships, and nuances in word meanings.
- Demonstrate knowledge of how to integrate and evaluate content presented in diverse formats and media.
- Apply knowledge of how to analyze two or more texts that address similar themes or topics in order to build knowledge or to compare the authors' approaches.
- Demonstrate knowledge of criteria for evaluating children's literature for classroom use according to the dimensions of text complexity and other factors (e.g., students' reading ability and interests; multiple genres; depiction of diverse cultures, perspectives, and time periods).

0002: Apply knowledge of informational texts.

- Apply knowledge of types of informational texts (e.g., autobiography, biography, literary nonfiction, editorials, speeches, technical texts) and informational text structures (e.g., chronological, cause/effect, comparison/contrast, problem/solution).
- Apply knowledge of how to use informational text features and search tools (e.g., headings, table of contents, glossary, captions, bold print, subheadings, sidebars, electronic menus, icons, key words, hyperlinks) to locate specific information efficiently.
- Apply knowledge of how to interpret information presented visually and quantitatively (e.g., in charts, graphs, diagrams, and timelines) in informational texts.
- Apply knowledge of author's point of view and purpose in informational texts and how the author acknowledges and responds to conflicting evidence or viewpoints.
- Apply knowledge of how to identify central idea(s) and how it/they develop over the course of the text.
- Apply knowledge of how to trace and evaluate the argument and specific claims in informational texts, including how to assess whether reasoning is sound and whether evidence is relevant and sufficient and how to recognize irrelevant information presented as evidence.
- Apply knowledge of how to use textual evidence to analyze what informational texts say explicitly and to draw inferences from informational texts.
- Apply knowledge of how to determine the meaning of grade-appropriate general academic and domain-specific words and phrases as they are used in informational texts.

0003: Apply knowledge of the characteristics of effective writing and research.

- Apply knowledge of techniques for composing opinion pieces and arguments by introducing an opinion or claim(s), supporting the opinion or claim(s) with clear reasons and evidence, logically grouping related ideas, using linking words and phrases, and providing a concluding statement that follows from and supports the opinion or argument presented.
- Apply knowledge of techniques for composing informative and explanatory texts by introducing a topic; developing the topic with logically organized and relevant facts; using precise language and domain-specific vocabulary, definitions, quotations, and examples; using formatting and multimedia to aid comprehension; and providing a conclusion that follows from the information or explanation presented.
- Apply knowledge of techniques for composing narratives by orienting the reader (e.g., introducing a narrator and/or characters, describing the setting, establishing a conflict); using narrative techniques (e.g., dialogue, pacing, description) to develop experiences, events, and/or characters; using sensory details; using precise words and phrases and relevant descriptive details to convey a tone and to convey experiences or events; and providing a conclusion that follows from and reflects on the narrated experiences or events.
- Apply knowledge of techniques for conducting research, including developing a research question; gathering relevant information from multiple print and digital sources; evaluating sources for accuracy, bias, credibility, and reliability; and citing sources accurately and responsibly.
- Apply knowledge of techniques for producing clear and coherent writing in which development, organization, and style are appropriate to task, purpose, and audience.
- Apply knowledge of strategies for developing and strengthening writing by planning, revising, editing, rewriting, or trying a new approach.
- Apply knowledge of the conventions of standard English grammar and usage when writing.
- Apply knowledge of the conventions of standard English capitalization, punctuation, and spelling when writing.
- Demonstrate knowledge of strategies for using technology, including current web-based communication platforms, to interact and collaborate with others to generate, revise, edit, produce, and publish writing.
- Demonstrate knowledge of selecting appropriate evidence from grade-level literary or informational texts to support written analysis, interpretation, reflection, and research.

0004: Demonstrate knowledge of techniques for speaking and/or expressive communication and listening and/or receptive communication to use in a variety of contexts.

