

ICS Middle School Science Standards

The documents used in drafting these science standards include the Georgia Department of Education Science Standards, American Education Reaches Out (AERO), the Nevada Department of Education Science Standards, Mid-continent Research for Education and Learning (McREL), the New Mexico State Department of Education Science Standards, and the Florida Department of Education 2008 Science Standards.

Grade 6

Nature of Science

N1: Students demonstrate an understanding of the importance of curiosity, honesty, open-mindedness, and skepticism in the active process of systematically examining the natural world.

6.N1.a	Keep honest, clear, and accurate records of scientific investigations.
6.N1.b	Question scientific claims based on vague attributions.
6.N1.c	Recognize that there may be more than one way to interpret a given set of findings.
6.N1.d	Define a problem, use appropriate resources for understanding, plan and carry out scientific investigations.
6.N1.e	Explain why scientific investigations should be replicable.
6.N1.f	Evaluate information to distinguish between fact and opinion.
6.N1.g	Recognize the design of God in creation.

N2: Students design and conduct scientific activities.

6.N2.a	Use appropriate technology to store and retrieve scientific information.
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6.N2.b	Estimate the effect of change in one part of a system on the system as a whole.
6.N2.c	Read meters on instruments used to make direct measurements of length, volume, weight, elapsed time, rate, and temperature, and appropriately report various quantities.
6.N2.d	Identify and critically evaluate information in data, tables, and graphs.

N3: Students clearly communicate scientific ideas and activities.

6.N3.a	Write clear instructions for conducting scientific investigations.
6.N3.b	Organize scientific information using appropriate tables, charts, and graphs, and identify relationships they reveal.
6.N3.c	Discuss and compare results and explanations with peers conducting the same experiment.

Physical Science

P1: Students demonstrate understanding that position and motion of objects can be observed, described, and measured.

6.P1.a	Describe the relationship between electric current and magnetic force.
6.P1.b	Describe types of forces including contact forces and forces acting at a distance (electrical, magnetic).
6.P1.c	Explain magnetic fields and describe various types of magnetic fields, including magnetic fields surrounding bar magnets and electromagnets, and magnetic fields found in nature.
6.P1.d	Explain production, distribution, and transformation of electricity into useful forms.
6.P1.e	Explain the relationship between electric and magnetic fields.
6.P1.f	Explain magnetic field and why some materials are not magnetic.
6.P1.g	Know that Earth has a magnetic field.
6.P1.h	Explain how an electromagnet is created and identify some of its uses.

P2: Students demonstrate understanding that all objects and substances in the world are made of matter and have observable properties.

6.P2.a	Know matter is made up of tiny particles called atoms which are arranged differently in solids, liquids, and gases of the same substance.
6.P2.b	Explain the relationship between temperature and motion of particles in matter.
6.P2.c	Explain the relationship between the energy of atoms and molecules and the state of matter.
6.P2.d	Describe the properties of the three states of matter and how matter changes from one state to another.
6.P2.e	Distinguish between chemical and physical properties and how these properties can influence interactions of matter.

P3: Students demonstrate an understanding of the different forms and transformations of energy and the significance of energy in understanding matter.

6.P3.a	Explain the relationship between potential and kinetic energy.
6.P3.b	Compare and contrast different forms of energy.
6.P3.c	Describe the transference of heat through matter and how current will facilitate the transference.
6.P3.d	Know that energy cannot be created or destroyed but that it can change form.
6.P3.e	Illustrate the transference of heat through materials by conduction, convection, and radiation.
6.P3.f	Know that heat moves from one object to another at different rates.
6.P3.g	Know that when warm and cool objects are put together, they lose or gain heat until they are the same temperature.

Earth Science

E1: Students demonstrate an understanding of the composition and structure of the Earth.

6.E1.a	Describe the differences between substances that were produced by living organisms (fossil fuels) and substances that result from nonliving processes (igneous rocks).
6.E1.b	Explain the rock cycle and identify sedimentary, metamorphic, and igneous rocks.
6.E1.c	Identify minerals and rocks according to their properties.
6.E1.d	Know that rocks contain evidence of the materials, temperatures, and forces that created them.
6.E1.e	Explain the difference between rocks and minerals.

