



**Prekindergarten – Grade 8
Curriculum Standards
And Assessment Expectations**

SCIENCE

2010 EDITION

Introduction

The 2010 edition of *Prekindergarten-Grade 8 Science Curriculum Standards* is a resource that adds detail to the content and inquiry standards in the 2004 Core Science Curriculum Framework. It includes Grade-Level Concepts (GLCs), Grade-Level Expectations (GLEs) and Key Concept Words that provide clear guidelines for developing curriculum and planning instructional activities.

GLCs describe what students should know in order to understand the broad idea expressed by each Framework content standard. They define the conceptual boundaries of the learning unit, identifying subconcepts that should be included and those that can be excluded. GLCs are organized in a suggested learning sequence that can be used as a unit pacing guide. Each GLC is typically the focus of one to three class sessions. The Key Concept Words highlight the “science talk” that students and teachers should use fluently in oral and written discourse about their learning. Many of the GLCs are assessed on the science portion of the Connecticut Mastery Test (CMT).

GLEs are examples of what students should be able to do to demonstrate their understanding of science concepts. They are measurable learner outcomes that can provide evidence of learning that is richer than merely memorized facts or terminology. The GLEs reflect a range of performances for all students, including outcomes such as describing, explaining, comparing, summarizing, evaluating and creating. Some scientific inquiry expected performances have been integrated within GLEs as examples of how students use scientific inquiry, literacy and numeracy practices to understand science content. Teachers have flexibility to modify, prioritize and enhance GLEs to reflect their curriculum and their students’ learning needs. GLEs can be useful for establishing measurable unit outcomes, designing learning activities, developing common formative and summative assessments, or for documenting and reporting student progress. While some of the GLE outcomes are assessed on the Science CMT, most are intended as school-based assessment opportunities.

The **Expected Performances** in the 2004 science framework continue to be the basis for developing questions for the science CMT. However, these Expected Performances represent only the selected content that could be assessed on this state test that covers multiple years of science learning. Narrowing the curriculum to include only those concepts that are tested on the CMT is likely to limit students’ abilities to make sense of science and retain what they learn. A coherent curriculum that aligns instruction with the content outlined in GLCs, GLEs and Key Concept Words will provide students with opportunities to achieve the broader goals of scientific literacy and preparation for advanced study as well as high achievement on state assessments.

Connecticut science educators, RESC science specialists and university scientists contributed to the development of the GLCs and GLEs. The Leadership and Learning Center (formerly the Center for Performance Assessment) reviewed the curriculum standards and GLEs for science. Recommendations were made and are reflected in this document. The following is a summary of the center’s comparative analysis of the Connecticut Prekindergarten-Grade 8 Science Curriculum Standards:

“The [*Connecticut Prekindergarten-Grade 8 Science Curriculum Standards*] present the science content and inquiry abilities that students need in order to be science literate. The Curriculum Standards are comparable to the National Science Education Standards

(National Research Council, 1996) and the Benchmarks for Science Literacy (AAAS, 1993), as well as to the science standards of two states (South Carolina and California) whose standards have been identified by the Thomas B. Fordham Institute’s State of the State Science Standards 2005 as being exemplary.”

Prekindergarten-Grade 8 Science Curriculum Standards is intended to raise interest and achievement in science in all Connecticut schools by supporting local curriculum development, selection of instructional materials, design of content-rich professional development, and instructional methods aligned with Connecticut’s 2004 Core Science Curriculum Framework.

Scientific knowledge is created and communicated through students' use of the following skills. All of the inquiry skills described below should be utilized by PK-2 students as they learn the content described by each Content Standard on the pages that follow.

Grades PreK-2 Core Scientific Inquiry, Literacy and Numeracy

How is scientific knowledge created and communicated?