- Demonstrate knowledge of language, including standard English when appropriate, and language conventions and how to adapt speech to a variety of contexts and tasks when speaking or listening.
- Demonstrate knowledge of techniques for presenting information, findings, and supporting evidence in a way that supports listeners' ability to follow a line of reasoning (e.g., using diverse media formats and visual displays to express information).
- Demonstrate knowledge of techniques for presenting information, findings, and supporting evidence such that organization, development, vocabulary, and style are appropriate to task, purpose, and audience.
- Demonstrate knowledge of techniques for initiating and participating in a range of collaborative discussions with diverse partners by building on others' ideas and by expressing one's own ideas clearly and persuasively.

HISTORY/SOCIAL SCIENCE

0005: Apply knowledge of basic economics, physical and human geography, and the relationships between geography and culture.

- Apply knowledge of the basic economic concepts of scarcity, choice, needs, wants, goods, services, income, and voluntary exchange.
- Analyze the relationships between natural resources, human resources, industries, jobs, and economic activities.
- Analyze factors that affect people's decisions about saving and using resources and buying goods and services.
- Demonstrate the ability to read, analyze, and interpret maps (e.g., cardinal directions, scales, legends, titles); distinguish physical and political maps; and compare various map projections (e.g., Mercator, Peters).
- Examine human interaction with the environment, including the effects of physical geographic features, climate, and natural resources on settlement patterns, the growth of major urban/suburban areas, and trade.
- Analyze patterns of human settlement and movement, including voluntary migration and forced migration (e.g., refugees, people driven from their homelands, enslaved people).
- Examine the ways in which complex societies interact and spread from one region to another (e.g., by trade, cultural or linguistic exchanges, migration, conquest, colonization, religious conversion).
- Demonstrate knowledge of the geography of North America and the world, including physical features such as bodies of water, rivers, mountain ranges, deserts, and political demarcations (e.g., national boundaries, state and provincial borders).
- Analyze the diverse cultural nature of the regions of the United States (i.e., Northeast, Southeast, Midwest, Southwest, and West), including contributions by all peoples that have had impacts on the regions, including Native Peoples, African Americans, Europeans, Asians, Latinx people, and immigrants from other regions of the world.

0006: Apply knowledge of major political, economic, social, cultural, and technological developments in world history to 1700 CE.

- Demonstrate knowledge of human origins and early societies (e.g., African origins, early migrations, Neolithic agricultural revolution, complex societies).
- Demonstrate knowledge of the political, social, cultural, and economic characteristics and historical development of the early societies of the areas now known as Western Asia, the Middle East, and North Africa (e.g., Mesopotamia, Egypt, Nubia, Phoenicia, Israel and Palestine).
- Demonstrate knowledge of the political, social, cultural, and economic characteristics and historical development of the early societies of the area now known as Sub-Saharan Africa (e.g., Axum, Songhai, Swahili coastal societies, Ghana, Mali).
- Demonstrate knowledge of the political, social, cultural, and economic characteristics and historical development of the early societies of the areas now known as Central and South Asia (e.g., Indus Valley civilization, Mauryan Empire, Gandharan Kingdom, Kushan Empire, Gupta Empire, Persian Empire) and East Asia (e.g., the Shang, Zhou, Qin, Song, and Yuan dynasties of China; the Mongol Empire; the Kamakura shogunate; ancient Korea).
- Demonstrate knowledge of the political, social, cultural, and economic characteristics and historical development of the early societies of the areas now known as Southeast Asia and Oceania (e.g., Khmer Empire, Aborigines, Maoris).
- Demonstrate knowledge of the political, social, cultural, and economic characteristics and historical development of the early societies of the areas now known as South and Central America (e.g., Maya, Olmec, Teotihuacán, Zapotec, Toltec, Chavín, Nazca, Moche, Lenca, Huetares, Chorotegas, Miskito) and the Caribbean Islands (e.g., Arawak, Taino, Carib).
- Demonstrate knowledge of the political, social, cultural, and economic characteristics and historical development of the early societies in the area now known as Europe (e.g., Celtic societies, Minoan and Mycenaean societies, ancient Greece, Roman Empire and Republic, Islamic Empire).
- Analyze the types of interactions between ancient societies (e.g., conquest; trade; colonization; diffusion of religion, language, and culture) and their effects on those societies.
- Apply knowledge of competing theories of the origins of Native Peoples and identify archaeological evidence of the political, social, cultural, and economic characteristics of major societies of North America.