E2: Students demonstrate understanding that features of the Earth's surface are constantly changing.

6.E2.a	Know that evidence for changing environments and the constancy of geologic processes can be found in sedimentary rocks and fossils.
6.E2.b	Explain the ways minerals are created.
6.E2.c	Explain cycles in an ecosystem including water, carbon, and nitrogen.

Life Science

L1: Students demonstrate understanding that there are many kinds of living things on earth.

6.L1.a	Explain and apply the classification of organisms into kingdom, phylum, class, order, family, genus, and species.
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6.L1.b	Explain the difference between herbivores, carnivores, and omnivores.
6.L1.c	Recognize beauty and variety in the creations of God.

L2: Students demonstrate understanding that living things have identifiable characteristics.

6.L2.a	Identify and classify organisms into species based upon their characteristics.
6.L2.b	Classify plants into major divisions and explain the characteristics of each division.
6.L2.c	Classify vertebrates and invertebrates into distinct groups and explain the characteristics of each group.

L3: Students demonstrate an understanding of the organization and development of living organisms.

6.L3.a	Explain the components of cell theory.
6.L3.b	Describe cell parts and their functions.
6.L3.c	Illustrate the process of photosynthesis and respiration.
6.L3.d	Identify basic cell structures and organelles and describe their functions.
6.L3.e	Describe and identify patterns in the organization of organisms from atoms to molecules and cells to tissues to organs to organ systems to organisms.
6.L3.f	Compare and contrast types of plant and animal cells, bacteria, protists, fungi, and parasites.
6.L3.g	Recognize the creation of life as intentional.

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Grade 7

Nature of Science

N1: Students demonstrate an understanding of the importance of curiosity, honesty, open-mindedness, and skepticism in the active process of systematically examining the natural world.

7.N1.a	Know the importance of keeping honest, accurate scientific records.
7.N1.b	Question claims based on vague attributions.
7.N1.c	Question claims based on small, biased, or uncontrolled samples.
7.N1.d	Identify flaws of reasoning based on poor or misleading research.
7.N1.e	Know that there may be more than one way to interpret given scientific findings.
7.N1.f	Explain bias and how it can affect scientific investigation and conclusions. Describe some ways scientists try to prevent bias.
7.N1.g	Explain why and how scientists determine if experimental results are reliable.
7.N1.h	Recognize the difference between theories and laws.
7.N1.i	Recognize the design of God in creation.

N2: Students design and conduct scientific activities.

7.N2.a	Follow correct procedures and safety practices in scientific activities.
7.N2.b	Use appropriate technology to retrieve and store information in an orderly manner.
7.N2.c	Use appropriate tools and techniques for investigating objects and substances.
7.N2.d	Design and conduct a controlled experiment.

N3: Students clearly communicate scientific ideas and activities.

7.N3.a	Analyze and evaluate scientific data in order to draw conclusions and communicate results and ideas.
7.N3.b	Write clear, sequential accounts of scientific investigations.
7.N3.c	Communicate and identify data by using appropriate graphs, charts, tables, diagrams, and symbols.
7.N3.d	Use models to explain the relationships between variables in an investigation.

Physical Science

P1: Students demonstrate understanding that all objects and substances in the world are made of matter and have observable properties.

7.P1.a	Describe basic facts about atoms, including size, uniqueness in each element, and capacity to organize into molecules.
7.P1.b	Describe the properties of electromagnetic waves and mechanical waves.
7.P1.c	Describe the structure of atoms including how their properties are determined by the number of protons, neutrons, and electrons.

7.P1.d	Know that compounds are formed when elements combine.
7.P1.e	Know that molecular arrangement and motion create states of matter.
7.P1.f	Know that an element contains only one kind of atom.

P2: Students demonstrate an understanding of the different forms and transformations of energy and the significance of energy in understanding matter.

7.P2.a	Explain the relationship between the energy of atoms and molecules and the state of matter.
7.P2.b	Know a transfer of energy is involved in physical, chemical, and nuclear changes.

P3: Students demonstrate an understanding of light and sound.