Expected Performances

- A INQ.1** Make observations and ask questions about objects, organisms and the environment.
- A INQ.2** Use senses and simple measuring tools to collect data.
- A INQ.3** Make predictions based on observed patterns.
- A INQ.4** Read, write, listen and speak about observations of the natural world.
- A INQ.5** Seek information in books, magazines and pictures.
- A INQ.6** Present information in words and drawings.
- A INQ.7** Use standard tools to measure and describe physical properties such as weight, length and temperature.
- A INQ.8** Use nonstandard measures to estimate and compare the sizes of objects.
- A INQ.9** Count, order and sort objects by their properties.
- A INQ.10** Represent information in bar graphs.

Properties of Matter — How does the structure of matter affect the properties and uses of materials?

PREKINDERGARTEN

PK.1 - Objects have properties that can be observed and used to describe similarities and differences

Core Science Curriculum Framework	Preschool Curriculum Framework	Grade-Level Expectations <i>Students should be able to:</i>	Preschool Assessment Framework
<p>PK.1.a. Some properties can be observed with the senses, and others can be discovered by using simple tools or tests.</p>	<p>Cognitive Development: Logical-Mathematical/Scientific Thinking -</p> <ol style="list-style-type: none"> 1. Ask questions about and comment on observations and experimentation; 2. Collect, describe and record information; 3. Use equipment for investigation; 4. Use common instruments to measure things; 5. Demonstrate understanding of one-to-one correspondence while counting; 6. Order several objects on the basis of one attribute; 7. Sort objects by one or more attributes and regroup the objects based on a new attribute; 8. Engage in a scientific experiment with a peer or with a small group. 	<ol style="list-style-type: none"> 1. Use senses to make observations of objects and materials within the child’s immediate environment. 2. Use simple tools (e.g., balances and magnifiers) and nonstandard measurement units to observe and compare properties of objects and materials. 3. Make comments or express curiosity about observed phenomena (e.g., “I notice that…” or “I wonder if…”). 4. Count, order and sort objects (e.g. blocks, crayons, toys) based on one visible property (e.g., color, shape, size). 5. Conduct simple tests to determine if objects roll, slide or bounce. 	<p>COG 1 Engages in scientific inquiry</p> <p>COG 3 Sorts objects</p> <p>COG 5 Compares and orders objects and events</p> <p>COG 6 Relates number to quantity</p>

Heredity and Evolution — What processes are responsible for life’s unity and diversity?

PREKINDERGARTEN

PK.2 — Many different kinds of living things inhabit the earth.

Core Science Curriculum Framework	Preschool Curriculum Framework	Grade-Level Expectations <i>Students should be able to:</i>	Preschool Assessment Framework
<p>PK.2.a. Living things have certain characteristics that distinguish them from nonliving things, including growth, movement, reproduction and response to stimuli.</p>	<p>Cognitive Development: Logical-Mathematical/Scientific Thinking</p> <ol style="list-style-type: none"> 1. Ask questions about and comment on observations and experimentation; 2. Collect, describe and record information; 3. Sort objects by one or more attributes and regroup the objects based on a new attribute; 4. Compare and contrast objects and events. <p>Personal and Social Development</p> <ol style="list-style-type: none"> 1. Identify themselves by family and gender. 2. State at least two ways in which children are similar and two ways in which they are different. 	<ol style="list-style-type: none"> 1. Use the senses and simple tools to make observations of characteristics and behaviors of living and nonliving things. 2. Give examples of living things and nonliving things. 3. Make observations and distinguish between the characteristics of plants and animals. 4. Compare attributes of self, family members or classmates, and describe how they are similar and different. 	<p>COG 1 Engages in scientific inquiry</p> <p>COG 3 Sorts objects</p> <p>COG 5 Compares and orders objects and events</p> <p>P & S 9 Recognizes similarities and appreciates differences</p>

Energy in the earth's Systems — How do external and internal sources of energy affect the earth's systems?

PREKINDERGARTEN

PK.3 — Weather conditions vary daily and seasonally.

