

**OFFICE OF CHIEF ACADEMIC OFFICER**  
**Summary of State Board of Education Agenda Items**  
**Consent Agenda**  
**April 19, 2018**

**OFFICE OF SPECIAL EDUCATION**

- V. Approval to begin the Administrative Procedures Act process: To establish the Mississippi Alternate Academic Achievement Standards for (1) Science Grades Kindergarten – 8 and (2) High School Biology

**Executive Summary**

The Mississippi Alternate Academic Achievement Standards for students with significant cognitive disabilities are aligned with the Mississippi College- and Career-Readiness Standards for Science and provide K-12 special education teachers with a basis for curriculum development. The Mississippi Department of Education has designed Mississippi Alternate Academic Achievement Standards for Science in the following areas:

1. Kindergarten Science
2. Grade 1 Science
3. Grade 2 Science
4. Grade 3 Science
5. Grade 4 Science
6. Grade 5 Science
7. Grade 6 Science
8. Grade 7 Science
9. Grade 8 Science
10. High School Biology

Designed for students with significant cognitive disabilities, the Mississippi Alternate Academic Achievement Standards for Grades Kindergarten - 8 and High School Biology are linked to the grade-level Mississippi College- and Career-Readiness Standards for Science (MS-CCRS). These expectations for students with significant cognitive disabilities will provide the basis for lesson plan development, instructional delivery, and assessment development and revisions which must occur in 2018-2019.

This item references Goals 1 and 2 of the *Mississippi Board of Education 2016-2020 Strategic Plan*.

Recommendation: Approval

Back-up material attached



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**2018**  
**Mississippi**  
**Alternate**  
**Academic**  
**Achievement**  
**Standards for**  
**Science**

**Effective Date: 2018-2019 School Year**



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# 2018 Mississippi Alternate Academic Achievement Standards for Science

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## Acknowledgements

The Mississippi Department of Education gratefully acknowledges the hard work of the following individuals for their involvement in developing the *Mississippi Alternate Academic Achievement Standards for Science* and the supporting documents.

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## Introduction

### Mission Statement

The Mississippi Department of Education is dedicated to student success, which includes improving student achievement in science and establishing communication skills within a technological environment. The *Mississippi Alternate Academic Achievement Standards* provides a consistent, clear understanding of what students are expected to know and be able to do by the end of each grade level or course. The purpose of the *Alternate Standards* is to build a bridge from the content in the general education science framework to academic expectations for students with the most significant cognitive disabilities. The standards are designed to be rigorous and relevant to the real world, reflecting the knowledge and skills that students need for success in postsecondary settings.

### Purpose

In an effort to closely align instruction for students with significant cognitive disabilities who are progressing toward postsecondary settings, the *Mississippi Alternate Academic Achievement Standards for Science* includes grade- and course-specific standards for K-12 science.

This document is designed to provide K-12 science teachers with a basis for curriculum development.

As such, this set of alternate standards addresses a small number of science standards, representing a breadth, but not depth, of coverage across the entire standards framework. In order to prepare students for postsecondary settings, it outlines what knowledge students should obtain and the types of skills students should demonstrate upon completion of each grade level. *The Mississippi Alternate Academic Achievement Standards* is aligned to the *Mississippi College- and Career-Readiness Standards (MS CCRS)*. The *MS CCRS* reflects national expectations while focusing on postsecondary success, but it is unique to Mississippi in addressing the needs of our students and teachers. The standards' content centers around three basic content strands of science: life science, physical science, and Earth and space science.

### Implementation

The *Mississippi Alternate Academic Achievement Standards for Science* will be implemented during the 2018-2019 school year.



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# 2018 Mississippi Alternate Academic Achievement Standards for Science Overview



## Research and Background Information

In today's modern world and complex society, our students are required to possess sufficient knowledge of science to become vigilant consumers of scientific and technological information. To meet the growing challenges facing our future workforce, the National Research Council (NRC) published a research-based report on teaching and learning science in a 2012 document titled *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (NRC, 2012). This document adapts *Mississippi's College- and Career-Readiness Standards for Science* for students with Significant Cognitive Disabilities (SCDs) with the goal of optimizing student learning to meet students where they are, according to their ability level. In doing so, the *Mississippi Alternative Academic Achievement Standards for Science (MS AAAS)* strives to help students understand our natural world so they can be more informed and productive citizens. All alternate standards and corresponding skills presented in this document are derived from 2018's *Mississippi College- and Career-Readiness Standards for Science*.

### Core Elements in the Use and Design of the *MS AAAS for Science*

The *MS AAAS for Science* contains goals aligned to the *MS CCRS for Science* and was developed for students with significant cognitive disabilities. This document does not dictate a manner or specific methods of teaching. The standards in this document are not sequenced for instruction and do not prescribe classroom activities, materials, or instruction strategies. These standards are end-of-year expectations for each grade or course. The standards are intended to drive relevant and rigorous instruction that emphasizes student knowledge of both disciplinary core ideas (concepts) and the application of science skills to support student readiness for postsecondary settings.

The *MS CCRS for Science* was developed with core elements that are integrated across standards and performance objectives in each grade and course. It should be noted that *MS AAAS for Science* was aligned to the *MS CCRS for Science* and represents a breadth, but not depth, of coverage. Thus, the *MS AAAS for Science* integrates the same core elements. The *MS AAAS for Science* are scaffolding, adapted, and written with consideration of students with significant cognitive disabilities. A brief description of each core element used is presented below.

1. Crosscutting concepts: These seven, binding concepts were adopted directly from the National Research Council's *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (2012) and should be woven into instruction for every grade and course. Crosscutting concepts are designed to help students discover interconnected patterns and relationships between all sciences.

A concept is crosscutting if it communicates a scientific way of thinking about a subject and it applies to many different disciplines of science and engineering. Crosscutting concepts are sometimes called “the ties that bind.” The seven concepts are listed below.

- a. **Patterns**
  - b. **Cause and effect: Mechanism and explanation**
  - c. **Scale, proportion, and quantity**
  - d. **Systems and system models**
  - e. **Energy and matter: Flows, cycles, and conservation**
  - f. **Structures and function**
  - g. **Stability and change**
2. **Technology:** If Mississippi students are to compete on a global stage and exit high school prepared for college, career, and life, technology should be used in the classroom in a way that suits 21<sup>st</sup>-century learners and reflects the modern workplace. Technology is essential in teaching and delivery, and increased convenience and regular use are key to improved fluency for both teachers and students. K-12 learners have fundamentally changed over the past few decades, and our classrooms should adapt to accommodate them. Dr. Ruben Puentedura’s SAMR (substitution, augmentation, modification, and redefinition) model is a resource that can be considered by teachers, administrators, and technology staff as they strive to integrate meaningful and appropriate digital learning experiences into the classroom. At the basic level, technology enhances instruction. Special education teachers are encouraged to explore the SAMR model and integrate technology into lessons whenever appropriate with a goal of increasing students’ digital and computer literacy.
  3. **Science and society:** This core element assures exploration of science’s impacts on society and the feedback loop that must be cultivated and sustained to continue improvement of systems. As a more abstract concept, teachers of SCD students may introduce these concepts on a limited basis with some of their higher-functioning pupils.
  4. **History and science:** Because most modern-day scientific advancement derives from past discoveries, it is essential that students understand the breakthroughs that make today’s work possible. When applying Mississippi’s alternate standards, teachers can provide assistance as needed to help provide desired layers of historic context according to student ability level.

Students should be provided a safe environment for failure without consequence, which is one of the most powerful drivers in learning. Providing many opportunities for students to fail, learn, and try again, with appropriate levels of support, fosters a deeper level of understanding and greater student interest and engagement. These practices are commonly referred to as productive struggle, failing forward, grit, and many others. This general approach helps strengthen habits of mind, such as perseverance, resilience, divergent thinking, resourcefulness, and creativity.

## Other Important Core Elements

Mathematics is integrated throughout the science standards document because it is essential to the scientific process, requiring students to quantify, analyze, and present results. Students must be familiar with data analysis, critical thinking, and recording their own data; students must organize and analyze it before presenting their findings. Analyses of scientific studies and publications from both quantitative and qualitative perspectives are very important. English/language arts skills are also integrated into the science standards. Students will be able to comprehend informational text for understanding as well as process and critique information. Whenever appropriate or possible, students should be able to demonstrate a critical point of view. For SCD students, data can include counting or organizing similar pictures or objects, then explaining in written, verbal, or nonverbal form what they have done with some level of justification. This can be scaled according to student ability.

## Content Strands and Disciplinary Core Ideas

Science fields can be divided into three content-stranded domains based on relative content presented in strands, extending from kindergarten to eighth grade. Grouping content in this way allows for vertical alignment of competencies and objectives to better organize content distribution. Content strands are not included in the Grades 9-12 course organization, which allows for a more logical sequential placement and flow of content. Content strands are subdivided into 10 disciplinary core ideas in which standards and performance objectives for science content can be placed in grades K-8.

Science Strands by Grade Band											
Strand	Grade	K	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	7 <sup>th</sup>	8 <sup>th</sup>	Biology
Life Science: Hierarchical Organization		x	x	x	x	x		x			
Life Science: Cells as a System											x
Life Science: Energy Transfer											x
Life Science: Reproduction and Heredity		x	x	x	x	x				x	x
Life Science: Ecology & Interdependence		x	x	x			x	x	x		
Life Science: Interdependence of Organisms & Their Environment											x
Life Science: Adaptations and Diversity		x	x	x	x			x		x	x
Life Science: Adaptations and Evolution											
Physical Science: Organization of Matter and Chemical Interactions		x		x	x		x		x		
Physical Science: Motions, Forces, and Energy			x	x	x	x	x	x		x	
Earth & Space Science: Earth's Structure and History					x					x	
Earth & Space Science: Earth and the Universe		x		x			x	x			
Earth & Space Science: Earth's Systems and Cycles			x		x	x			x	x	
Earth and Space Science: Earth's Resources		x	x	x	x	x	x			x	