- Evaluate reasons for early European exploration of North and South America, and analyze the nature of the contacts between European explorers and Native Peoples.
- Examine the relationship of European settlers to the Native Peoples of the Americas in the seventeenth and eighteenth centuries, the great loss of life due to diseases introduced by Europeans to Native populations, the loss of territory by Native Peoples, and the conflicts between the two groups.

0007: Apply knowledge of the history of the United States.

- Analyze the diversity of Native Peoples, present and past, in the New England region (e.g., names and locations of tribal territories, physical geographic features and their influence on locations of traditional settlements, contributions of tribal groups).
- Demonstrate knowledge the formation of the original thirteen English colonies in what is now the United States.
- Analyze the origins of slavery in what is now known as the United States, its legal status in the colonies through the eighteenth century, and the prevalence of slave ownership, including by many of the country's early leaders.
- Demonstrate knowledge of the Triangular Trade and the conditions of transatlantic voyages (called the Middle Passage) for enslaved Africans.
- Demonstrate knowledge of the living and working conditions of enslaved and free Africans in the colonies in the eighteenth century and of how some enslaved people sought their freedom.
- Analyze the causes, events, and results of the American Revolution, including the events that led to the Revolution; battles and actions of the Revolutionary War; the role of Native Peoples, African Americans, and women; consequences of the Revolution; and significant historical figures of that period (e.g., Samuel Adams, Crispus Attucks, John Hancock, James Otis, Paul Revere, John and Abigail Adams, Mercy Otis Warren, Phillis Wheatley, Peter Salem).
- Analyze the growth and expansion of the United States through territorial acquisition; wars; trade, transportation innovations, and public works; and human migration (e.g., immigration, westward expansion, the Trail of Tears).
- Examine nineteenth-century conflicts between Native Peoples and national, state, and local governments in the United States over land ownership, loss of territory, and rights to self-government.
- Analyze why the United States is called "a nation of immigrants," identify the significant impacts of migration and the elements that define the culture of a society, and examine how a community is enriched by contributions from all the people who form it today.
- Examine the ideas and roles of the people of the pre-Civil War era who led the struggle for the abolition of slavery and for voting and property rights for African Americans (e.g., Harriet Tubman, Nat Turner, Sojourner Truth, Frederick Douglass, William Lloyd Garrison, Harriet Beecher Stowe).
- Examine the causes, events, and consequences of the Civil War, including the events that preceded the war, central figures of the war, major battles of the war, and the important consequences of the conflict.

- Analyze the consequences of the Emancipation Proclamation and the Thirteenth, Fourteenth, and Fifteenth Amendments of the U.S. Constitution, and demonstrate knowledge of the living conditions for African Americans following the Civil War and during the Jim Crow era (e.g., limited educational and economic opportunities, separate public facilities, white supremacist beliefs and organizations, violence from the Ku Klux Klan and other groups).
- Demonstrate knowledge of the causes, challenges, and effects of the struggle for civil rights of African Americans, women, and others in the United States, including key events, people, organizations, and legislation (e.g., the 1963 March on Washington, efforts to desegregate schools, Martin Luther King Jr., Bayard Rustin, Gloria Steinem, Lorraine Hansberry, César Chávez, Thurgood Marshall, Ruth Bader Ginsburg, Civil Rights Act of 1964, Voting Rights Act of 1965, Title IX).
- Examine the relationships between the twentieth-century African American Civil Rights Movement and other movements for civil rights (e.g., the second phase of the women's movement in the 1960s and 1970s, the disability rights movement, the LGBTQ rights movement).

0008: Apply knowledge of the development, principles, structure, and functions of government in the United States.