Core Science Curriculum Framework	Preschool Curriculum Framework	Grade-Level Expectations <i>Students should be able to:</i>	Preschool Assessment Framework
<p>PK.3.a. Daily and seasonal weather conditions affect what we do, what we wear and how we feel.</p>	<p>Cognitive Development: Logical-Mathematical/Scientific Thinking</p> <ol style="list-style-type: none"> 1. Ask questions about and comment on observations and experimentation; 2. Collect, describe and record information; 3. Demonstrate an understanding of sequence of events and time periods; 4. Make and verify predictions about what will occur. <p>Personal and Social Development</p> <ol style="list-style-type: none"> 1. Use self-help skills 	<ol style="list-style-type: none"> 1. Use the senses to observe and describe evidence of current or recent weather conditions (e.g., flags blowing, frost on window, puddles after rain, etc.) 2. Notice weather conditions and use words and numbers to describe and analyze conditions over time (e.g., “it rained 5 times this month”.) 3. Identify the season that corresponds with observable conditions (e.g., falling leaves, snow vs. rain, buds on trees or greener grass). 4. Make judgments about appropriate clothing and activities based on weather conditions. 	<p>COG 1 Engages in scientific inquiry</p> <p>PHY 3 Cares for self independently</p>

Science and Technology in Society — How do science and technology affect the quality of our lives?

PREKINDERGARTEN

PK.4 — Some objects are natural, while others have been designed and made by people to improve the quality of life.

Core Science Curriculum Framework	Preschool Curriculum Framework	Grade-Level Expectations <i>Students should be able to:</i>	Preschool Assessment Framework
<p>PK.4.a. Humans select materials with which to build structures based on the properties of the materials.</p>	<p>Cognitive Development: Logical-Mathematical/Scientific Thinking</p> <ol style="list-style-type: none"> 1. Ask questions about and comment on observations and experimentation; 2. Sort objects by one or more attributes and regroup the objects based on a new attribute; 3. Make and verify predictions about what will occur; 4. Engage in a scientific experiment with a peer or with a small group; <p>Personal and Social Development</p> <ol style="list-style-type: none"> 1. Demonstrate the ability to use a minimum of two different strategies to attempt to solve a problem; <p>Creative Expression/Aesthetic Development</p> <ol style="list-style-type: none"> 1. Use a variety of art materials and activities for sensory experience and exploration. 	<ol style="list-style-type: none"> 1. Observe, describe and sort building materials by properties such as strength, weight, stiffness or flexibility. 2. Pose questions and conduct simple tests to compare the effectiveness of different building materials (e.g., blocks of wood, plastic, foam or cardboard) for constructing towers, bridges and buildings. 3. Make judgments about the best building materials to use for different purposes (e.g., making the tallest tower or the longest bridge). 4. Invent and explain techniques for stabilizing a structure. 5. Compare block structures to pictures and to real structures in the neighborhood. 	<p>P & S 1 Shows self-direction with a range of materials</p> <p>COG 1 Engages in scientific inquiry</p> <p>COG 2 Uses a variety of strategies to solve problems</p> <p>COG 3 Sorts objects</p> <p>COG 7 Demonstrates spatial awareness</p> <p>CRE 1 Builds and constructs to represent own ideas</p>

Properties of Matter — How does the structure of matter affect the properties and uses of materials?

KINDERGARTEN

K.1 - Objects have properties that can be observed and used to describe similarities and differences