**K-8 content strands with the 10 disciplinary core ideas include:**

**Life Science**

1. Hierarchical Organization
2. Reproduction and Heredity
3. Ecology and Interdependence
4. Adaptations and Diversity

**Physical Science**

5. Organization of Matter and Chemical Interactions
6. Motions, Forces, and Energy

**Earth and Space Science**

7. Earth's Structure and History
8. Earth and the Universe
9. Earth's Systems and Cycles
10. Earth's Resources

## Structure of the Standards Document

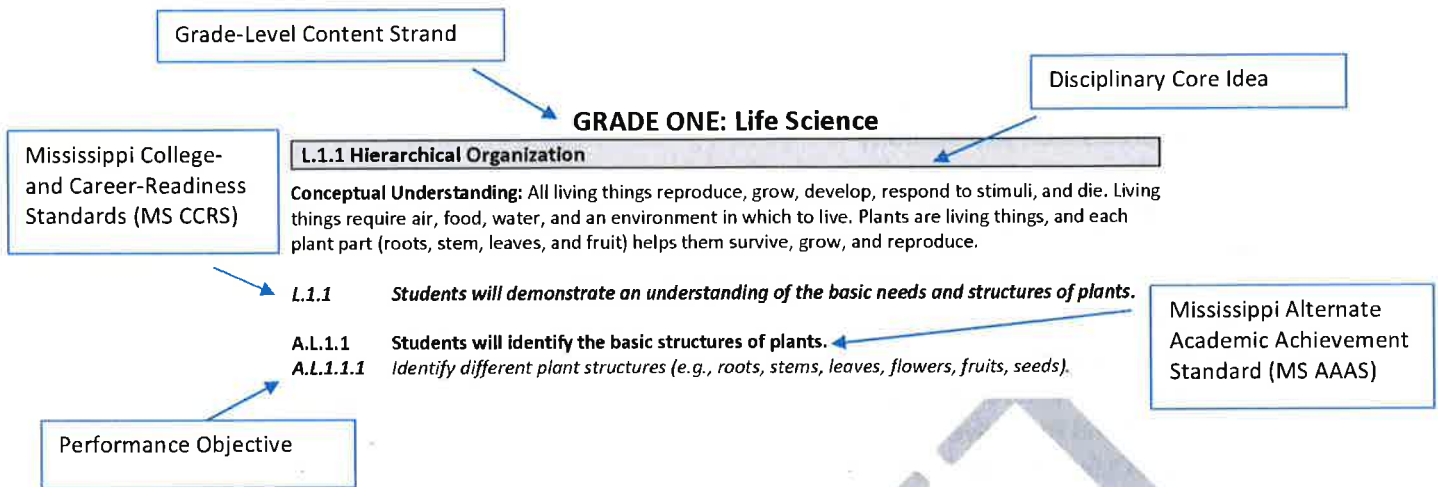
**Content strand:** Domains into which science fields can be divided based on relative content extending from kindergarten to eighth grade. In grades K-8, the content strands are organized into three distinct areas: (1) life science, (2) physical science, and (3) Earth and space science. For Grade 9-12 courses, the content areas are organized around the core ideas of each course.

**Disciplinary core ideas:** Subdivision of the main content strands providing recurring ideas from the three content strands. The core ideas are the key organizing principles for the development of emphasis on one of the three content strands in each grade level. All content strands will be found in each grade level, but all disciplinary core ideas will not be found in every grade level in K-8 due to the spiral arrangement of content.

**Conceptual understanding:** Statements of the core ideas for which student should demonstrate an understanding. Some grade level and/or course topics include more than one conceptual understanding with each guiding the intent of the standards.

**Mississippi College- and Career-Readiness content standard:** Each *MS AAAS for Science* is aligned to a specific *MS CCRS for Science* and that standard is listed for each *MS AAAS for Science*.

**Mississippi Alternate Academic Achievement content standard:** The *MS AAAS for Science* is a general statement of what students with significant cognitive disabilities should know and be able to do because of instruction.



## Safety in the Science Classroom

The National Science Teachers Association (NSTA) encourages K-12 school leaders and teachers to promote and support the use of science activities in science instruction and work to avoid and reduce inquiry. NSTA provides the following guidelines for school leaders and teachers to develop safety programs that include the effective management of chemicals, implement safety training for teachers and others, and create school environments that are as safe as possible (NSTA 2013). For students with significant cognitive disabilities, it is important for teachers to embed safety practices into all science lessons and instructional materials.

- 1) National Science Teachers Association's Safety in the Science Classroom, accessible at <http://www.nsta.org/docs/SafetyInTheScienceClassroom.pdf>
- 2) An extensive list of safety resources is available at <http://www.nsta.org/safety/>

## Support Documents and Resources

The MDE Office of Special Education will develop support documents after the *MS AAAS* is approved by the State Board of Education. Local districts, schools, and teachers may use these documents to construct standards-based science instruction and lessons, allowing them to customize content and delivery methods to fit each student's needs. The support documents may include suggested resources, instructional strategies, sample lessons, and blue prints. Professional development efforts will be aligned to the *MS AAS for Science* and delivered in accord with teacher resources to help expand expertise in delivering student-centered lessons. The most successful national models and programs will be referenced for a capacity-building effort that can develop a more effective culture of science education in Mississippi.

## Investigate, Apply, and Understand

The essence of science is natural to all children and includes discovery, observation, questions, design, testing, failure, iteration, and hands-on application. Research based approaches such as inquiry-based, (IB), project-based, and discovery learning are all pedagogical pathways that make sense, especially in the science classroom. Teachers are encouraged to embrace the growth mindset and constantly seek to upgrade classroom approaches by experimenting and adopting methods that excite students to learn and become functional in postsecondary environments.

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DRAFT

## KINDERGARTEN

### Theme: Change in the Natural World

In kindergarten, students observe changes in the natural world and identify how animals use their senses to recognize those changes. As student language and vocabulary develops, they become more capable of describing life cycle changes in plants and animals. Students learn that change occurs when plants and animals do not get the food, water, and space needed for growth. Students learn to recognize seasonal changes in the environment. Students explore and identify how sunlight affects the temperature of sand, soil, rocks, and water.

### KINDERGARTEN: Life Science

#### L.K.1 Hierarchical Organization

**Conceptual Understanding:** Objects in the environment can be classified as living and nonliving. Living things include plants and animals. All living things reproduce, grow, develop, respond to stimuli, and die; and nonliving things do not. Living things require air, food, water, and an environment in which to live. Acting as scientists, students will observe the natural world and use investigations, charts, drawings, sketches, and models to communicate ideas.

**L.K.1A** *Students will demonstrate an understanding of living and nonliving things.*

**A.L.K.1A** *Students will identify living things and nonliving things.*

**A.L.K.1A.1** *Differentiate between living thing and nonliving things.*

**Conceptual Understanding:** All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Animals (including humans) use their senses to learn about the world around them.

**L.K.1B** *Students will demonstrate an understanding of how animals (including humans) use their physical features and their senses to learn about their environment.*

**A.L.K.1B** *Students will identify how animals (including humans) use their physical features and their senses to learn about their environment.*

**A.L.K.1B.1** *Identify the five senses and the related body part.*

**A.L.K.1B.2** *Select body parts animals use to obtain food and move.*

### KINDERGARTEN: Life Science

#### L.K.2 Reproduction and Heredity

**Conceptual Understanding:** Plants and animals change in form as they go through stages in the life cycle. Young plants and animals are very much like their parents and other plants and animals of the same kind, but they can also vary in many ways.

**L.K.2** *Students will demonstrate an understanding of how living things change in form as they go through the general stages of a life cycle.*



**A.L.K.2** Students identify how living things change in form as they go through the general stages of a life cycle.

**A.L.K.2.1** *Identify two stages in the life cycle of a plant (e.g., seed and plant).*

**A.L.K.2.2** *Identify stages in the life cycle (baby and adulthood) of a familiar mammal (e.g., dog, squirrel, rabbit, deer) and human.*

## KINDERGARTEN: Life Science

### L.K.3 Ecology and Interdependence

**Conceptual Understanding:** The environment consists of many types of living things including plants and animals. Living things depend on the land, water, and air to live and grow.

**L.K.3A** *Students will demonstrate an understanding of what animals and plants need to live and grow.*

**A.L.K.3A** Students will identify what animals and plants need to live and grow.

**L.K.3A.1** *Identify what plants and animals need to survive.*

**Conceptual Understanding:** Interdependence exists between plants and animals within an environment. Living things can only survive in areas where their needs for air, water, food, and shelter are met.

**L.K.3B** *Students will demonstrate an understanding of the interdependence of living things and the environment in which they live.*

**A.L.K.3B** Students will identify organisms' interdependence on the environment in which they live.

**A.L.K.3B.1** *Match an animal to where it lives (e.g., fish to water, bears to forests).*

## KINDERGARTEN: Life Science

### L.K.4 Adaptations and Diversity

**Conceptual Understanding:** Some animals are now extinct because they were unable to adapt when the environment changed. There are similarities between some present-day animals and extinct animals.

**L.K.4** *Students will demonstrate an understanding that some groups of plants and animals are no longer living (extinct) because they were unable to meet their needs for survival.*

**A.L.K.4** Students will identify some groups of animals that are no longer living (extinct).

**A.L.K.4.1** *Identify examples of different animals that are extinct.*

**A.L.K.4.2** *Identify some present-day animals that resemble extinct animals (i.e., elephants resemble woolly mammoths).*

**KINDERGARTEN: Physical Science****P.K.5 Organization of Matter and Chemical Interactions**

**Conceptual Understanding:** Matter exists in different states, including solid and liquid forms. Water can exist as a solid or a liquid. Solid objects can be described and sorted according to their attributes. Different materials possess properties that are better suited for certain purposes.

**P.K.5A** *Students will demonstrate an understanding of the solid and liquid states of matter.*

**A.P.K.5A** *Students will identify the solid and liquid states of matter.*

**A.P.K.5A.1** *Identify a solid.*

**A.P.K.5A.2** *Identify a liquid.*

**Conceptual Understanding:** Many objects can be built from a smaller set of pieces (e.g., blocks, construction sets). Most objects can be broken down into various component pieces and any piece of uniform matter (e.g., a sheet of paper, a block of wood,) can be subdivided into smaller pieces of the same material. If pieces of the original object are damaged or removed, the object may not have the same properties or work the same.

**P.K.5B.** *Students will demonstrate an understanding of how solid objects can be constructed from a smaller set.*

**A.P.K.5B** *Students will identify that solid objects can be constructed from a smaller set.*

**A.P.K.5B.1** *Given pictures, other media sources, or basic shapes, construct or choose a constructed set that represents a larger object using a set of small objects. (e.g., blocks, construction sets).*

**A.P.K.5B.2** *Identify smaller components of a large object.*

**A.P.K.5B.3** *Identify possible scenarios that may happen if some parts are missing or taken away.*

**KINDERGARTEN: Earth and Space Science****E.K.8 Earth and the Universe**

**Conceptual Understanding:** Seasonal changes occur as the Earth orbits the sun. These seasonal changes repeat in a pattern. Patterns of sunrise and sunset can be described and predicted.

