

## SCIENCE – UNIFYING STANDARDS

THE NATURE OF SCIENCE

- 1.0 **Research and Investigation:** Students understand that science is a way of learning about the natural world. They use scientific inquiry and develop ideas based on data collected from investigations they design.
- 2.0 **Communication:** Students understand that the universe can be described by principles derived through scientific inquiry. They effectively communicate their understanding of ideas developed in scientific investigation through a variety of media.
- 3.0 **Connections and Implications:** Students review the consequences of the process and products of scientific inquiry. They understand the role that scientific advances have had throughout history.

EARTH SCIENCE

- 1.0 **Characteristics of the Universe:** Students understand Earth-based and space-based astronomy reveals the structure, scale, and dynamic nature of the solar system, stars, galaxies, and the universe.
- 2.0 **The Dynamic Earth:** Students understand that the Earth is constantly changing and being shaped due to a variety of natural events, processes, and human activity. The Earth is a collection of interacting cycles, structures, and processes that can be described in terms of space, time, energy, and matter.

LIFE SCIENCE

- 1.0 **Diversity and Interdependence:** Students understand that living things are diverse and interdependent. They recognize the relationship between cooperation and competition among organisms in ecosystems.
- 2.0 **Cellular Structures and Functions:** Students understand that cells are the basic structures of all living systems. They understand the complementary relationship between the structure and function of cells, organs, organ systems, whole organisms, and ecosystems.
- 3.0 **Change and Evolution:** Students understand that living things grow, develop, change, and evolve through time, depending on environmental influences. They know that traits of species can change through generations and that instruction of traits is contained in the genetic material of organisms.

PHYSICAL SCIENCE

- 1.0 **Forces and Motion:** Students understand the nature of forces and the relationship between forces and motion. They recognize that the relationship is described by one set of laws. They understand that all matter is in motion and that motion changes as a result of forces between matter. They realize that these forces affect everyday life, and that the effects can be identified, measured, and predicted.
- 2.0 **Energy, Momentum and Transformation:** Students understand that when matter interacts with matter, energy and momentum can be transferred or distributed, and that energy may be transformed. When matter interacts the total amount of matter, energy, and momentum remain the same.
- 3.0 **Structure and Properties of Matter:** Students understand that all matter is made up of particles. They understand the relationship between the structure and properties of matter. They know that a finite number of basic elements combine in various ways which determine all properties, characteristics, and behaviors of matter.

**EARTH SCIENCE**

**Level 8**

**1.0 Characteristics of the Universe:** Students understand Earth-based and space-based astronomy reveals the structure, scale, and dynamic nature of the solar system, stars, galaxies, and the universe.

Focus Goals

1.1 Begin to understand the scale, structure, development, and physical behavior of planetary systems, stars, and galaxies.

**2.0 The Dynamic Earth:** Students understand that the Earth is constantly changing and being shaped due to a variety of natural events, processes, and human activity. The Earth is a collection of interacting cycles, structures, and processes that can be described in terms of space, time, energy, and matter.

2.0 Not addressed at this level.

**EARTH SCIENCE****Level 8**

**1.0 Characteristics of the Universe:** Students understand Earth-based and space-based astronomy reveals the structure, scale, and dynamic nature of the solar system, stars, galaxies, and the universe.

**1.1 Begin to understand the scale, structure, development, and physical behavior of planetary systems, stars, and galaxies.**

- θ Identify galaxies as clusters of billions of stars, that may have different shapes.(c4a)
- θ Distinguish the sun as one of many stars in our Milky Way galaxy, and explain how stars differ in size, temperature and color.(c4b)
- θ Explain how stars are sources of light for all bright objects in outer space. The moon and planets are visible because they reflect sunlight, but do not produce light. (c4d)
- θ Explain how astronomical units and light years are used as measures of distance between the sun, stars and Earth. (c4c)
- θ Describe the appearance, general composition, relative position and size, and motion of objects in the solar system, including planets, planetary satellites, comets, and asteroids. (c4e)

**2.0 The Dynamic Earth:** Students understand that the Earth is constantly changing and being shaped due to a variety of natural events, processes, and human activity. The Earth is a collection of interacting cycles, structures, and processes that can be described in terms of space, time, energy, and matter.

**2.0 Not addressed at this level.**

**LIFE SCIENCE**  
**Level 8**

**1.0 Diversity and Interdependence:** Students understand that living things are diverse and interdependent. They recognize the relationship between cooperation and competition among organisms in ecosystems..

Focus Goals

1.0 Not addressed at this level.

**2.0 Cellular structures and Functions:** Students understand that cells are the basic structures of all living systems. They understand the complementary relationship between the structure and function of cells, organs, organ systems, whole organisms, and ecosystems.

Focus Goals

2.1 Begin to understand that principles of chemistry that underlie functions of biological systems.

**3.0 Change and Evolution:** Students understand that living things grow develop, change, and evolve through time, depending on environmental influences. They know that traits of species can change through generations and that instruction of traits is contained in the genetic material of organisms.

