MIDDLE GRADES GENERAL SCIENCE

Test Framework

	Content Domain	Range of Competencies	Approximate Percentage of Test Score
I.	Nature of Science	0001–0003	19%
II.	Physical Science	0004–0008	31%
III.	Life Science	0009–0012	25%
IV.	Earth and Space Science	0013–0016	25%

I. Nature of Science

0001 Understand principles and procedures of scientific inquiry.

- Demonstrate knowledge of the principles and procedures for designing and carrying out scientific investigations.
- Recognize methods and criteria for collecting, organizing, analyzing, and presenting scientific data.
- Recognize the evidential basis of scientific claims.
- Demonstrate knowledge of safety procedures and hazards associated with scientific investigations.
- Demonstrate knowledge of the materials, equipment, and technology used in the sciences.
- Apply basic mathematical procedures in reporting data and solving problems in the sciences.

0002 Understand the history and nature of science.

- Demonstrate knowledge of the historical development of major scientific ideas.
- Demonstrate knowledge of current major theories, models, and concepts in physical science, life science, and Earth and space science.
- Identify unifying themes, principles, and relationships that connect the different branches of the sciences.
- Demonstrate knowledge of the nature of science as a system of inquiry.

0003 Understand the relationships between science, technology, engineering, mathematics, and society.

- Analyze the interrelationships between science, technology, engineering, mathematics, and society.
- Demonstrate scientific literacy in evaluating scientific research and the coverage of science in the media.
- Analyze social, economic, and ethical issues associated with technological and scientific developments.

II. Physical Science

0004 Understand the properties and characteristics of matter.

- Recognize historic and contemporary theories of atomic structure and the kinetic theory of matter.
- Demonstrate knowledge of the physical and chemical properties of matter.
- Recognize the characteristics of different types of chemical bonds and their effects on the properties of matter.
- Demonstrate knowledge of the organization of the periodic table and its relationship to the structure and behavior of elements.
- Recognize the characteristics of elements, compounds, and mixtures, including solutions, suspensions, and colloids.
- Demonstrate knowledge of the nature of radioactive materials.

0005 Understand physical and chemical changes in matter.

- Demonstrate knowledge of the conservation of matter in chemical reactions and in balancing chemical equations.
- Apply knowledge of chemical formulas, the mole concept, and chemical equations to solve problems.
- Analyze phase changes and the characteristics of the different states of matter.
- Recognize the characteristics of different types of chemical reactions and factors that affect rates of reaction and chemical equilibrium.

0006 Understand the characteristics and transformations of different forms of energy.

- Demonstrate knowledge of the characteristics of different forms of energy and their transformations.
- Apply knowledge of the law of conservation of energy to the analysis of physical and chemical changes.
- Demonstrate knowledge of thermal energy and the transfer of energy through conduction, convection, and radiation.
- Analyze characteristics of electric charge, static electricity, Ohm's law, and series and parallel circuits.
- Demonstrate knowledge of the relationship between magnetism and electricity as well as the properties of permanent magnets.

0007 Understand relationships between force, mass, and motion.

- Demonstrate knowledge of Newton's three laws of motion in a variety of situations.
- Solve problems involving force, mass, and motion, including the interpretation of force diagrams.
- Apply knowledge of gravity, friction, pressure, and buoyancy, in a variety of situations.
- Demonstrate knowledge of the principles of work and power, including as applied to simple machines.

0008 Understand characteristics and properties of mechanical and electromagnetic waves.

- Apply knowledge of the characteristics of mechanical waves and their behavior as they pass through different media.
- Analyze the properties and propagation of sound in a variety of situations.
- Recognize the characteristics of the electromagnetic spectrum.
- Analyze the effects of mirrors, lenses, and prisms on the behavior of light.
- Demonstrate knowledge of refraction and reflection in natural phenomena.