**E.K.8A** *Students will demonstrate an understanding of the pattern of seasonal changes on the Earth.*

**A.E.K.8A** *Students will identify patterns of seasonal changes on the Earth.*

**A.E.K.8A.1** *Identify the four seasons; spring, summer, fall, and winter.*

**Conceptual Understanding:** The sun is the source of heat and light for the solar system. This heat can impact Earth's natural resources. Living things depend upon the effects of the sun (warms the land, air, water, and helps plants grow) to survive.

**E.K.8B** *Students will demonstrate an understanding that the Sun provides the Earth with heat and light.*

**A.E.K.8B** *Students will identify that heat and light on Earth are produced by the Sun.*

**A.E.K.8B.1** *Use pictures or other media sources to identify day and night.*

**A.E.K.8B.2** *Identify the properties of the sun (warmth and light).*

**A.E.K.8B.3** *Identify objects (e.g., umbrella, tree) that can shield the sun's heat and light.*

## KINDERGARTEN: Earth and Space Science

### E.K.10 Earth's Resources

**Conceptual Understanding:** Humans use Earth's resources for everything they do. Choices that humans make to live comfortably can affect the world around them. Recycling, reusing, and reducing consumption of natural resources is important in protecting our Earth's environment. Humans can make choices that reduce their impact on Earth's environment.

**E.K.10** *Students will demonstrate an understanding of how humans use Earth's resources.*

**A.E.K.10** *Students will identify ways humans use Earth's resources.*

**A.E.K.10.1** *Identify a type of the Earth's material as rock, sand, or water.*

**A.E.K.10.2** *Identify objects that could be recycled.*

## GRADE ONE

### Theme: Discovering Patterns and Constructing Explanations

In Grade 1, students build on the language, vocabulary, and concepts developed in kindergarten to identify patterns observed in the natural environment. Students explore to recognize what plants need to live and grow. Students observe plant adaptations, such as trees shedding leaves or leaves turning toward the sun, and establish the cause-and-effect relationship between adaptations and environmental changes. Students describe, compare, and analyze daily weather data to determine weather patterns in different seasons. They learn how to better plan and respond to severe weather. Students investigate light and sound to find materials that light passes through and materials that change sound. Students develop investigations and make predictions about patterns in the natural world.

### GRADE ONE: Life Science

#### L.1.1 Hierarchical Organization

**Conceptual Understanding:** All living things reproduce, grow, develop, respond to stimuli, and die. Living things require air, food, water, and an environment in which to live. Plants are living things, and each plant part (roots, stem, leaves, and fruit) helps them survive, grow, and reproduce.

**L.1.1** *Students will demonstrate an understanding of the basic needs and structures of plants.*

**A.L.1.1** *Students will identify the basic structures of plants.*

**A.L.1.1.1** *Identify different plant structures (e.g., roots, stems, leaves, flowers, fruits, seeds).*

### GRADE ONE: Life Science

#### L.1.2 Reproduction and Heredity

**Conceptual Understanding:** Plants and animals change with each stage of life. Plants have predictable and observable characteristics at each developmental stage (germination, growth, reproduction, and seed dispersal). Most plants are stationary, so they depend upon animals or the wind for seed dispersal. Plants and animals are similar to their parents and resemble other plants and animals of the same kind.

**L.1.2** *Students will demonstrate an understanding of how living things change in form as they go through the general stages of a life cycle.*

**A.L.1.2** *Students will identify general stages of a life cycle.*

**A.L.1.2.1** *Identify the life cycle of a flowering plant as it grows from seed to plant.*

**A.L.1.2.2** *Identify the life cycle (egg, larva, pupa, adult) of pollinating insects (e.g., bees, butterflies).*

**GRADE ONE: Life Science****L.1.3 Ecology and Interdependence**

**Conceptual Understanding:** The needs of plants must be met to survive. Sunlight, water, nutrients, and space to grow are necessary for plant growth.

**L.1.3A** *Students will demonstrate an understanding of what plants need from the environment for growth and repair.*

**A.L.1.3A** *Students will identify what plants need from the environment to grow.*

**A.L.1.3A.1** *Identify basic plant needs (e.g., air, water, sunlight, soil, space).*

**Conceptual Understanding:** Animals, such as insects, depend on other living organisms for food. Many plants depend on insects or other animals for pollination or to move their seeds around, so the plant species can survive and persist over generations.

**L.1.3B** *Students will demonstrate an understanding of the interdependence of flowering plants and pollinating insects.*

**A.L.1.3B** *Students will identify the interdependence of flowering plants and pollinating insects.*

**A.L.1.3B.1** *Identify bees and butterflies as pollinating insects.*

**A.L.1.3B.2** *Identify pollinating insects' role in transferring pollen in flowering plants to enable plants to produce seeds.*

**GRADE ONE: Life Science****L.1.4 Adaptations and Diversity**

**Conceptual Understanding:** Plants respond to stimuli (e.g., turn their leaves to the sun, use tendrils to grab and support) to adapt to changes in the environment. There are distinct environments in the world that support certain types of plants. Plants have features that help them survive in their environment.

**L.1.4** *Students will demonstrate an understanding of the ways plants adapt to their environment in order to survive.*

**A.L.1.4** *Students will identify ways plants adapt to their environment in order to survive.*

**A.L.1.4.1** *Match a plant to its distinct environment (e.g. cactus to desert).*

**A.L.1.4.2** *Match a change in an environment to a response in a plant (e.g., in cooler weather, leaves change colors.)*

**GRADE ONE: Physical Science****P.1.6 Motions, Forces, and Energy**

**Conceptual Understanding:** Some objects allow light to pass through them, and some objects do not allow any light to pass through them, creating shadows. Objects reflect light, and objects can only be seen when light is reflected off of them.

**P.1.6A** *Students will demonstrate an understanding that light is required to make objects visible.*

**A.P.1.6A** *Students will demonstrate a basic understanding that light is required to make objects visible.*

**A.P.1.6A.1** *Identify objects that give off light (e.g., sun, light bulb).*

**A.P.1.6A.2** *Identify whether light passes through an object (e.g., glass and cardboard).*

**A.P.1.6A.3** *Determine how objects create shadows.*

**Conceptual Understanding:** Vibrations of matter can create sound, and sound can make an object vibrate. Humans use sound and light to communicate over long distances.

**P.1.6B** *Students will demonstrate an understanding of sound.*

**A.P.1.6B** *Students will identify basic actions that form sound.*

**A.P.1.6B.1** *Identify that vibrations create sound (e.g., pluck a guitar string).*

**A.P.1.6B.2** *Identify that sound can create vibrations (e.g., feeling sound through a speaker).*

**GRADE ONE: Earth and Space Science****E.1.9 Earth's Systems and Cycles**

**Conceptual Understanding:** Weather is a combination of temperature, sunlight, wind, snow, or rain in a particular place at a particular time. People measure weather conditions (temperature, precipitation) to describe and record the weather and to notice patterns over time. Temperature and precipitation can change with the seasons. Some kinds of severe weather (hurricane, tornado, flood, and drought) are more likely to occur in certain regions. Meteorologists forecast severe weather so that communities can prepare for and respond appropriately.

**E.1.9A** *Students will demonstrate an understanding of the patterns of weather by describing, recording, and analyzing weather data to answer questions about daily and seasonal weather patterns.*

**A.E.1.9A** *Students will identify basic patterns of weather.*

**A.E.1.9A.1** *Observe local weather conditions (e.g., temperature and precipitation) to identify weather patterns.*

**A.E.1.9A.2** *Identify types of short-term weather (e.g., rain, snow, clear).*

**A.E.1.9A.3** *Describe changes in a season (e.g., some trees lose leaves in winter).*

**A.E.1.9A.4** *Identify a weather condition that is a problem for human activities (e.g., rain).*

**Conceptual Understanding:** The Earth is made of different materials, including rocks, soil, and water (nonliving things). Plants and animals, including humans, depend on the Earth's land, water, and air to live and grow. Animals, including humans, can change the environment (e.g., shape of the land, the flow of

water).

**E.1.9B** *Students will demonstrate an understanding of models (drawings or maps) to describe how water and land are distributed on Earth.*

**A.E.1.9B** *Students will identify and classify bodies of water and land masses on Earth using drawings, maps, or physical models.*

**A.E.1.9B.1** *Classify regions of Earth as land or bodies of water.*

## GRADE ONE: Earth and Space Science

### E.1.10 Earth's Resources

**Conceptual Understanding:** Water is essential to life on Earth. Humans and other living things are dependent on clean water to survive. Water is an Earth material, and like all of Earth's resources, the amount of water is limited. Continued health and survival of humans are dependent on solutions that maintain clean water sources.

**E.1.10** *Students will demonstrate an understanding of human dependence on clean and renewable water resources.*

**A.E.1.10** *Students will demonstrate an understanding of human dependence on clean and renewable water resources.*

**A.E.1.10.1** *Identify the impact of human pollution on water in the local environment.*

**A.E.1.10.2** *Describe possible solutions to human pollution on the local environment.*

## GRADE TWO

### Theme: Systems, Order, and Organization

In Grade 2, students organize plants and animals according to their physical characteristics and recognize that living things are part of a larger system. Students identify characteristics of animals that help them survive in their environments. Students explore evidence where plants and animals compete or cooperate with other plants in a system before identifying the adaptations that help them survive in that environment. Students investigate the relationship between friction and the motion of an object by changing the strength, direction, and speed of pushes and pulls.

### GRADE TWO: Life Science

#### L.2.1 Hierarchical Organization

**Conceptual Understanding:** Animals have unique physical and behavioral characteristics that enable them to survive in their environment. Animals can be classified based on physical characteristics.

- L.2.1** *Students will demonstrate an understanding of the classification of animals based on physical characteristics.*
- A.L.2.1** *Students will identify the classification of animals based on physical characteristics.*
- A.L.2.1.1** *Differentiate between animals with backbones (vertebrates) and animals without backbones (invertebrates).*
- A.L.2.1.2** *Categorize vertebrates (mammals, fish, birds, amphibians, and reptiles) based on their physical characteristics.*

### GRADE TWO: Life Science

#### L.2.2 Reproduction and Heredity

**Conceptual Understanding:** Plants and animals experience different life cycles as they grow and develop. Plants and animals exhibit predictable characteristics at each developmental stage throughout the life cycle.