7.P3.a	Describe and explain the pitch of sound.
7.P3.b	Describe and explain how light waves, sound waves, and other waves travel through the different materials.
7.P3.c	Know vibrations set up wavelike disturbances that spread away from the source and move at different speeds through different materials.
7.P3.d	Know that waves carry energy from one place to another.
7.P3.e	Identify transverse and longitudinal waves in various media.
7.P3.f	Use wavelengths, frequency, and wave speed to solve problems.
7.P3.g	Explain that sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.
7.P3.h	Explain that radio waves, visible light, and x-rays are different wavelength bands in the spectrum of electromagnetic waves.
7.P3.i	Know visible light is narrow band with the electromagnetic spectrum.
7.P3.j	Observe and explain that light can be reflected, refracted, and/or absorbed.

7.P3.k	Illustrate the various wavelengths of the sun's energy, including infrared, visible, ultraviolet and the makeup of white light.
7.P3.l	Explain how the human eye sees objects and colors in terms of wavelengths.
7.P3.m	Describe how a medium (air, water, solids) affects the behavior of waves.
7.P3.n	Illustrate the parts of the wave and explain how the parts are affected by changes in amplitude and pitch.

Earth Science

E1: Students demonstrate an understanding of how climate, weather, and the water cycle influence and are influenced by key features of the Earth and sky.

7.E1.a	Know that the regular and predictable motions of the Earth, moon, and sun system explain phenomena on Earth, including Earth's motion in relation to a year, a day, the seasons, the phases of the moon, eclipses, tides, and shadows.
7.E1.b	Explain that seasons are a result of the variations in the Sun's energy reaching Earth due to the planet's axial tilt.

E2: Students demonstrate an understanding of the composition and structure of the Earth.

7.E2.a	Explain the difference between organic and inorganic materials.
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E3: Students demonstrate understanding that there are many components of the universe.

7.E3.a	Explain how energy from the sun supports life on Earth.
7.E3.b	Explain how and why Earth is unique in our solar system.
7.E3.c	Describe how days, year, phases of the moon, and eclipses occur.
7.E3.d	Recognize created order in the universe.

Life Science

L1: Students demonstrate understanding that there are many kinds of living things on Earth.

7.L1.a	Compare and contrast organisms that reproduce asexually and sexually (bacteria, protists, fungi, plants, and animals).
7.L1.b	Compare and contrast prokaryotes, eukaryotes, and viruses.
7.L1.c	Explain how selective breeding has resulted in new varieties of cultivated plants and domestic animals.
7.L1.d	Explain the difference between unicellular and multicellular organisms.
7.L1.e	Recognize beauty and variety in the creations of God.

L2: Students demonstrate understanding that living things have identifiable characteristics.

7.L2.a	Compare and contrast plant and animal cells.
7.L2.b	Know that genetic heredity is the passage of genetic information from one generation to another.
7.L2.c	Know that changes in inherited characteristics can be the result of changes in genes of eggs and sperm.

L3: Students demonstrate an understanding of how and why organisms are dependent on one another and their environment.

7.L3.a	Categorize relationships among organisms that are competitive or mutually beneficial.
7.L3.b	Describe reactions of plants and animals to environmental stimuli.
7.L3.c	Describe positive and negative relationships among organisms (predator/prey, parasite/host, mutualism, commensalism).
7.L3.d	Describe ways living organisms interact with the abiotic factors in an ecosystem.

L4: Students demonstrate an understanding of the organization and development of living organisms.

7.L4.a	Explain that cells grow, divide, and take in nutrients which provide energy for cell functions. Know that cells use inorganic compounds (vitamins, minerals, water) to make materials that the cell or organism needs.
7.L4.b	Identify cell structures and relate them to cell functions.
7.L4.c	Explain the organization of cells into tissues, tissues into organs, organs into systems, and systems into organisms.
7.L4.d	Explain that the needs cells have for oxygen, food, and waste removal are provided for by tissues, organs and organ systems.
7.L4.e	Explain the role of the excretory system.
7.L4.f	Know that genes are encoded segments of DNA that carry hereditary information and that genes are located on chromosomes.
7.L4.g	Define and explain the stages of mitosis.
7.L4.h	Define and explain the stages of meiosis.
7.L4.i	Know the processes and results of asexual reproduction.
7.L4.j	Know the processes and results of sexual reproduction.
7.L4.k	Explain the principle of dominance and recessiveness, the principle of segregation, and the principle of independent assortment.
7.L4.l	Predict genotype and phenotype ratios of possible offspring using a Punnett Square.
7.L4.m	Compare the structure and processes of plant cells and animal cells.
7.L4.n	Explain the process and purpose of photosynthesis in green plants.
7.L4.o	Describe how cellular activity can be influenced by chemical substances.
7.L4.p	Explain respiration and its role in the exchange of oxygen and carbon dioxide.
7.L4.q	Know that hormones are chemicals and explain how they affect other parts of the body (response to danger, human growth, development, reproduction).