III. Life Science

0009 Understand the characteristics, organization, and processes of cells.

- Analyze the structure and function of cell organelles in eukaryotic and prokaryotic cells.
- Analyze the processes of respiration and photosynthesis at the cellular level.
- Recognize how the structure of specialized cells relates to their different functions.
- Demonstrate knowledge of mitosis and meiosis.

0010 Understand characteristics and life processes of living organisms.

- Analyze the reproduction, development, and life cycles of representative organisms.
- Demonstrate knowledge of the structures and functions of plant and animal systems, including the different levels of biological organization.
- Demonstrate knowledge of the structures and functions of human body systems.
- Analyze how organisms obtain, use, and store matter and energy.
- Analyze how organisms both maintain homeostasis and fight diseases.

0011 Understand the concepts and principles related to genetics, the theory of evolution, and the classification of organisms.

- Recognize the basic principles of heredity, the nature of the genetic code, the basic processes of DNA replication and protein synthesis, and the methods and uses of genetic engineering.
- Apply knowledge of the principles and evidence of biological evolution to explain how species change over time.
- Demonstrate knowledge of the major events in the history of life, including mass extinctions and the evolution of organisms that characterize specific periods in Earth's history.
- Demonstrate knowledge of the principles of biological classification.

0012 Understand characteristics of different biomes, relationships between organisms, population dynamics, and the flow of matter and energy through ecosystems.

- Recognize the characteristics of terrestrial and aquatic biomes, including representative species of plants and animals that inhabit them.
- Analyze the relationships between organisms in a variety of ecosystems.
- Demonstrate knowledge of biotic and abiotic factors that affect population dynamics in ecosystems, including competition, resource availability, and niche and habitat requirements.
- Recognize the ways both human activities and climate change affect ecosystems.
- Recognize strategies used by different organisms to obtain the basic needs for life.
- Analyze the cycling of matter and the flow of energy through different types of ecosystems.

IV. Earth and Space Science

0013 Understand the history of Earth, characteristics of Earth materials and resources, and the geologic processes that shape Earth.

- Demonstrate knowledge of Earth's formation, history, and structure, as well as the supporting geologic evidence.
- Analyze tectonic processes, the mechanisms driving plate movements, and the landforms and geologic phenomena produced by movement at plate boundaries.
- Demonstrate knowledge of the processes involved in the rock cycle and of the characteristics of igneous, metamorphic, and sedimentary rocks.
- Analyze the constructive and destructive processes that shape Earth's surface, including weathering, erosion, transportation, and deposition.
- Recognize the characteristics and origins of common rocks, minerals, and fossils, as well as mineral, geothermal, and fossil fuel resources.

0014 Understand characteristics and properties of the hydrosphere.

- Analyze the physical processes of the hydrologic cycle.
- Identify the processes and characteristics of marine and freshwater systems, including oceans, rivers, lakes, and glaciers.
- Demonstrate knowledge of groundwater aquifers as well as their use and recharge.
- Analyze coastal processes, the formation of barrier islands, and the physical characteristics of deltas and estuaries.

0015 Understand Earth's atmosphere, weather, and climate.

- Demonstrate knowledge of the structure and characteristics of the different layers of the atmosphere.
- Analyze atmospheric conditions and geographic factors that produce weather in different parts of the world.
- Analyze weather maps and data to predict and explain weather events.
- Recognize factors controlling regional climate conditions and the causes for the changes in climate that occurred during the Pleistocene and Holocene epochs.
- Recognize how current changes in global climate are affecting ecosystems, the hydrosphere, coastal processes, and agriculture.

0016 Understand characteristics of the solar system and the universe.

- Demonstrate knowledge of the characteristics of objects in the solar system.
- Analyze the interactions of the sun, moon, and Earth and the effects of these interactions on Earth.
- Recognize the characteristics and evolution of stars and galaxies, including theories on the origin and nature of the universe.
- Demonstrate knowledge of evidence supporting the current understanding of the solar system and universe and of the technology used to gather that evidence.
- Demonstrate knowledge of the role of gravity in the solar system and the universe.