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that ...</i>	Grade-Level Expectations <i>Students should be able to...</i>	Assessment
<p>K.1.a. Some properties can be observed with the senses, and others can be discovered by using simple tools or tests.</p>	<ol style="list-style-type: none"> 1. Humans have five senses that they use to observe their environment. A specific sense organ is associated with each sense. 2. Objects have properties that can be observed using the senses. Examples include size, weight, shape, color, texture, transparency, etc. An object’s observable properties do not include the object’s name or its uses. 3. Sorting objects into groups based on one (or more) of their properties makes it possible to observe and describe their similarities and differences. 4. Placing objects in order based on their size or weight makes it possible to observe patterns and describe relationships among the objects in a group. 5. Objects can be described and sorted based on the materials from which they are made (for example, wood, paper, fabric, plastic, glass or metal). Objects can be made of a mixture of materials. 6. Objects can be described and sorted based on the results of simple tests. Simple tests include actions such as bending, squeezing, holding it near a magnet or putting it in water. Objects can be described as magnetic/nonmagnetic, flexible/not flexible, hard/soft, a floater/sinker, etc. 7. The heaviness of objects can be compared using the sense of touch. Balances and scales are measurement tools that allow people to observe and compare the heaviness of objects more accurately. 8. The temperature of the air, water or bodies can be compared using the sense of touch. A thermometer is a measurement tool that allows people to compare temperatures more accurately. 	<ol style="list-style-type: none"> 1. Match each of the five senses with its associated body part and the kind of information it perceives. 2. Make scientific observations using the senses, and distinguish between an object’s observable properties and its name or its uses. 3. Classify organisms or objects by one and two observable properties and explain the rule used for sorting (e.g., size, color, shape, texture or flexibility). 4. Use simple tools and nonstandard units to estimate or predict properties such as size, heaviness, magnetic attraction and float/sink. 5. Describe properties of materials such as wood, plastic, metal, cloth or paper, and sort objects by the material from which they are made. 	<p>A1. Use the senses and simple measuring tools, such as rulers and equal-arm balances, to observe common objects and sort them into groups based on size, weight, shape or color.</p> <p>A2. Sort objects made of materials such as wood, paper and metal into groups based on properties such as</p>

	<p>9. Objects can be sorted into groups based on measurements of their size. Nonstandard units for measuring size include hands, footsteps, pennies or paper clips.</p> <p>KEY CONCEPT WORDS: senses, observe, observation, property, sort, classify, material, float, sink, flexible, heavy, magnetic, nonmagnetic, thermometer</p>	<p>6. Count, order and sort objects by their observable properties.</p>	<p>flexibility, attraction to magnets, and whether they float or sink in water.</p> <p>A3. Count objects in a group and use mathematical terms to describe quantitative relationships such as: same as, more than, less than, equal, etc.</p>
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Heredity and Evolution — What processes are responsible for life’s unity and diversity?

KINDERGARTEN

K.2 — Many different kinds of living things inhabit the earth.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	Assessment
<p>K.2.a. Living things have certain characteristics that distinguish them from nonliving things, including growth, movement, reproduction and response to stimuli.</p>	<ol style="list-style-type: none"> 1. Things in our environment can be classified based on whether they are alive, were once alive or whether they were never alive. 2. Growing, responding to stimuli, and breathing are characteristics of many living things. Many living things move, but movement alone is not evidence of life. For example, cars and the wind both move, but they are not alive. 3. Reproduction is a characteristic of living things. Living things can be classified into groups based on the different ways they reproduce. For example, some living things lay eggs, while others produce seeds or give birth. 4. Living things can be classified as plants or animals. Plants have characteristics (such as roots, stems, leaves and flowers) that animals do not have. Animals have characteristics (such as body parts and body coverings) that plants do not have. 5. Animals can be classified into groups based on generally similar characteristics such as number of legs, type of body covering, or way of moving. Some animal groups are reptiles, insects, birds, fish and mammals. 6. Offspring generally resemble their parents but are not identical to them. 7. Members of the same group of animals can look and act very differently from each other. For example, goldfish and sharks are both fish, but there are distinct differences in their size, color and lifestyle. In addition, all goldfish are not identical to each other and neither are all sharks. 8. Plants can be classified into groups based on similarities in the 	<ol style="list-style-type: none"> 1. Observe and describe differences between living and nonliving things in terms of growth, offspring and need for energy from “food.” 2. Sort, count, and classify living and nonliving things in the classroom, the schoolyard and in pictures. 3. Use nonstandard measures to estimate and compare the height, length or weight of different kinds of plants and animals. 4. Observe and write, speak or draw about similarities and differences between plants and animals. 5. Match pictures or models of adults with their offspring (animals and plants). 6. Classify varied individuals of the same species by one and two attributes (e.g., rabbits or cats with different fur colors; rabbits or dogs with upright 	<p>A4. Describe the similarities and differences in the appearance and behaviors of plants, birds, fish, insects and mammals (including humans).</p> <p>A.5 Describe the similarities and differences in the appearance and behaviors of adults and their offspring.</p> <p>A6. Describe characteristics that distinguish living from nonliving things.</p>