7.L4.r	Know how fertilization of an egg cell occurs and describe the stages of human embryonic development.
7.L4.s	Recognize the usual sequence of development from birth to death of human beings.
7.L4.t	Explain how sensory stimuli contribute to learning.
7.L4.u	Recognize the creation of life as intentional.

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Grade 8

Nature of Science

N1: Students demonstrate an understanding of the importance of curiosity, honesty, open-mindedness, and skepticism in the active process of systematically examining the natural world.

8.N1.a	Use critical reasoning and draw independent conclusions based on scientific data.
8.N1.b	Know that hypotheses that lead to fruitful investigations are important, even if the hypotheses turn out no to be true.
8.N1.c	Recognize that there may be more than one way to interpret a given set of scientific findings. Suggest alternative ways of explaining scientific data and criticize arguments in which data, explanations, or conclusions are represented as the only ones worth consideration, with no mention of other possibilities.
8.N1.d	Identify flaws in arguments based on faulty, misleading, or incomplete data.
8.N1.e	Know that if more than one variable changes at the same time in an experiment, the outcome may not be clearly attributable to any one variable, and that sometimes scientists can design research to account for this.
8.N1.f	Know that scientific knowledge is revised as new evidence is gained through scientific investigation.
8.N1.g	Distinguish between scientific and pseudoscientific ideas.
8.N1.h	Recognize the design of God in creation.

N2: Students design and conduct scientific activities.

8.N2.a	Use appropriate, systematic procedures for recording and organizing information.
8.N2.b	Know the functions and use of complex pieces of scientific equipment.
8.N2.c	Use appropriate technology and laboratory procedures for observing, collecting, and analyzing scientific data.
8.N2.d	Compare and contrast different models that could be used to represent the same object and select models useful in relating the results of their own investigations.
8.N2.e	Evaluate the accuracy and reproducibility of scientific data and observations.

N3: Students clearly communicate scientific ideas and activities.

8.N3.a	Defend conclusions and recognize the validity of other positions.
8.N3.b	Defend a position with accurate and explicit statements of critical assumptions.
8.N3.c	Recognize and explain anomalous data.
8.N3.d	Use mathematical expressions and techniques to explain data and communicate findings.
8.N3.e	Create models to explain findings.
8.N3.f	Organize and identify scientific data in appropriate tables, charts, and graphs.
8.N3.g	Analyze and evaluate scientific data to draw valid conclusions and state predictions based on scientific evidence.

Physical Science

P1: Students demonstrate understanding that position and motion of objects can be observed, described, and measured.

8.P1.a	Illustrate that the force on a body is the sum of all forces acting on it.
8.P1.b	Know that every object exerts gravitational force on every other object dependent on the masses and distance of separation.
8.P1.c	Demonstrate that the greater the mass of an object the more force is needed to achieve the same change in motion, that greater acceleration will occur if a greater force is applied to an object, and that an object will remain unchanged unless acted upon by an unbalanced force (Newton's Laws of Motion).
8.P1.d	Illustrate the principles of balanced and unbalanced forces on the motion of an object.
8.P1.e	Predict the motion of most objects using Newton's three laws of motion.
8.P1.f	Explain that gravity is a function of mass and distance.
8.P1.g	Know that there are fundamental forces in nature (gravity, electromagnetic, nuclear).
8.P1.h	Recognize that a force has both magnitude and direction.
8.P1.i	Know that the motion of an object is always described in relation to some other object or point.
8.P1.j	Know that forces cause motion in living systems including specific systems in the human body.

P2: Students demonstrate understanding that all objects and substances in the world are made of matter and have observable properties.