- L.2.2** *Students will demonstrate an understanding of how living things change in form as they go through the general stages of a life cycle.*
- A.L.2.2** *Students demonstrate an understanding of how living things change in form as they go through the general stages of a life cycle.*
- A.L.2.2.1** *Identify different stages of the life cycle of trees (i.e., pines, oaks) to compare how trees change and grow over time.*
- A.L.2.2.2** *Sequence the life cycle of an animal (e.g., dog, from puppy, adult, death).*



## GRADE TWO: Life Science

### L.2.3 Ecology and Interdependence

**Conceptual Understanding:** Animals respond to stimuli (e.g., temperature adaptations and migration for food) to adapt to changes in the environment. There are distinct environments in the world that support certain types of animals. Animals have features that help them survive in their environment.

**L.2.3A** *Students will demonstrate an understanding of the interdependence of living things and the environment in which they live.*

**A.L.2.3A** *Students will identify the interdependence of animals and the environment in which they live.*

**A.L.2.3A.1** *Classify animals to distinct environments (e.g., fish to water).*

**A.L.2.3A.2** *Classify changes in an environment to animals' responses (e.g., winter coat/shedding of fur, migration, and preparing for hibernation).*

**Conceptual Understanding:** All animals and plants need food to provide energy for activity and raw materials for growth. All living things in an environment interact with each other in different ways and for different reasons.

**L.2.3B** *Students will demonstrate an understanding of the interdependence of living things.*

**A.L.2.3B** *Students will identify examples of the interdependence of living things.*

**A.L.2.3B.1** *Use models to identify the how animals are dependent upon plants (e.g. Honey bees collect pollen and nectar as food for the entire colony, and as they do, they pollinate plants).*

## GRADE TWO: Life Science

### L.2.4 Adaptations and Diversity

**Conceptual Understanding:** Living things need air, food, water, and space to survive. Different environments support different types of animals. Animals have adaptations allowing them to grow and survive in the climate of their specific environment.

**L.2.4** *Students will demonstrate an understanding of the ways animals adapt to their environment in order to survive.*

**A.L.2.4** *Students will identify various ways animals adapt to their environment in order to survive.*

**A.L.2.4.1** *Identify animals that have adapted to their environment for survival and describe the adaptation. (e.g., ducks use webbed feet to swim in lakes and ponds, giraffes use their long necks to reach food source).*

## GRADE TWO: Physical Science

### P.2.5 Organization of Matter and Chemical Interactions

**Conceptual Understanding:** Matter exists in different states, including solid and liquid. Solids have a definite shape, weight, and size (length). Liquids have a definite size (volume) but not a definite shape. A gas has neither definite shape, nor size (volume). Changes to matter can result from changes in temperature. Some changes may or may not be reversible (i.e., melting or freezing versus burning a cake).

- P.2.5** *Students will demonstrate an understanding of the properties of matter.*
- A.P.2.5** *Students will distinguish basic properties of matter.*
- A.P.2.5.1** *Sort matter as solids or liquids.*
- A.P.2.5.2** *Identify whether a substance has been melted or frozen (e.g. water, ice cream, popsicle).*

## GRADE TWO: Physical Science

### P.2.6 Motions, Forces, and Energy

**Conceptual Understanding:** An object at rest will stay at rest unless it is pushed or pulled by an unbalanced force. Pushes and pulls can have different strengths, directions, or speeds. Friction occurs when two objects make contact. Friction can change the motion of an object and the speed of an object. Friction can be increased or decreased.

- P.2.6** *Students will demonstrate an understanding of how the motion of objects is affected by pushes, pulls, and friction on an object.*
- A.P.2.6** *Students will demonstrate a basic understanding of how the motion of objects is affected by pushes, pulls, and friction.*
- A.P.2.6.1** *Identify examples of push and pull.*
- A.P.2.6.2** *Describe how friction affects the movement of an object.*
- A.P.2.6.3** *Identify forces that affect the rate of speed of an object (e.g. uphill slower, downhill faster).*

## GRADE TWO: Earth and Space Science

### E.2.8 Earth and the Universe

**Conceptual Understanding:** Patterns of the Sun, Moon, and stars can be observed, described, and predicted. The sun is the source of heat and light for the solar system. Seasonal changes occur as the Earth orbits the Sun because of the tilt of the Earth on its axis. At night, one can see light from stars and sunlight being reflected from the moon. Telescopes make it possible to observe the Moon and the planets in greater detail. Space observation and exploration continue to help humans understand more about the universe.

- E.2.8** *Students will demonstrate an understanding of the appearance, movements, and patterns of the sun, moon, and stars.*
- A.E.2.8** *Students will identify appearance, movements, and patterns of the sun, moon, and stars.*
- A.E.2.8.1** *Identify stars that can be observed in the night sky.*

- A.E.2.8.2** *Demonstrate an understanding that the Sun is the Earth's closest star.*
- A.E.2.8.3** *Classify day/night in relation to an understanding of sunrise and sunset.*
- A.E.2.8.4** *Identify characteristics of the moon, planets, and the Sun.*
- A.E.2.8.5** *Identify tools scientist use to explore space.*

## GRADE TWO: Earth and Space Science

### E.2.10 Earth's Resources

**Conceptual Understanding:** Earth is made of different materials, including rocks, sand, soil, and water. An Earth material is a resource that comes from Earth. Earth materials can be classified by their observable properties. Human life and health are heavily dependent on these materials. Understanding how to best conserve these resources will continue to be a major challenge for humans.

- E.2.10** *Students will demonstrate an understanding of how humans use Earth's resources.*
- A.E.2.10** *Students will identify how humans use Earth's resources.*
  - A.E.2.10.1** *Identify the properties of Earth materials (including rocks, soils, sand, and water).*
  - A.E.2.10.2** *Classify everyday objects that are resources from the Earth (e.g., drinking water, granite countertops, clay dishes, wood furniture, or gas grill).*
  - A.E.2.10.3** *Identify ways Earth materials are used (e.g., soil and water to grow plants; rocks to make roads, walls or building; or sand to make glass).*

## GRADE THREE

### Theme: Interactions within an Environment

In Grade 3, the crosscutting concept can be seen in life science through an organism's ability to grow, develop, survive, obtain food/energy, and reproduce within a given environment. In physical science, the concept is developed through a study of matter and its properties and their interactions based on environmental changes and surroundings. The study of Earth science in third grade investigates surface features affected by one or more of Earth's spheres and human impacts on the environment. Students will gain content knowledge about the ways matter and organisms interact and are affected by the environment.

### GRADE THREE: Life Science

#### L.3.1 Hierarchical Organization

**Conceptual Understanding:** Plants and animals have physical characteristics and features that allow them to receive information from the environment. Structural adaptations within groups of plants and animals allow them to better survive and reproduce in an environment.

- L.3.1** *Students will demonstrate an understanding of internal and external structures in plants and animals and how they relate to their growth, survival, behavior, and reproduction within an environment.*
- A.L.3.1** **Students will identify characteristics of organisms and how they relate to their growth, survival, behavior, and reproduction within an environment.**
- A.L.3.1.1** *Describe physical characteristic of animals (e.g., fur, fins, scales).*
- A.L.3.1.2** *Identify the function of body parts. (e.g., mouth for eating).*
- A.L.3.1.3** *Identify the stages of an animal's life cycle, (e.g., baby, adolescent, adult, and death).*
- A.L.3.1.4** *Identify characteristics of animals that help them survive in distinct environments (e.g., water, desert, forest, polar).*
- A.L.3.1.5** *Identify unique characteristics of organisms that allow survival in their environment (e.g., duck has webbed feet to swim).*
- A.L.3.1.6** *Identify structures of plants (e.g., thorns, leaves, stems, roots, or colored petals) with their function (e.g., survival, growth, and reproduction).*

### GRADE THREE: Life Science

#### L.3.2 Reproduction and Heredity

**Conceptual Understanding:** Scientists have identified and classified many types of plants and animals. Some characteristics and traits that are possessed by organisms are inherited, and some result from interactions with the environment.

- L.3.2** *Students will demonstrate an understanding that through reproduction, the survival and physical features of plants and animals are inherited traits from parent organisms, but those features can also be influenced by the environment.*

- A.L.3.2** **Students will demonstrate an understanding that through reproduction, features of plants**

and animals are inherited from parent organisms but can also be influenced by the environment.

**A.L.3.2.1** *Match offspring of parent organism(s).*

**A.L.3.2.2** *Describe similar traits passed from parent organisms to offspring.*

**A.L.3.2.3** *Identify traits that can be influenced by the environment (e.g., arctic fox's coat gets thicker and turns white in winter; cacti have thick waxy covering to seal moisture).*

## GRADE THREE: Life Science

### L.3.4 Adaptations and Diversity

**Conceptual Understanding:** When the environment or habitat changes, some organisms survive, some move to new locations, and some become extinct.

**L.3.4** *Students will demonstrate an understanding of how adaptations allow animals to satisfy life needs and respond both physically and behaviorally to their environment.*

**A.L.3.4** *Students will identify how adaptations allow animals to meet their needs.*

**A.L.3.4.1** *Classify organisms to their biome.*

**A.L.3.4.2** *Identify changes in a habitat to organisms' responses. (e.g., cold or drought means less food, more light) in a habitat and possible responses (e.g., hibernating, migrating, death, growing taller) of the plants and animals.*

## GRADE THREE: Physical Science

### P.3.5 Organization of Matter and Chemical Interactions

**Conceptual Understanding:** Matter is made up of particles that are too small to be seen. Even though the particles are very small, the movement and spacing of these particles determine the basic properties of matter. Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat is added or removed.

**P.3.5** *Students will demonstrate an understanding of the physical properties of matter to explain why matter can change states between a solid, liquid, or gas dependent upon the addition or removal of heat.*

**A.P.3.5** *Students will apply the physical properties of matter and recognize changes in states between a solid, liquid, or gas.*

**A.P.3.5.1** *Identify an observable property of a matter (e.g. hard/soft, rough/smooth).*

**A.P.3.5.2** *Sort objects or substances as being a solid, liquid, or gas.*

**A.P.3.5.3** *Identify a change in the form of matter (e.g., solid to liquid, liquid to gas).*

## GRADE THREE: Physical Science

### P.3.6 Motions, Forces, and Energy

**Conceptual Understanding:** Magnets are a specific type of solid that can attract and repel certain other kinds of materials, including other magnets. There are some materials that are neither attracted to, nor repelled by magnets. Because of their special properties, magnets are used in various ways. Magnets can exert forces—a push or a pull—on other magnets or magnetic materials, causing energy transfer between them, even when the objects are not touching.