- Demonstrate knowledge of the purposes of a government and how governments provide services, spend funds, protect rights, and provide community safety.
- Apply knowledge of the fundamental principles and values of political and civic life in the United States (e.g., liberty, the common good, justice, equality, tolerance, law and order, due process, rights of individuals, diversity, civic unity, patriotism, constitutionalism, popular sovereignty, representative democracy).
- Analyze the development of government, the role and structure of local government, and the ways in which people participate in and contribute to their communities.
- Demonstrate knowledge of the structure and responsibilities of federal, state, and local governments in the United States, including ways in which governments at various levels divide and share power.
- Analyze key ideas and principles in major documents that influenced the development of government in the United States, including documents that restrict rights (e.g., Declaration of Independence, Articles of Confederation, Iroquois Confederacy Constitution).
- Demonstrate knowledge of the reasons for the adoption of the Articles of Confederation, the weaknesses of the Articles as a plan for government, and the reasons for their failure.
- Demonstrate knowledge of the major issues debated by members of the Constitutional Convention and the political principles reflected in the U.S. Constitution, including the Preamble.
- Apply knowledge of the content of the Bill of Rights, including the restriction of full citizenship to white male property owners over the age of 21.
- Apply knowledge of key amendments to the U.S. Constitution (e.g., the Fourteenth, Nineteenth, and Twenty-sixth Amendments).
- Demonstrate knowledge of unifying symbols, phrases, and songs in the United States (e.g., the U.S. flag, E pluribus unum, "The Star-Spangled Banner").
- Demonstrate knowledge of the rights and responsibilities of U.S. citizens and residents (e.g., electing leaders who serve fixed terms, paying taxes, contributing to the community) and of the skills and dispositions necessary for participation in a democratic society (e.g., ability to make and support arguments, respect for others, capacity for listening).

0009: Apply knowledge of methods, procedures, and sources used in the study of history and social science and of the guiding principles and instructional practices of effective history and social science education.

- Demonstrate knowledge of the methods that are used cooperatively by archaeologists, historians, geographers, economists, and political scientists to analyze evidence, develop hypotheses, and construct interpretations about ancient and classical civilizations.
- Demonstrate knowledge of how different academic fields in the social sciences concentrate on different means of studying societies in the past and how current historical interpretation might build upon, extend, or reject an interpretation of the past.
- Analyze the relationship between a primary and secondary source on the same topic, and evaluate the bias, credibility, accuracy, and relevance of primary and secondary sources.
- Demonstrate the ability to interpret information and data from multiple primary and secondary sources presented in a variety of formats and media (e.g., charts, graphs, diagrams, timelines, photographs, videos, maps).
- Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally), and evaluate the motives (e.g., social, commercial, political) behind its presentation.
- Demonstrate knowledge of methods for gathering information from print and digital sources and of methods of reporting research findings.
- Identify purpose, point of view, and central ideas in primary and secondary sources, and distinguish fact from opinion.
- Demonstrate knowledge of how individual contexts and perspectives influence perceptions about history.
- Demonstrate the ability to critique evidence-based claims and reasoned arguments on social science topics.
- Demonstrate knowledge of effective instructional strategies that encourage honest and informed academic discussions about prejudice, racism, sexism, and/or bigotry in the past and present.
- Identify problematic narratives and instructional strategies that conflict with current historical scholarship and pedagogy and uphold racism, sexism, and/or bigotry.

INTEGRATION OF KNOWLEDGE AND UNDERSTANDING

0010: Prepare an organized, developed written analysis comparing the treatment of a specific history/social science topic in given primary and secondary sources.

- Determine and compare the main ideas or information presented in each source.
- Analyze and compare the purpose and point of view of each source.
- Integrate information and cite evidence from multiple sources to support comparison of primary and secondary sources.

SUBTEST 2: MATHEMATICS, SCIENCE, AND TECHNOLOGY/ENGINEERING**MATHEMATICS**

0011: Apply number theory, structures of numeration systems and operations, and arithmetic properties to the real number system using the Standards for Mathematical Practice.