	<p>appearance of their leaves, stems, blossoms or fruits. Some plant groups are grasses, vegetables, flowering plants and trees.</p> <p>9. Members of the same group of plants can look and act very differently from each other. For example, although oaks and palms are both trees, their size, shape, leaves and growth habits are very different. In addition, all oak trees are not identical to each other and neither are all palms.</p> <p>KEY CONCEPT WORDS: classify, reproduce, offspring, characteristics, reptile, insect, mammal</p>	<p>or floppy ears, etc.).</p>	
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Energy in the earth's systems — How do external and internal sources of energy affect the earth's systems?

KINDERGARTEN

K.3 — Weather conditions vary daily and seasonally.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	Assessment
<p>K.3.a. Daily and seasonal weather conditions affect what we do, what we wear and how we feel.</p>	<ol style="list-style-type: none"> 1. The sun is the source of heat and light that warms the land, air and water. Variations in the amount of sunlight that reaches the earth cause the weather. 2. Weather conditions can be observed and described as sunny, cloudy, rainy, foggy, snowy, stormy, windy, hot or cold. Weather observations can be made based on how we feel, what we see or hear, or by using weather measurement instruments such as thermometers. 3. Changes in weather conditions can be recorded during different times of day, from day to day, and over longer periods of time (seasonal cycle). Repeated observations can show patterns that can be used to predict general weather conditions. For example, temperatures are generally cooler at night than during the day and colder in winter than in spring, summer or fall. 4. Weather influences how we dress, how we feel, and what we do outside. 5. Weather affects the land, animals and plants, and bodies of water. 6. When the temperature is below “freezing,” water outside freezes to ice and precipitation falls as snow or ice; when the temperature is above freezing, ice and snow melt and precipitation falls as rain. 7. Clouds and fog are made of tiny drops of water. Clouds have different shapes, sizes and colors that can be observed and compared. Some cloud types are associated with precipitation and some with fair weather. 8. Wind is moving air. Sometimes air moves fast and sometimes it hardly 	<ol style="list-style-type: none"> 1. Use the senses to observe daily weather conditions and record data systematically using organizers such as tables, charts, picture graphs or calendars. 2. Analyze weather data collected over time (during the day, from day to day, and from season to season) to identify patterns and make comparisons and predictions. 3. Observe, compare and contrast cloud shapes, sizes and colors, and relate the appearance of clouds to fair weather or precipitation. 4. Write, speak or draw ways that weather influences humans, other animals and plants. 5. Make judgments about appropriate clothing and activities based on weather conditions. 	<p>A7. Describe and record daily weather conditions.</p> <p>A8. Relate seasonal weather patterns to appropriate choices of clothing and activities.</p>

	<p>moves at all. Wind speed can be estimated by observing the things that it moves, such as flags, tree branches or sailboats.</p> <p>KEY CONCEPT WORDS: weather, season (winter, spring, summer, fall), thermometer, precipitation, freeze, melt</p>		
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Science and Technology in Society — How do science and technology affect the quality of our lives?

KINDERGARTEN

K.4 — Some objects are natural, while others have been designed and made by people to improve the quality of life.