**P.3.6** *Students will demonstrate an understanding of magnets and the effects of pushes, pulls, and friction on the motion of objects.*

**A.P.3.6** *Students will demonstrate a basic understanding of magnets.*

**A.P.3.6.1** *Identify items or materials that are not attracted to magnets.*

**A.P.3.6.2** *Classify objects that are attracted to magnets.*

**A.P.3.6.3** *Identify how magnets are used in everyday life.*

## GRADE THREE: Earth and Space Science

### E.3.7 Earth's Structure and History

**Conceptual Understanding:** Since its formation, the Earth has undergone a great deal of geological change driven by its composition and systems. Earth materials include rocks, soils, water, and gases. Rock is composed of different combinations of minerals. Smaller rocks come from the breakage and weathering of bedrock and larger rocks. Soil is made partly from weathered rock, partly from plant remains, and contains many living organisms.

**E.3.7A** *Students will demonstrate an understanding of the various processes involved in the rock cycle, superposition of rock layers, and fossil formation.*

**A.E.3.7A** *Students will identify and classify characteristics of Earth's materials.*

**A.E.3.7A.1** *Use observational data to compare properties (e.g., size, shape, color, rough, smooth, wet, salty) of the Earth's materials (e.g., rocks, soils, sand, water).*

**A.E.3.7A.2** *Classify Earth's materials by the way they could be used (e.g., soil and water to grow plants, rocks to build roads).*

**Conceptual Understanding:** Earth has an active mantle, which interacts with the Earth's crust to drive plate tectonics and form new rocks. Resulting surface features change through interactions with water, air, and living things. Waves, wind, water, and ice shape and reshape the Earth's land surface by eroding rock and soil in some areas and depositing them in other areas. Scientists use many methods to learn more about the history and age of Earth.

**E.3.7B** *Students will demonstrate an understanding of the composition of Earth and the processes which change Earth's landforms.*

**A.E.3.7B** *Students will demonstrate a basic understanding of the composition of Earth and the processes which change Earth's landforms.*

**A.E.3.7A.1** *Identify oceans, seas, rivers, streams, lakes and ponds, and glaciers as a body of water.*

**A.E.3.7A.2** *Identify volcanoes, mountains, valleys, canyons, plains, deserts, hills, and islands as Earth's landforms and match characteristics of each.*

**A.E.3.7B.3** *Use models to match a natural event (e.g., fires, landslides, earthquakes, volcanic eruptions, or floods) or human activity (e.g., farming, mining, or building) to its environmental impact.*

**GRADE THREE: Earth and Space Science****E.3.9 Earth's Systems and Cycles**

**Conceptual Understanding:** The Earth's land can be situated above or submerged below water. The water levels of bodies of water rise or recede depending on variables, such as the position of the sun or moon and weather conditions. Movement of water as it flows shapes the appearance of the land (e.g. movement of water to the ocean).

**E.3.9** *Students will demonstrate an understanding of how the Earth's systems (i.e., geosphere, hydrosphere, atmosphere, and biosphere) interact in multiple ways to affect Earth's surface materials and processes.*

**A.E.3.9** *Students will demonstrate an understanding of how the Earth's systems (i.e. weather conditions and position of the sun) interact in multiple ways to affect Earth's surface.*

**A.E.3.9.1** *Identify different landforms and surface features that are a result from the location and movement of water on Earth's surface (e.g., ponds, creeks, lakes, rivers, canyons).*

**GRADE THREE: Earth and Space Science****E.3.10 Earth's Resources**

**Conceptual Understanding:** Earth is made of materials that provide resources for human activities, and their use affects the environment in multiple ways. Some resources are renewable, and others are not.

**E.3.10** *Students will demonstrate an understanding that all materials, energy, and fuels that humans use are derived from natural sources.*

**A.E.3.10** *Students will identify materials, energy, and fuels that humans use which are derived from natural sources.*

**A.E.3.10.1** *Identify some of Earth's resources that are used in everyday life, such as water, wind, soil, forests, oil, natural gas, and minerals.*

**A.E.3.10.2** *Identify ways humans attain, use, and protect Earth resources.*

## GRADE FOUR

### Theme: Energy and Systems

In Grade 4, students discover patterns related to energy and change in the world around them. The crosscutting concept can be seen in life science through the study of human body systems, including their functions. In physical science, the concept is developed through a study of energy in the forms of heat, light, sound, and electricity, as well as the conservation and transfer of energy from one form to another. The study of Earth science in fourth grade investigates the driving force of energy as it relates to the water cycle and changes in patterns of weather and climate. Because of this yearlong study, students will gain knowledge about the ways energy and change relate to the world around us.

### GRADE FOUR: Life Science

#### L.4.1 Hierarchical Organization

**Conceptual Understanding:** All organisms need energy for growth and development. Animals have specialized structures and systems for obtaining and processing energy. These structures and systems cannot function properly without adequate nourishment. Living organisms can be adversely affected by environmental conditions or disease.

- L.4.1** *Students will demonstrate an understanding of the organization, functions, and interconnections of the major human body systems.*
- A.L.4.1** *Students will identify the major human body systems.*
- A.L.4.1.1** *Identify the major organs in human body systems.*
- A.L.4.1.2** *Communicate how infectious diseases (e.g., cold, flu) effect the function of the body system.*
- A.L.4.1.3** *Identify lifestyle activities that influence body systems (e.g., diet, exercise, vaccines, etc.).*

### GRADE FOUR: Life Science

#### L.4.2 Reproduction and Heredity

**Conceptual Understanding:** Scientists have identified and classified many types of plants and animals. Each plant or animal has a unique pattern of growth and development called a life cycle. All of Earth's cycles are driven by energy which can be traced back to the sun.

- L.4.2** *Students will demonstrate an understanding of life cycles, including familiar plants and animals (e.g., reptiles, amphibians, or birds).*
- A.L.4.2** *Students will demonstrate a basic understanding of life cycles, including familiar plants and animals (e.g., reptiles, amphibians, or birds).*
- A.L.4.2.1** *Sequence the life cycles of familiar plants and animals.*



**GRADE FOUR: Physical Science****P.4.6 Motions, Forces, and Energy**

**Conceptual Understanding:** As different forms of energy, heat and electricity can be produced in different ways and are transferred and conducted from one form or object to another. Electricity can be transferred from place to place by electric currents to produce motion, sound, heat, or light.

**P.4.6A** *Students will demonstrate an understanding of the common sources and uses of heat and electric energy and the materials used to transfer heat and electricity.*

**A.P.4.6A** *Students will identify common sources of electric energy and the materials used to transfer electricity.*

**A.P.4.6A.1** *Identify uses of electricity.*

**A.P.4.6A.2** *Identify items that transmit electricity (batteries, power lines, generators).*

**Conceptual Understanding:** Light, as a form of energy, has specific properties, including brightness. Light travels in a straight line until it strikes an object. The way light behaves when it strikes an object depends on the object's properties.

**P.4.6B** *Students will demonstrate an understanding of the properties of light as forms of energy.*

**A.P.4.6B** *Students will identify properties of light as a form of energy.*

**A.P.4.6B.1** *Identify colors in a rainbow or prism reflection.*

**A.P.4.6B.2** *Demonstrate an understanding of reflection or absorption (e.g. sunlight shining on window, sunlight on a wall).*

**A.P.4.6B.3** *Describe how light behaves when it strikes transparent, translucent, and opaque materials.*

**Conceptual Understanding:** Sound, as a form of energy, is produced by vibrating objects (matter) and has specific properties, including pitch and volume. Sound travels through air and other materials and is used to communicate information in various forms of technology.

**P.4.6C** *Students will demonstrate an understanding of the properties of sound as a form of energy.*

**A.P.4.6C** *Students will identify the properties of sound as a form of energy.*

**A.P.4.6C.1** *Use models to identify the pitch (high/low) and volume (loud/soft) of a sound.*

**A.P.4.6C.2** *Identify ways to change the pitch and volume of a sound.*

**GRADE FOUR: Earth and Space Science****E.4.9 Earth's Systems and Cycles**

**Conceptual Understanding:** Earth's atmosphere is a mixture of gases, including water vapor and oxygen. Water, which is found almost everywhere on Earth, including the atmosphere, changes form and cycles between Earth's surface to the air and back again. This cycling of water is driven by energy from the sun. The movement of water in the water cycle is a major process that influences weather conditions. Clouds form during this cycle and various types of precipitation result.

**E.4.9A** *Students will demonstrate an understanding of how the water cycle is propelled by the sun's energy.*

**A.E.4.9A** *Students will identify the water cycle is propelled by the sun's energy.*

**A.E.4.9A.1** *Identify parts of the water cycle.*

**Conceptual Understanding:** Scientists record patterns in weather conditions over time and across the globe to make predictions about what kind of weather might occur next. Climate describes the range of an area's typical weather conditions and the extent to which those conditions vary over long periods of time.

**E.4.9B** *Students will demonstrate an understanding of weather and climate patterns.*

**A.E.4.9B** *Students will identify weather phenomenon and climate patterns.*

**A.E.4.9B.1** *Match severe weather conditions (e.g., thunderstorms, hurricanes, floods, and tornadoes) to safety precautions.*

**A.E.4.9B.2** *Identify commonly used weather measurement instruments (e.g., barometer, rain gauge, anemometer, or wind vane).*

**Conceptual Understanding:** Earth's oceans and landforms can be affected in various ways by natural processes in one or more of Earth's spheres (i.e., atmosphere, biosphere, geosphere, and hydrosphere). Humans cannot eliminate natural hazards caused by these processes but can take steps to reduce their impacts. Human activities can affect the land and oceans in positive and negative ways.

**E.4.9C** *Students will demonstrate an understanding of how natural processes and human activities affect the features of Earth's landforms and oceans.*

**A.E.4.9C** *Students will identify how natural processes and human activities affect the features of Earth's landforms and oceans.*

**A.E.4.9C.1** *Match natural processes (e.g., weathering, erosion, deposition, earthquakes, tsunamis, hurricanes, or storms) to the possible impact on Earth's surface.*

**A.E.4.9C.2** *Demonstrate an understanding that human activities (conservation and pollution) affect the Earth.*

## GRADE FOUR: Earth and Space Science

### E.4.10 Earth's Resources

**Conceptual Understanding:** Energy and fuels are derived from natural sources and human use of these materials affects the environment in multiple ways. Due to limited natural resources, humans are exploring the use of abundant solar, water, wind, and geothermal energy resources to develop innovative, high-tech renewable energy systems.