- Identify developmental foundations and progressions related to the concept of number (e.g., counting, recognition of numerals, one-to-one correspondence, cardinality, comparing quantitative values, subitizing, conservation of number, number structures).
- Analyze the structures and properties of the base-ten numeration system, including interpretation and representation of place value.
- Distinguish between prime and composite numbers, and generate factors and multiples using prime factorization.
- Compare, sort, and order numbers, including fractions and decimals (e.g., on a number line).
- Apply rounding and estimating to whole numbers, decimals, and percentages, and judge the effect of those estimations on the results.
- Apply the properties of operations, and recognize relationships between operations (e.g., multiplication as repeated additions).
- Analyze strategies based on place value, properties of operations, and relationships between operations.
- Analyze and convert among various representations (e.g., graphic, pictorial, verbal) of numbers and of number operations.
- Evaluate and justify standard and nonstandard computational algorithms and computational strategies.
- Interpret multiple representations/models of addition, subtraction, multiplication, and division of whole numbers and decimals, and use these operations to evaluate expressions.
- Apply knowledge of areas of mathematical content (e.g., counting and cardinality, operations and algebraic thinking, number and operations in base ten), and identify strategies for integrating mathematics content across other content areas and into students' play and everyday lives.

- Model diverse real-world and scientific situations and solve corresponding mathematical problems involving whole numbers, decimals, fractions, and percentages.

0012: Apply properties and applications of fractions, ratios, rates, and proportions using the Standards for Mathematical Practice.

- Demonstrate knowledge of fractions as numbers (e.g., unit fraction, relative size, relation to the whole, relation to division).
- Interpret multiple representations of fractions (including mixed numbers), test for equivalency between and compare two or more fractions, and represent equivalent fractions.
- Apply and extend knowledge of procedures for adding, subtracting, multiplying, and dividing fractions, and justify why procedures for operations with fractions make sense.
- Apply rounding and estimating methods to expressions with fractions, and judge the effect of those estimations on the results.
- Analyze multiple representations for modeling operations involving fractions.
- Demonstrate knowledge of the connections between fractions, ratios, and rates.
- Apply ratio and rate concepts, and use ratio and rate language to describe relationships and situations.
- Analyze multiple representations of proportional relationships (e.g., equations, tape diagrams, double number lines, tables), and solve proportional relationships for a missing value.
- Apply proportional reasoning to calculate a percent, and use percents to find unknown values.
- Model diverse real-world and scientific situations and solve corresponding mathematical problems involving fractions, ratios, rates, and proportions (e.g., mixtures, speeds, scale factors, scale drawings).

0013: Apply knowledge of patterns, algebraic relationships, and functions using the Standards for Mathematical Practice.

- Apply properties of numbers and operations to interpret and explain relationships (e.g., the product of two even numbers is even).
- Interpret graphs that model diverse real-world situations, including those representing linear and nonlinear relationships.
- Apply the concepts of equality, equation, variable, and function to express relationships algebraically.
- Recognize, extend, and analyze patterns using a variety of representations (e.g., verbal, numeric, graphic, symbolic).
- Manipulate, simplify, and critique algebraic expressions using the properties of operations and relations.
- Solve equations and inequalities either to determine an unknown value or to express one variable in terms of another.
- Identify, calculate, and interpret features of linear relationships (e.g., slope, solutions to an equation, intercept values).
- Use algebra to solve word problems involving fractions, ratios, proportions, and percentages.
- Calculate and interpret the meaning of a rate of change, and analyze situations characterized by a constant rate of change.
- Model diverse real-world and scientific situations and solve corresponding mathematical problems involving algebraic expressions, equations, inequalities, and linear relations.

0014: Apply concepts of geometry using the Standards for Mathematical Practice.

- Identify and classify two- and three-dimensional figures according to their characteristics (e.g., sides, angles, faces, vertices, edges).
- Determine area and volume of composite figures by composition and decomposition using standard and nonstandard units.
- Justify area and volume formulas obtained through compositions and decompositions of unit squares or unit cubes, including formulas for the area of rectangles and volume of rectangular prisms.
- Calculate surface area and volume of common three-dimensional figures.
- Determine the measures of radius, diameter, circumference, and area of a circle, and recognize the relationships among these characteristics.
- Interpret and use nets representing three-dimensional figures.
- Classify and analyze figures in the coordinate plane using distance, slope, and parallel and perpendicular lines.
- Analyze the effects of translations, rotations, and reflections on figures in the coordinate plane.
- Classify angles and analyze relationships between related angles in polygons and intersecting lines.
- Model diverse real-world and scientific situations and solve corresponding mathematical problems involving two- and three-dimensional figures and coordinate geometry.