Focus Goals

3.0 Not addressed at this level.

**LIFE SCIENCE**  
**Level 8**

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**2.0 Cellular structures and Functions:** Students understand that cells are the basic structures of all living systems. They understand the complementary relationship between the structure and function of cells, organs, organ systems, whole organisms, and ecosystems.

**2.1 Begin to understand that principles of chemistry that underlie functions of biological systems.**

- θ Explain that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms. (c6a)
- θ Describe how living organisms are made of molecules largely consisting of carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur. (c6b)
- θ Describe how living organisms have many different kinds of molecules including small ones such as water and salt, and very large ones such as carbohydrates, fats, proteins and DNA. (c6c)

**3.0 Change and Evolution:** Students understand that living things grow develop, change, and evolve through time, depending on environmental influences. They know that traits of species can change through generations and that instruction of traits is contained in the genetic material of organisms.

**3.0 Not addressed at this level.**

**FOCUS ON PHYSICAL SCIENCE****Level 8**

**1.0 Forces and Motion:** Students understand the nature of forces and the relationship between forces and motion. They recognize that the relationship is described by one set of laws. They understand that all matter is in motion and that motion changes as a result of forces between matter. They realize that these forces affect everyday life, and that the effects can be identified, measure, and predicted.

Focus Goals

- 1.1 Describe motion of objects.
- 1.2 Demonstrate and understand the effects of forces on objects.

**2.0 Energy, Momentum and Transformation:** Students understand when matter interacts with matter, energy and momentum can be transferred or distributed, and that energy may be transformed. When matter interacts the total amount of matter, energy, and momentum remain the same.

Focus Goals

- 2.1 Understand that matter and energy are conserved in chemical reactions.

**3.0 Structure and Properties of Matter:** Students understand that all matter is made up of particles. They understand the relationship between the structure and properties of matter. They know that a finite number of basic elements combine in various ways which determine all properties, characteristics, and behaviors of matter.

Focus Goals

- 3.1 Understand that elements have distinct properties and atomic structure, and that all matter is comprised of one or more of over 100 elements.
- 3.2 Understand that the states of matter depend on molecular motion.
- 3.3 Understand that the organization of the Periodic Table is based on the properties of the elements and reflects the structure of atoms.
- 3.4 Identify characteristic properties of matter.

**FOCUS ON PHYSICAL SCIENCE****Level 8**

**1.0 Forces and Motion:** Students understand the nature of forces and the relationship between forces and motion. They recognize that the relationship is described by one set of laws. They understand that all matter is in motion and that motion changes as a result of forces between matter. They realize that these forces affect everyday life, and that the effects can be identified, measure, and predicted.

**1.1 Describe motion of objects.**

- θ Know and understand that position is defined relative to some choice of standard reference point and a set of reference directions. (c1a)
- θ Know average speed is the total distance traveled divided by the total time elapsed and that the speed of an object along the path traveled can vary. (c1b)
- θ Solve problems involving distance, time, average speed, and acceleration. (c1c)
- θ Describe the velocity of an object, specifying both direction and speed. (c1d)
- θ Determine changes in velocity (acceleration) as changes in speed, direction, or both. (c1e)
- θ Interpret graphs of position, versus time and speed, versus time for motion in a single direction. (c1f)

**1.2 Demonstrate and understand the effects of forces on objects.**

- θ Demonstrate how a force has both direction and magnitude. (c2a)
- θ Recognize when an object is subject to two or more forces at once, the effect is the accumulative effect of all the forces. (c2b)
- θ Illustrate when the forces on an object are balanced, the motion of the object does not change. (c2d)
- θ Illustrate when the forces on an object are unbalanced, the object will change its motion (that is, it will speed up, slow down, or change direction). (c2c)
- θ Identify separately, two or more forces acting on a single static object, including gravity, elastic forces due to tension or compression in matter, and friction. (c2d)
- θ Recognize the role of gravity in forming and maintaining planets, stars and solar systems. (c2g)
- θ Know that the greater mass of an object, the more force is needed to achieve the same change in motion. (c2f)
- θ Know that all objects experience a buoyant force when immersed in a fluid, and that this is an upward force equal to the weight of the fluid it has displaced. (\*)
- θ Predict and explain why an object will sink or float. (\*)

**2.0 Energy, Momentum and Transformation:** Students understand when matter interacts with matter, energy and momentum can be transferred or distributed, and that energy may be transformed. When matter interacts the total amount of matter, energy, and momentum remain the same.

**2.1 Understand that matter and energy are conserved in chemical reactions.**

θ Know how atoms explain the conservation of matter: in chemical reactions, the number of atoms stays the same no matter how they are arranged, so their total mass stays the same. (c5b)

θ Discover that chemical reactions usually liberate heat or absorb heat. (c5c)

**3.0 Structure and Properties of Matter:** Students understand that all matter is made up of particles. They understand the relationship between the structure and properties of matter. They know that a finite number of basic elements combine in various ways which determine all properties, characteristics, and behaviors of matter.