**E.4.10** *Students will demonstrate an understanding of the various sources of energy used for human needs along with their effectiveness and possible impacts.*

**A.E.4.10** *Students will identify various sources of energy used by humans.*

**A.E.4.10.1** *Identify various forms of energy (e.g., wind, solar, water).*

**GRADE FIVE****Theme: Interdependence of Systems**

In Grade 5, students will identify processes, obtaining a lifelong, applicable knowledge base about relationships among a variety of systems. The crosscutting concept can be seen in life science through the transfer of energy from the sun into all parts of a food web and ecosystem. In physical science, the concept is developed through a study of matter and an examination of forces and motion through the lens of gravity's effect on an object. The study of Earth and space science in fifth grade investigates the Earth in the universe, relationships between the bodies of our solar system, and human interaction with the Earth.

**GRADE FIVE: Life Science****L.5.3 Ecology and Interdependence**

**Conceptual Understanding:** All organisms need energy to live and grow. Energy is obtained from the sun. Plants transform energy from the sun to perform essential life functions. Structures of plants have specific functions.

**L.5.3A** *Students will demonstrate an understanding of photosynthesis and the transfer of energy from the sun into chemical energy necessary for plant growth and survival.*

**A.L.5.3A** **Identify that the sun is the source of energy in the photosynthesis process.**

**A.L.5.3A.1** *Identify the structures of a plant (e.g., roots, stems and leaves) that transport food and water.*

**A.L.5.3A.2** *Match structures of a plant and their functions (e.g., leaves make food, stems provide support).*

**A.L.5.3A.3** *Demonstrate an understanding that light and water are necessary for green plants' survival to make food (photosynthesis).*

**A.L.5.3A.4** *Use observational data and models to recognize that plants grow toward light, roots grow down, and stems grow up.*

**Conceptual Understanding:** The role an organism serves in an ecosystem can be described by the way in which it obtains its energy. Energy is transferred within an ecosystem by producers and consumers.

**L.5.3B** *Students will demonstrate an understanding of a healthy ecosystem with a stable web of life and the roles of living things within a food chain and/or food web, including producers, primary and secondary consumers, and decomposers.*

**A.L.5.3B** **Students will list the roles of living things within a food chain.**

**A.L.5.3B.1** *Identify living factors in an ecosystem.*

**A.L.5.3B.2** *Classify organisms as producers or consumers.*

**A.L.5.3B.3** *Use models to organize a simple food chain.*

**A.L.5.3B.4** *Sort the roles of organisms in a food chain (e.g., producer, predator, prey).*

**GRADE FIVE: Physical Science****P.5.5 Organization of Matter and Chemical Interactions**

**Conceptual Understanding:** Substances exhibit specific properties that can be observed and measured.

**P.5.5A** *Students will demonstrate an understanding of the physical properties of matter.*

**A.P.5.5A** **Students will identify the physical properties of matter.**

**A.P.5.5A.1** *Describe physical properties of solids, liquids, and gases.*

**A.P.5.5A.2** *Using an appropriate tool, identify the mass of items.*

**A.P.5.5A.3** *Classify items, objects, or substances by density.*

**A.P.5.5A.4** *Make predictions about how the density of an object affects whether the object sinks or floats when placed in a liquid.*

**Conceptual Understanding:** Substances of the same type can be classified by their similar, observable properties. Substances can be combined in a variety of ways. A mixture is formed when two or more kinds of matter are physically combined. Solutions are a special type of mixture in which one substance is distributed evenly into another substance. When the physical properties of the components in a mixture are not changed, they can be separated in different physical ways.

**P.5.5B** *Students will demonstrate an understanding of mixtures and solutions.*

**A.P.5.5B** **Students will identify mixtures and solutions along with methods for separation of mixtures and solutions common to life application.**

**A.P.5.5B.1** *Identify a mixture as two or more substances that are mixed together.*

**A.P.5.5B.2** *Identify mixtures in which the individual materials substances can easily be separated (e.g., salad, sand and water).*

**A.P.5.5B.3** *Identify systems (e.g., sifting, filtration, evaporation, magnetic attraction, or floatation) for separating various mixtures.*

**Conceptual Understanding:** Physical properties can be observed and measured without changing the composition of matter. A physical change occurs when the matter's physical appearance is altered while leaving the composition of the matter unchanged. When two or more substances are mixed together, a new substance with different properties can sometimes be formed, but the total amount (i.e., mass) of the substances is conserved (i.e., total mass stays the same). In a chemical change, the composition of the original matter is altered to create a new substance. A different compound is present at the completion of the chemical change.

**P.5.5C** *Students will demonstrate an understanding of the difference between physical and chemical changes.*

**A.P.5.5C** **Students will identify physical and chemical changes.**

**A.P.5.5C.1** *Identify a physical change (e.g., ice melting, paper torn into smaller pieces).*

**A.P.5.5C.2** *Identify a chemical change (e.g., burning wood or a candle, rusting of iron, souring of milk).*

## GRADE FIVE: Physical Science

### P.5.6 Motions, Forces, and Energy

**Conceptual Understanding:** Gravity is a force that draws objects to Earth. This force acting on an object near Earth's surface pulls that object toward the planet's center. The motion of an object can be described in terms of its position, direction, and speed. Multiple factors determine the rate and motion of an object.

- P.5.6** *Students will demonstrate an understanding of the factors that affect the motion of an object through a study of Newton's Laws of Motion.*
- A.P.5.6** *Students will identify factors that affect the motion of an object.*
- A.P.5.6.1** *Use models to identify the speed (fast or slow) or direction (up or down) of a moving object.*
- A.P.5.6.2** *Identify forces that can make objects move faster, slower, stop, or change direction.*
- A.P.5.6.3** *Demonstrate an understanding that unbalanced forces change the rate and direction of motion of an object.*
- A.P.5.6.4** *Identify that when the same force (push or pull) is applied to two different objects, the mass (heavy or light) of the objects will affect their motion (e.g., when the same push is applied to a heavier book and to a light book, the heavy book will move less).*
- A.P.5.6.5** *Use models to demonstrate that friction is a force that acts against motion.*

## GRADE FIVE: Earth and Space Science

### E.5.8 Earth and the Universe

**Conceptual Understanding:** Astronomy is the study of celestial objects in our solar system and beyond. A solar system includes one or more suns (stars) and all other objects orbiting in that system. Planets in our night sky change positions and are not always visible from Earth as they orbit our sun. Stars that can be seen in the night sky lie beyond our solar system and appear in patterns called constellations. Constellations can be used for navigation and appear to move together across the sky because of Earth's rotation and revolution around the sun.

- E.5.8A** *Students will demonstrate an understanding of the locations of objects in the universe.*
- A.E.5.8A** *Students will identify locations and positions of objects in the universe.*
- A.E.5.8A.1** *Identify objects in our solar system (sun, planets, moon, and comets).*
- A.E.5.8A.2** *Use models to place the positions/locations of the sun, moon, and Earth in our solar system.*
- A.E.5.8A.3** *Identify tools that are used to study space (e.g., telescope and satellite).*
- Conceptual Understanding:** Earth orbits around the sun as the moon orbits around Earth. The revolution and rotation of Earth on a tilted axis provide evidence of patterns that can be observed, studied, and predicted.
- E.5.8B** *Students will demonstrate an understanding of the principles that govern moon phases, day and night, appearance of objects in the sky, and seasonal changes.*
- A.E.5.8B** *Students will identify moon phases, day and night, appearance of objects in the sky, and seasonal changes.*
- A.E.5.8B.1** *Match the Earth's seasons to temperature changes.*

**A.E.5.8B.2** *Identify changes in the appearance of the moon as it revolves around Earth.*

## GRADE FIVE: Earth and Space Science

### E.5.10 Earth's Resources

**Conceptual Understanding:** Human activities can impact natural processes and availability of resources. To reduce impacts on the environment (including humans), various best practices can be used.

**E.5.10** *Students will demonstrate an understanding of the effects of human interaction with Earth and how Earth's natural resources can be protected and conserved.*

**A.E.5.10** *Students will identify the effects of human interaction with Earth and how Earth's natural resources can be protected and conserved.*

**A.E.5.10.1** *Classify recyclable materials (e.g. plastic, paper, aluminum).*

**A.E.5.10.2** *Identify ways that individuals and communities can prepare for geographically specific natural disasters.*

## GRADE SIX

### Theme: Structure and Function

Grade 6 students need concrete opportunities to engage with natural phenomena. The integration of Earth and space, life, and physical sciences gives students many opportunities to explore the relationship of structure and function in the world around them. By analyzing the macro- and microscopic world, the role of cells in life functions, the interdependence in ecosystems, the diversity of life on Earth, the relationship between force and motion, and the organization and interactions of objects in the universe, Grade 6 students develop knowledge about structure-function relationships in different scientific domains.

### GRADE SIX: Life Science

#### L.6.1 Hierarchical Organization

**Conceptual Understanding:** Living things are distinguished from nonliving things by several characteristics. All living things are comprised of one (unicellular) or more (multicellular) cells, which are the smallest units of life. Cells carry out life functions and undergo cell division using specialized structures that allow them to acquire energy and water, grow, reproduce, dispose of waste, and survive. Multicellular organisms are organized in a hierarchy of increasing complexity with related, specialized structures and functions.

- L.6.1** *Students will demonstrate an understanding that living things range from simple to complex organisms, are organized hierarchically, and function as whole living systems.*
- A.L.6.1** *Students will demonstrate an understanding that living things range from simple to complex organisms and are organized hierarchically.*
- A.L.6.1.1** *Identify living and nonliving things.*
- A.L.6.1.2** *Match pictures, drawings, or models of cells as belonging to a plant or an animal.*
- A.L.6.1.3** *Classify organisms as unicellular or multicellular.*
- A.L.6.1.4** *Identify parts of a plant cell (e.g., nucleus, cell membrane, cell wall, vacuoles) and animal cell.*
- A.L.6.1.5** *Arrange cells, tissues, organs, and systems in order from least to most complex.*

### GRADE SIX: Life Science

#### L.6.3 Ecology and Interdependence

**Conceptual Understanding:** All organisms depend on environmental factors for survival. When any environmental factor changes, a corresponding change in diversity and population of organisms will also occur. The environment and the organism in which it lives are therefore interdependent.