0015: Apply principles, concepts, and procedures related to measurement and data using the Standards for Mathematical Practice.

- Select appropriate units and methods of measurement for a given application (e.g., direct versus indirect measurement, relationship of a measurement to the size of the unit).
- Perform unit conversions within a measurement system.
- Model diverse real-world and scientific situations and solve corresponding mathematical problems involving money, length, perimeter, area, volume, mass, capacity, density, elapsed time, temperature, angles, and rates of change.
- Analyze the relationships between linear dimensions on measures of perimeter, area, and/or volume (e.g., the effect of changing the dimensions of a shape on its area, maximizing area by changing a dimension).
- Interpret and compare data represented in tables, charts, and graphs (e.g., picture graphs, bar graphs, dot plots, histograms, box plots, circle graphs).
- Calculate and analyze measures of central tendency (i.e., mean, median, and mode) and dispersion (i.e., range and interquartile range).
- Select appropriate graphs or numerical summaries to represent the distribution of categorical or numerical data, and compare data distributions in terms of differences in center, variability, and shape.
- Analyze sampling techniques used to collect data for diverse real-world and scientific situations.
- Develop and justify appropriate inferences, interpolations, and extrapolations from a set of data.
- Apply fundamental principles of probability, including analyzing simulations and probability models of diverse real-world and scientific situations.

SCIENCE AND TECHNOLOGY/ENGINEERING

0016: Apply knowledge of Earth and space science principles and the Science and Engineering Practices to interpret and analyze phenomena.

- Demonstrate knowledge of the solar system, including its structure and the relationships among objects in the solar system (e.g., the Moon's effect on Earth, the change of seasons, lunar phases).
- Demonstrate knowledge of the forces that shape Earth's surface (e.g., erosion, weathering, deposition, volcanism) and evidence of these forces.
- Recognize the structure and patterns of Earth's features (e.g., earthquake epicenters, deep-ocean trenches, mountain ranges, volcanoes, bodies of water), including analyzing Earth's features through maps and other models.
- Analyze the components and processes of the water cycle and where water is found on Earth (e.g., watersheds).
- Apply knowledge of the difference between weather and climate, of factors that affect weather and climate (e.g., proximity to large bodies of water, mountains, energy input from the Sun), of the patterns that predict typical weather in an area, and of tools (e.g., thermometer, rain gauge) and systematic methods for making quantitative observations of local weather conditions that describe patterns over time.
- Demonstrate knowledge of the effects of natural events (e.g., floods, hurricanes, blizzards, earthquakes, extreme heat, fires) and ways to predict, minimize, and mitigate these effects.
- Analyze the ways humans use their local and global renewable and nonrenewable resources, the impact of humans on the environment (e.g., pollution, climate change, deforestation), and ways to minimize that impact (e.g., reusing, recycling, or composting resources; reducing energy consumption; improving drinking water).
- Apply knowledge of the use of science and engineering practices in exploring and understanding content related to the Earth and space sciences, such as developing and using models, planning and safely conducting investigations, applying mathematical concepts, constructing explanations, and communicating and evaluating data and conclusions.

0017: Apply knowledge of life science principles and the Science and Engineering Practices to interpret and analyze phenomena.