8.P2.a	Explain how reaction times are influenced by various factors.
8.P2.b	Use models to explain the motion of particles in solids, liquids, and gases.
8.P2.c	Describe the structure of an atom and the role of protons, neutrons, and electrons in determining the properties of an atom.

8.P2.d	Know that total mass remains unchanged when substances undergo physical and chemical changes.
8.P2.e	Recognize that elements are grouped in the periodic table according to their properties.
8.P2.f	Classify substances on the basis of properties that can be demonstrated or measured, including acids, bases, and salts.
8.P2.g	Distinguish among mixtures (including solutions) and pure substances.
8.P2.h	Differentiate between physical changes and chemical changes.
8.P2.i	Know how to use density, boiling point, freezing point, conductivity, and color to identify various substances.
8.P2.j	Differentiate among element, compounds, and mixtures by classification of materials, interpretation of chemical formulas, and separation of mixtures into compounds.
8.P2.k	Know that phase changes are physical changes that can be reversed (melting, condensation, evaporation).

P3: Students demonstrate an understanding of the different forms and transformations of energy and the significance of energy in understanding matter.

8.P3.a	Know a that transfer of energy is involved in physical, chemical, and nuclear changes and that one form of energy can be changed into another form of energy.
8.P3.b	Identify examples of energy transformation.
8.P3.c	Identify factors that influence the rate at which chemical reactions occur.
8.P3.d	Explain that dissolving substances in water facilitates reactions between them.

Earth Science

E1: Students demonstrate an understanding of how climate, weather, and the water cycle influence and are influenced by key features of the Earth and sky.

8.E1.a	Explain that variations in the amounts of the Sun's energy reaching Earth's surface due to the axial tilt of the Earth causes seasons.
8.E1.b	Know that light from the Sun and other stars travels great distances to reach Earth.

E2: Students demonstrate understanding that there are many components of the universe.

8.E2.a	Describe our solar system, including the planets, the Moon, and comets and asteroids.
8.E2.b	Describe our Sun, the place of the Sun in our galaxy, and the place of the galaxy in the universe.
8.E2.c	Know that the universe contains billions of galaxies and that each galaxy contains billions of stars.
8.E2.d	Compare and contrast characteristics of the objects within our solar system (Sun, planets, moons) including gravitational force, distance from the Sun, speed, movement, temperature, and atmospheric conditions.
8.E2.e	Know that Earth is part of a solar system located within the Milky Way Galaxy, part of which can be seen as a glowing band of light spanning the night sky.
8.E2.f	Know that the Sun is thousands of times closer to Earth than any other star, and billion of times closer than the far end of the Milky Way Galaxy.
8.E2.g	Distinguish the hierarchical relationships between planets and other astronomical bodies in relation to solar system, galaxy, and universe, including distance, size, and composition.
8.E2.h	Classify physical properties of stars (magnitude, temperature, size, and luminosity).
8.E2.i	Recognize the benefits and risks of space exploration.

8.E2.j	Explain how properties of light (emission, reflection, refraction) emitted from the sun and stars are used in learning about the universe.
8.E2.k	Explain how objects in the solar system and the universe are affected by gravity.
8.E2.l	Recognize the created order in the universe.

Life Science

L1: Students demonstrate an understanding of the organization and development of living organisms.

8.L1.a	Describe systems in multicellular organisms that perform specialized functions (digestive, respiratory, circulatory, excretory, reproductive, movement, control, skeletal/muscular, protective).
8.L1.b	Describe the function of skin (protection, regulation of body temperature).
8.L1.c	Describe ways the body defends against germs (tears, saliva, skin, blood cells, stomach secretions).
8.L1.d	Describe the function and development of the brain.
8.L1.e	Describe the digestive process.
8.L1.f	Explain the role of the skin and lungs in the removal of excess body heat.
8.L1.g	Describe the formation of natural immune responses.
8.L1.h	Describe the processes of the circulatory system.
8.L1.i	Know the development of germ theory and its role in learning how to strengthen the immune system and cure infections.
8.L1.j	Describe how the skeletal/muscular system allows control and coordination of movements.
8.L1.k	Know that disease can result when damage to the structure or function of a body system occurs.
8.L1.l	Explain the role of white blood cells and antibodies in the defense of the body.
8.L1.m	Recognize the creation of life as intentional.