- L.6.3** *Students will demonstrate an understanding of the relationships among survival, environmental changes, and diversity as they relate to the interactions of organisms, populations, and the environment.*
- A.L.6.3** *Students will identify the relationships between survival of organisms and environmental changes.*
- A.L.6.3.1** *Identify environmental factors that living organisms depend upon to survive.*
- A.L.6.3.2** *Identify levels of organization within ecosystems (species, populations, ecosystems, and biomes).*
- A.L.6.3.3** *Classify consumers as carnivores, herbivores and omnivores.*
- A.L.6.3.4** *Indicate whether an environmental factor will impact an organism's survival in an ecosystem.*



**GRADE SIX: Life Science****L.6.4 Adaptations and Diversity**

**Conceptual Understanding:** Because living organisms are so diverse, scientists have created a system by which living things are organized into groups according to their characteristics (physical and/or genomic) for identification and research purposes. Organisms exhibit structural and behavioral characteristics such as adaptations that increase their chances of survival in a changing environment.

**L.6.4** *Students will demonstrate an understanding of classification tools and models, such as dichotomous keys, to classify representative organisms based on the characteristics of the kingdoms: Archaeobacteria, Eubacteria, Protists, Fungi, Plants, and Animals.*

**A.L.6.4** *Students will classify representative organisms based on characteristics.*

**A.L.6.4.1** *Use a graphic organizer to classify characteristics of organisms. Obtain information about the characteristics (e.g., cones, fruits, seeds, bones, hair, feathers, scales, gills) of plants and animals to classify plants as flowering (e.g., daisies, apple trees) or nonflowering (e.g., ferns, pine trees) and animals as vertebrate (e.g., mammals, fish, amphibians, reptiles, birds) or invertebrate with hard shells (e.g., insects, spiders, clams, snails).*

**A.L.6.4.2** *Use observational data to classify characteristics of an animal or plant that are inherited or influenced by the environment.*

**GRADE SIX: Physical Science****P.6.6 Motions, Forces, and Energy**

**Conceptual Understanding:** The motion of an object (speed and direction) is determined by many factors. Forces, including gravity and friction, can affect the speed and direction of an object. Motion occurs when there is a change in position of an object with respect to a referenced starting point.

**P.6.6** *Students will demonstrate an understanding of Newton's laws of motion using real world models and examples.*

**A.P.6.6** *Students will demonstrate an understanding of Newton's laws of motion using real world models and examples.*

**A.P.6.6.1** *Use models to predict how the motion of objects with different masses will be affected by the same amount of force (e.g., which will travel farther: a golf ball or a ping pong ball).*

**A.P.6.6.2** *Identify the effect of gravity or friction on the motion of an object (e.g. football thrown is an arc, skateboard slows down).*

**A.P.6.6.3** *Predict the motion of an object according to its direction, speed, and/or acceleration.*

**GRADE SIX: Earth and Space Science****E.6.8 Earth and the Universe**

**Conceptual Understanding:** The hierarchical organization of the universe is the result of complex structure and function. Current theories suggest that time began with a period of extremely rapid expansion. Presently, Earth's solar system consists of the Sun and other objects that are held in orbit by the Sun's gravitational force. The interactions of the Earth, the Moon, and the Sun have effects that can be observed on Earth. Various technologies have aided in our understanding of Earth's place in the universe.

- E.6.8** *Students will demonstrate an understanding of Earth's place in the universe and the interactions of the solar system (sun, planets, their moons, comets, and asteroids) using evidence from multiple scientific resources to explain how these objects are held in orbit around the Sun because of its gravitational pull.*
- A.E.6.8** *Students will identify Earth's place in the universe and the interactions of the solar system (sun, planets, their moons, comets, and asteroids).*
- A.E.6.8.1** *Identify the characteristics and movements of objects in our solar system (including planets, moons, asteroids, comets, and meteors).*
- A.E.6.8.2** *Identify modern techniques used to explore our solar system's position in the universe.*
- A.E.6.8.3** *Use models to illustrate phases of the moon.*

## GRADE SEVEN

### Theme: Systems and Cycles

Students relate systems and cycles through analyzing various small scale and large-scale phenomena. Using scientific methods, students can connect Earth's systems with the flow of energy in supporting living and nonliving organisms and specific interactions of matter. Students use multiple investigative methods to discover evidence, make claims, and generate explanations about systems and cycles that take place on Earth. A focus on organization and cycles of matter requires students to apply skills and make connections across genres of science since most complex cycles have multiple interactions.

## GRADE SEVEN: Life Science

### L.7.3 Ecology and Interdependence

**Conceptual Understanding:** In this section, emphasis should be placed on predicting consistent patterns of interactions among different cycling systems in terms of the relationships between organisms and abiotic components within ecosystems. Rearrangement of food molecules through chemical processes in cellular respiration and photosynthesis is an important part of energy cycling in all life systems. Preservation of biodiversity and consideration of human impacts are themes in maintaining ecosystem services.

**L.7.3** *Students will demonstrate an understanding of the importance that matter cycles between living and nonliving parts of the ecosystem to sustain life on Earth.*

**A.L.7.3** **Students will identify the water cycle and its relationship among ecosystems to sustain life on Earth.**

**L.7.3.1** *Label the cycling of water through ecosystems to organisms.*

**L.7.3.2** *Identify how the interruption of the water cycle affects populations of organisms.*

## GRADE SEVEN: Physical Science

### P.7.5 Organization of Matter and Chemical Interactions

**Conceptual Understanding:** Matter and its interactions can be distinguished by investigating physical properties (e.g., mass, density, solubility) using chemical processes and experimentation. Changes to substances can either be physical or chemical.

**P.7.5A** *Students will demonstrate an understanding of the physical and chemical properties of matter.*

**A.P.7.5A** **Students will identify the physical properties of matter.**

**A.P.7.5A.1** *Using pictures, drawings, or models, sort substances by physical properties (e.g., appearance, texture, color, strength, temperature, flexibility).*

**A.P.7.5A.2** *Use pictures to match substances to its state of matter (e.g. solid, liquid, gas).*

**Conceptual Understanding:** Matter is made of atoms and/or molecules that are in constant motion. The movement of atoms and molecules depends on the amount of energy in the system at the time. The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.

**P.7.5B** *Students will demonstrate an understanding about the effects of temperature and pressure on physical state, molecular motion, and molecular interactions.*

**A.P.7.5B** *Students will identify the effects of temperature the physical state of matter.*

**A.P.7.5B.1** *Make predictions about the effect of temperature on the state of matter (e.g. expansion, contraction, melting, boiling, evaporation).*

**Conceptual Understanding:** Changes to substances can either be physical or chemical. Many substances react chemically with other substances to form new substances with different properties. Substances (such as metals or acids) are identified according to their physical or chemical properties. Some chemical reactions release energy and others store energy.

**P.7.5D** *Students will demonstrate an understanding of chemical formulas and common chemical substances to predict the types of reactions and possible outcomes of the reactions.*

**A.P.7.5D** *Students will identify chemical properties of matter.*

**A.P.7.5D.1** *Use models to identify chemical changes of matter; distinguish between physical and chemical changes.*

**A.P.7.5D.2** *Explain how chemical changes affect the properties of a substance.*

**A.P.7.5D.3** *Use observational data and models to identify what happens when two or more substances undergo a chemical reaction.*

## GRADE SEVEN: Earth and Space Science

### E.7.9 Earth's Systems and Cycles

**Conceptual Understanding:** Complex patterns in the movement of air and water in the atmosphere are major determinants of local weather. Global movements of water and its changes in form are propelled by sunlight and gravity. Variations in temperature drive a global pattern of interconnected currents. Interactions between sunlight, oceans, atmosphere, ice, landforms, and living things vary with latitude, altitude, and local and regional geography. Weather is difficult to predict; however, large scale patterns and trends in global climate, such as the gradual increase in average temperature, are more easily observed and predicted.

**E.7.9A** *Students will demonstrate an understanding of how complex changes in the movement and patterns of air and water molecules caused by the sun, winds, landforms, ocean temperatures, and currents in the atmosphere are major determinants of local and global weather patterns.*

**A.E.7.9A** *Students will identify factors that could impact local and global weather (e.g., sun, wind, ocean temperature, current).*

**A.E.7.9A.2** *Identify differences in weather across varying geographical regions.*

**A.E.7.9A.3** *Identify tools used to predict weather patterns and conditions.*

**Conceptual Understanding:** The tilt of Earth's spin axis with respect to the plane of its orbit around the sun is important for a habitable Earth. The Earth's spin axis is tilted 23.5 degrees. Earth's axis points in the same direction in space no matter where Earth is in relation to the sun. The seasons are a result of this tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.

**E.7.9C** *Students will demonstrate an understanding that the seasons are the direct result of the Earth's tilt and the intensity of sunlight on the Earth's hemispheres.*

**A.E.7.9C** *Students will demonstrate a basic understanding that the seasons are the direct result of the Earth's tilt and the intensity of sunlight on the Earth's hemispheres.*

**A.E.7.9C.1** *Classify weather conditions (e.g., temperature, precipitation) typically found during each season.*

## GRADE EIGHT

### Theme: Cause and Effect

In Grade 8, students develop a knowledge base to explain patterns and make predictions based on an understanding of cause and effect. Some examples of the relationships include: the role of genetics in reproduction and heredity, the biology that explains unity and diversity, the transfer of energy, the result of dynamic changes to the Earth's surface, and human impact on the biosphere.

## GRADE EIGHT: Life Science

### L.8.2 Reproduction and Heredity

**Conceptual Understanding:** Organisms reproduce and transfer their genetic information to their offspring. The process of passing genetic information to offspring is inheritance. During sexual reproduction, genetic information is passed to offspring resulting in similarities and differences between parental organisms and their offspring.

**L.8.2A** *Students will demonstrate an understanding of how sexual reproduction results in offspring with genetic variation while asexual reproduction results in offspring with identical genetic information.*

**A-L.8.2A** *Students will demonstrate an understanding of how sexual reproduction results in offspring with genetic variation.*

**A-L.8.2A.1** *Provide examples of genetic variation (e.g. eye color, hair color, height, plant stem height).*

**Conceptual Understanding:** Inheritance is the key process causing similarities between parental organisms and their offspring. Organisms that reproduce sexually transfer genetic information (DNA) to their offspring. This transfer of genetic information through inheritance leads to greater similarity among individuals within a population than between populations. Genetic changes can accumulate through natural selection or mutation that can lead to the evolution of species. Humans can manipulate genetic information using technology.