- Identify the basic characteristics of life that distinguish organisms from nonliving things (e.g., cellular structure, growth, reproduction).
- Demonstrate knowledge of the basic structures of plants and animals (e.g., leaves, flowers, wings, eyes) and how body structures and systems (e.g., root, circulatory, digestive) interact to carry out essential functions of life (e.g., obtaining energy and nutrients, maintaining internal conditions, responding to stimuli).
- Identify the basic principles of heredity, and distinguish between inherited characteristics and characteristics influenced by interaction with the environment.
- Demonstrate knowledge of how species adapt and evolve over time as a result of differences in characteristics between individuals that can provide advantages in survival and reproduction, and demonstrate knowledge of the use of evidence (e.g., fossil record, anatomical similarities) to support arguments about changes in life-forms throughout the history of Earth and about evolutionary relationships between organisms.
- Analyze how organisms interact with one another and their environments, including ways in which the structures and behaviors of animals and plants help them survive and reproduce.
- Demonstrate knowledge of the cycling of matter and flow of energy between living and nonliving parts of an ecosystem, and analyze the interactions of organisms with their environment and interactions between organisms.
- Apply knowledge of the use of science and engineering practices in exploring and understanding content related to life science, such as developing and using models, planning and safely conducting investigations, applying mathematical concepts, constructing explanations, and communicating and evaluating data and conclusions.

0018: Apply knowledge of physical sciences principles and the Science and Engineering Practices to interpret and analyze phenomena.

- Demonstrate knowledge of the properties of materials and matter (e.g., color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, solubility), states of matter (i.e., liquid, solid, and gas) and changes in phase, and representations of matter and its interactions (e.g., the particle model).
- Demonstrate knowledge of pure substances, compounds, and mixtures and of physical changes and chemical reactions.
- Recognize forms of energy (e.g., heat, electrical, magnetic, sound, light, kinetic, potential) and that energy can change from one form to another and can transfer from place to place.
- Apply the basic concept of forces (e.g., gravitational, frictional, magnetic, applied) to the motion of objects.
- Demonstrate knowledge of gravitational forces and that gravitational forces between objects with mass are attractive and are only noticeable if one or both objects have a very large mass.
- Recognize changes in energy when objects collide, and relate the speed of an object to its energy.
- Apply the principles of the conservation of matter and energy (e.g., conservation of atoms during a reaction, conservation of energy when force is applied to an object).
- Apply knowledge of waves, including sound and light; methods of transferring energy and information by various types of waves (e.g., electromagnetic, mechanical) through various media; and wave phenomena (e.g., reflection, absorption, transmittal) in everyday life.
- Apply knowledge of the use of science and engineering practices in exploring and understanding content related to the physical sciences, such as developing and using models, planning and safely conducting investigations, applying mathematical concepts, constructing explanations, and communicating and evaluating data and conclusions.

0019: Apply knowledge of engineering principles and practices to interpret and analyze design problems.

- Demonstrate knowledge of the processes of engineering design (i.e., defining problems; developing and using models; planning and carrying out investigations; analyzing and interpreting data; using mathematics and computational thinking; constructing explanations and designing solutions; engaging in argument from evidence; and obtaining, evaluating, and communicating information).
- Recognize the relationship between the use of a material (e.g., metal, plastic, wood) and the material's physical and chemical properties (e.g., flexibility, ductility, thermal conductivity, electrical conductivity, melting point).
- Apply knowledge of how to identify a design problem and communicate design solutions, including making improvements to existing designs.
- Demonstrate knowledge of how to apply engineering design practices to define a problem and to identify the criteria and constraints (e.g., materials, time, cost) associated with the problem.
- Recognize the selection and appropriate and safe use of tools for a design solution, including measuring tools, hand tools, fasteners, and common handheld power tools in a variety of contexts, including manufacturing processes, engineering projects, and daily activities.
- Apply knowledge of the iterative design process, including testing, comparing design solutions, analyzing the impact of design solutions on society, and modifying design solutions to improve a prototype in a real-world context.

INTEGRATION OF KNOWLEDGE AND UNDERSTANDING

0020: Prepare an organized, developed analysis of a scenario that integrates science/engineering and mathematics content and practices.

- Analyze a description or model of a situation involving a scientific phenomenon, an investigation, or an engineering design problem.
- Apply appropriate mathematical knowledge and skills to the given situation (e.g., to select appropriate units of measurement; to apply geometry concepts; to summarize, interpret, and/or analyze data; to model relationships with tables, graphs, and equations; to verify quantifiable data).