**3.1 Understand that elements have distinct properties and atomic structure, and that all matter is comprised of one or more of over 100 elements.**

θ Know and illustrate how an atom is structured and composed of protons, neutrons and electrons. (c3a)

θ Identify examples of compounds that are formed by combining two or more different elements. (c3b)

θ Identify examples of compounds with properties that are different from the constituent elements. (c3c)

θ Describe how reactant atoms and molecules interact to form products with different chemical properties. (c5c)

θ Explain how elements are defined by the number of protons in the nucleus, which is called the atomic number. Different isotopes of an element have a different number of neutrons in the nucleus. (c7b)

**3.2 Understand that the states of matter depend on molecular motion.**

θ In solids, the atoms are closely locked in position and can only vibrate; in liquids, the atoms and molecules are loosely connected and can collide with, and move past each other; in gases, the atoms or molecules move independently, colliding frequently. (c3e)

θ Demonstrate how atoms and molecules form solids by building up repeating patterns such as the crystal structure of NaCl or long chain polymers. (c3c)

θ Show how physical processes include freezing and boiling, involve changes in form with no chemical reaction. (c5d)

**3.3 Understand that the organization of the Periodic Table is based on the properties of the elements and reflects the structure of atoms.**

θ Use the Periodic Table to identify elements in simple compounds. (c3f)

θ Identify regions corresponding to metals, nonmetals and inert gases. (c7a)

**3.4 Identify characteristic properties of matter.**

- θ Classify substances by their properties, including melting temperature, density, hardness, heat, and electrical conductivity. (c7c)
- θ Determine that density is mass per unit volume. (c8a)
- θ Calculate the density of liquids and regular and irregular solids from measurements of mass and volume. (c8b)
- θ Determine whether a solution is acidic, basic or neutral. (c5e)

## THE NATURE OF SCIENCE

### Level 8

**1.0 Research and Investigation:** Students understand that science is a way of learning about the natural world. They use scientific inquiry and develop ideas based on data collected from investigations they design.

#### Focus Goals

1.1 Demonstrate and apply the process of scientific inquiry. (p)

**2.0 Communication:** Students understand that the universe can be described by principles derived through scientific inquiry. They effectively communicate their understanding of ideas developed in scientific investigation through a variety of media.

#### Focus Goals

2.1 Know how to justify and communicate scientific thinking. (p)

**3.0 Connections and Implications:** Students review the consequences of the process and products of scientific inquiry. They understand the role that scientific advances have had throughout history.

#### Focus Goals

- 3.1 Recognize the value of technology in science. (p)
- 3.2 Explore careers in science.
- 3.3 Apply Literacy skills to make scientific connections.

**THE NATURE OF SCIENCE****Level 8**

**1.0 Research and Investigation:** Students understand that science is a way of learning about the natural world. They use scientific inquiry and develop ideas based on data collected from investigations they design.

**1.1 Demonstrate and apply the process of scientific inquiry.** (p)

- θ Plan and conduct a scientific investigation developed around questions. (c9a)
- θ Evaluate the accuracy and reproducibility of data. (c9b)
- θ Distinguish between variables and controlled parameters in a test. (c9c)

**2.0 Communication:** Students understand that the universe can be described by principles derived through scientific inquiry. They effectively communicate their understanding of ideas developed in scientific investigation through a variety of media.

**2.1 Know how to justify and communicate scientific thinking.** (p)

- θ Recognize the slope of the linear graph as the constant in the relationship  $y=kx$  and apply this to interpret graphs constructed from data. (c9d)
- θ Construct appropriate graphs from data and develop quantitative statements about the relationships between variables. (c9e)
- θ Apply simple mathematical relationships to determine one quantity given the other two (including speed = distance/time, density = mass/volume, force = pressure x area, volume = area x height). (c9f)
- θ Distinguish between linear and non-linear relationships on a graph of data.

**3.0 Connections and Implications:** Students review the consequences of the process and products of scientific inquiry. They understand the role that scientific advances have had throughout history.

**3.1 Recognize the value of technology in science.** (p)

- θ Identify the intended and unintended benefits and consequences of technology solutions.

**3.2 Explore careers in science.** (p)

- θ Identify the people engaged in science and how they work.
- θ Research careers that require scientific skills and knowledge and describe how they are applied.

**3.3 Apply Literacy skills to make scientific connections.** (p-Literacy Standards)

- θ Learn and use new words encountered through reading scientific text. (R-1.0)
- θ Read, comprehend, analyze, and evaluate scientific information. (R-2.0)
- θ Write persuasive essays and interpretive responses to scientific topics or investigations. (W-2.0)
- θ Use technology and reference sources to locate and interpret information on science topics. (W-3.0)
- θ Deliver research and persuasive presentations on scientific topics or investigations. (L/S-3.0)