**L.8.2B** *Students will demonstrate an understanding of the differences in inherited and acquired characteristics and how environmental factors (natural selection) and the use of technologies (selective breeding, genetic engineering) influence the transfer of genetic information.*

**A-L.8.2B** *Students will identify environmental factors that influence the transfer of genetic information.*

**A-L.8.2B.1** *Identify environmental and genetic factors that influence the growth of organisms.*

**A-L.8.2B.2** *Classify traits by genotype and phenotype.*

**A-L.8.2B.3** *Use models to predict if offspring will have a recessive or dominant trait.*

**GRADE EIGHT: Life Science****L.8.4 Adaptations and Diversity**

**Conceptual Understanding:** The scientific theory of evolution underlies the study of biology and provides an explanation for both the diversity of life on Earth and similarities of all organisms. Adaptations are physical or behavioral changes that are inherited and enhance the ability of an organism to survive.

**L.8.4A** *Students will demonstrate an understanding of the process of natural selection, in which variations in a population increase some individuals' likelihood of surviving and reproducing in a changing environment.*

**A.L.8.4A** *Students will identify environment and genetic factors which increase an individuals' likelihood of surviving in a changing environment.*

**A.L.8.4A.1** *Identify environmental factors which promote an organism's survival.*

**A.L.8.4A.2** *Identify genetic factors which promote an organism's survival.*

**Conceptual Understanding:**

The traits of organisms that survive a change in the environment are inherited by offspring and become more common in the population. The traits of organisms that cannot survive a change in the environment are not passed to offspring and become less common. Extinction occurs when the environment changes and the adaptive characteristics of a species, including its behaviors, are insufficient to allow its survival.

**L.8.4B** *Students will demonstrate an understanding of how similarities and differences among living and extinct species provide evidence that changes have occurred in organisms over time and that similarity of characteristics provides evidence of common ancestry.*

**A.L.8.4B** *Students will compare similarities and differences between fossils and living organisms.*

**A.L.8.4B.1** *Use graphic organizers to compare and contrast fossils and living organisms.*

**A.L.8.4B.2** *Classify groups of organisms with similar characteristics.*

**A.L.8.4B.3** *Match fossils to the current modern-day organisms.*

**GRADE EIGHT: Physical Science****P.8.6 Motions, Forces, and Energy**

**Conceptual Understanding:** Waves have energy that is transferred when they interact with various types of matter. A repeating pattern of motion allows the transfer of energy from place to place without overall displacement of matter. All types of waves have some features in common. When waves interact, they affect each other resulting in changes to the resonance. Many modern technologies are based on waves and their interactions with matter.

**P.8.6** *Students will demonstrate an understanding of the properties, behaviors, and application of waves.*

**A.P.8.6** *Students will demonstrate a basic understanding of the properties and behaviors sound waves.*

**A.P.8.6.1** *Identify technology that used sound waves.*

**A.P.8.6.2** *Identify how sound waves react when they interact with various types of matter (e.g. soft, high pitch, loud).*

**GRADE EIGHT: Earth and Space Science****E.8.7 Earth's Structure and History**

**Conceptual Understanding:** Fossils are preserved remains or traces of organisms that lived in the past. Thousands of layers of sedimentary rock not only provide evidence of the history of Earth itself, but also of changes in organisms whose fossil remains have been found in those layers. The collection of fossils and their placement in chronological order (e.g., through the location of rock layers or through radioactive dating) is collectively known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth.

**E.8.7** *Students will demonstrate an understanding of geological evidence to analyze patterns in Earth's major events, processes, and evolution in history.*

**A-E.8.7** *Students will identify major events and processes that change the Earth over time.*

**A.E.8.7.1** *Identify the layers of the Earth.*

**A.E.8.7.2** *Identify older fossils as being found in deeper, older rock layers.*

**GRADE EIGHT: Earth and Space Science****E.8.9 Earth's Systems and Cycles**

**Conceptual Understanding:** Natural processes can cause sudden or gradual changes to Earth's systems. Some may adversely affect humans such as volcanic eruptions or earthquakes.

**E.8.9B** *Students will demonstrate an understanding of natural hazards (volcanic eruptions, severe weather, earthquakes) and construct explanations for why some hazards are predictable and others are not.*

**A.E.8.9B** *Students will demonstrate an understanding of natural hazards and identify precautions for these conditions.*

**A.E.8.9B.1** *Identify technologies that predict or warn communities in case of a natural hazards.*

**A.E.8.9B.2** *Match appropriate safety precautions in relation to specific weather conditions or events (e.g., thunderstorms, hurricanes, floods, and tornadoes).*

**GRADE EIGHT: Earth and Space Science****E.8.10 Earth's Resources**

**Conceptual Understanding:** Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources, both renewable and nonrenewable. Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats that could cause extinction or the threat of extinction of many species.

**E.8.10** *Students will demonstrate an understanding that a decrease in natural resources is directly related to the increase in human population on Earth and must be conserved.*

**A.E.8.10** *Students will identify the impact on natural resources by an increase in population.*

**E.8.10.1** *Classify objects and materials as trash and recyclables (e.g., plastic, paper, and glass).*

**E.8.10.3** *Match human activities with their effect on Earth's resources.*



## ALTERNATE BIOLOGY ELEMENTS

Alternate Biology Elements, **a one-credit course**, offered to students who are determined to have a significant cognitive disability (SCD). This course is a requirement for students who are working toward achieving an Alternate Diploma which is documented in the student's Individualized Education Program (IEP).

This is a course designed to build a life science foundation emphasizing patterns, processes, and interactions among organisms. Individual learning experiences are used to support claims and engage in evidence-based arguments. In this way, students explore the organization of life; the interdependence between organisms and their environment; the chemical composition of life; the role of DNA in cellular structure and function; inheritance; and evolution.

The standards and performance objectives do not have to be taught in the order presented in this document. The performance objectives are intentionally broad to allow school districts and teachers the flexibility to create a curriculum that meets the needs of their students.

### Alternate Biology Elements: Life Science

#### A.BIO.1 Cells as a System

**Conceptual Understanding:** Biologists have determined that organisms share unique characteristics that differentiate them from nonliving things. Organisms range from very simple to extremely complex. The cell is the smallest component of life. Plant, animal, and bacterial cells have similarities and differences to support organismal needs.

**BIO.1A** *Students will demonstrate an understanding of the characteristics of life and biological organization.*

**A.BIO.1A** **Students will demonstrate an understanding of organisms' characteristics and organization.**

**A.BIO.1A.1** *Use a graphic organizer to classify organisms as living and nonliving things.*

**A.BIO.1A.2** *Identify similarities in characteristics of plants and animals of the same type (species).*

**A.BIO.1A.3** *Categorize cells as plant, animal, or bacteria.*

**A.BIO.1A.4** *Identify what happens when water moves into and out of a cell (into, the cell-swells; out of, the cell-shrivels.)*

**A.BIO.1A.5** *Identify a model of cell division.*

## Alternate Biology Elements: Life Science

### A.BIO.2 Energy Transfer

**Conceptual Understanding:** Organisms require energy to perform life functions. Cells are transformers of energy, continuously utilizing a complex sequence of reactions in which energy is transferred from one form to another, for example, from light energy to chemical energy to kinetic energy.

- BIO.2** *Students will explain that cells transform energy through the processes of photosynthesis and cellular respiration to drive cellular functions.*
- A.BIO.2** **Demonstrate a basic understanding that plants use light from the sun to convert to energy.**
- A.BIO.2.1** *Identify that the sun is the main source of energy for plants.*
- A.BIO.2.2** *Classify parts of plants, such as leaf, stem, root, seed, and flower, to the functions of food production, support, water transport, and reproduction.*
- A.BIO.2.3** *Demonstrate the exchange to show that oxygen produced by plants is used by animals and carbon dioxide produced by animals is used by plants.*
- A.BIO.2.4** *Identify why photosynthesis is important.*

## Alternate Biology Elements: Life Science

### A.BIO.3 Reproduction and Heredity

**Conceptual Understanding:** Sexual reproduction involves the joining of a female gamete (egg) and a male gamete (sperm). The joining of these gametes occurs during fertilization. The result of the joining of the egg and sperm is the formation of a fertilized egg. The fertilized egg develops into an offspring that is different genetically from the parents. Offspring inherit DNA from both of their parents. Genes contained in the DNA determine the traits expressed in the offspring's genetic makeup. Various patterns of inheritance may be present. These patterns of inheritance may be followed through multiple generations within families.

- BIO.3A** *Students will develop and use models to explain the role of meiosis in the production of haploid gametes required for sexual reproduction.*
- A.BIO.3A** **Students will demonstrate an understanding of sexual reproduction.**
- A.BIO.3A.1** *Recognize that sexual reproduction maintains the chromosome material of the species and is the combination of a female gamete (egg) and a male gamete (sperm).*
- A.BIO.3A.2** *Identify and provide examples of how genes can determine traits and characteristics of offspring.*
- A.BIO.3A.3** *Identify examples that illustrate how patterns of inheritance can affect multiple generations within families.*

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### A.BIO.4 Adaptations and Evolution

**Conceptual Understanding:** Evolution is a key unifying principle in biology. Students can understand common features and differences between species and thus the relatedness between species. There are several factors that affect how natural selection acts on populations within their environments leading to speciation, extinction, and the current diversity of life on earth.

- BIO.4** *Students will analyze and interpret evidence to explain the unity and diversity of life.*
- A.BIO.4** *Students will recognize the adaptations that over time have helped populations survive.*
- A.BIO.4.1** *Use a graphic organizer to identify organisms that were unable to adapt to changes in their environment and have become extinct.*
- A.BIO.4.2** *Identify the variations in a trait within a species that would increase survival in given environment (e.g., giraffes with longer necks can reach leaves on high branches).*
- A.BIO.4.3** *Compare the differences between organisms found as fossils and those that are alive today.*
- A.BIO.4.4** *Match groups of organisms with similar characteristics to demonstrate an understanding that they are related (e.g., elect two species from an array that are most closely related e.g., lion, tiger, and deer: lion and tiger are more closely related to each other than they are to a deer).*

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### A.BIO.5 Interdependence of Organisms and Their Environments

**Conceptual Understanding:** Interactions within an ecosystem affect the number and types of organisms that survive. Fluctuations in conditions can affect the ecosystem's resources and habitat availability.

- BIO.5** *Students will investigate and evaluate the interdependence of living organisms and their environment.*
- A.BIO.5** *Students will relate the interdependence of living organisms and their environment.*
- A.BIO.5.1** *Predict how a habitat could change as a population changes (e.g., availability of resources).*
- A.BIO.5.2** *Identify the effect that a change in nonliving environmental factor could have on particular populations (e.g., too little rain would not allow most plants to grow and animals would have to leave the environment to find water.)*
- A.BIO.5.3** *Categorize human activities as positive or negative on the basis of their effect on the Earth.*