This content standard is an application of the concepts in content standard K.1 and should be integrated into the same learning unit.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	Assessment
<p>K.4.a. Humans select both natural and man-made materials to build shelters based on local climate conditions, properties of the materials, and their availability in the environment.</p>	<ol style="list-style-type: none"> 1. People need shelters to keep warm or cool, dry and safe. Shelters are made of materials whose properties make them useful for different purposes. 2. People in different regions of the world build different kinds of shelters, depending on the materials available to them, the local climate and their customs. 3. Traditionally, people have built shelters using materials that they find nearby. Today, people build houses from materials that may come from far away. <ol style="list-style-type: none"> a. People who live in forested regions have traditionally built shelters using wood and/or leaves from nearby trees. b. People who live in regions with clay soils have traditionally built shelters using bricks or adobe made from clay. c. People who live in snowy regions have traditionally built shelters using snow and ice. d. People who live in regions with large animals have traditionally built shelters using animal skins. 4. Although they may look quite different, most shelters have walls, roofs and an entrance/exit; some shelters have doors, windows and floors. Walls, roofs and windows are made of materials that have specific properties. For example, walls require materials that are rigid, windows require materials that are transparent, and roofs require materials that are 	<ol style="list-style-type: none"> 1. Conduct simple tests to compare the properties of different materials and their usefulness for making roofs, windows, walls or floors (e.g., waterproof, transparent, strong). 2. Seek information in books, magazines and pictures that describes materials used to build shelters by people in different regions of the world. 3. Compare and contrast the materials used by humans and animals to build shelters. 	<p>A9. Describe the types of materials used by people to build houses and the properties that make the materials useful.</p>

	<p>water-resistant.</p> <p>5. Animals build shelters using materials that are easily available to them. The materials they use have properties that help the animals stay warm or cool, dry and safe.</p> <p>KEY CONCEPT WORDS: shelter, rigid, transparent</p>		
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Forces and Motion — What makes objects move the way they do?

GRADE 1

1.1 — The sun appears to move across the sky in the same way every day, but its path changes gradually over the seasons.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	Assessment
<p>1.1.a. An object’s position can be described by locating it relative to another object or the background.</p> <p>1.1.b. An object’s motion can be described by tracing and measuring its position over time.</p>	<p>GRADE-LEVEL CONCEPT 1.1.a.</p> <ol style="list-style-type: none"> 1. An object’s relative position can be described by comparing it to the position of another stationary object. One object can be <i>in front of, behind, next to, inside of, above or below</i> another object. 2. The sun’s position in the daytime sky can be described relative to stationary objects on Earth. For example, the sun can be “just above the treetops,” “high or low in the sky,” or “on the other side of the school.” 3. The description of an object’s position from one observer’s point of view may be different from that reported from a different observer’s viewpoint. For example, a box of crayons between two students is near Susan’s left hand but near John’s right hand. 4. When an observer changes position, different words may be needed to describe an object’s position. For example, when I am sitting on the bench the sun is “behind” me; when I move to the slide, the sun is “in front of” me. 5. The same object when viewed from close up <u>appears</u> larger than it does when viewed from far away (although the actual size of the object does not change.) For example, a beach ball held in one’s arms appears larger than it does when viewed from across the playground. 6. An object’s position can be described using words (“near the door”), numbers (10 centimeters away from the door) or labeled diagrams. <p>GRADE-LEVEL CONCEPT 1.1.b.</p> <ol style="list-style-type: none"> 1. Things move in many ways, such as spinning, rolling, sliding, bouncing, flying or sailing. 	<ol style="list-style-type: none"> 1. Compare and contrast the relative positions of objects using words (in front of, behind, next to, inside of, above or below) and numbers (by measuring its distance from another object). 2. Apply direct and indirect pushes and pulls to cause objects to move (change position) in different ways (e.g., straight line, forward and backward, zigzag, in a circle). 3. Classify objects by the way they move (e.g., spinning, rolling, bouncing). 4. Conduct simple experiments and evaluate different ways to change the speed and direction of an object’s motion. 5. Observe, record and predict the sun’s position at different times of day (morning, noon, afternoon or night). 6. Conduct simple investigations 	<p>A10. Describe how the motion of objects can be changed by pushing and pulling.</p> <p>A11. Describe the apparent movement of the sun across the sky and the changes in the length and direction of shadows during the day.</p>

	<p>2. Motion can be caused by a push or a pull. A push or pull is called a force. Pushes and pulls can start motion, stop motion, speed it up, slow it down or change its direction.</p> <p>3. An object is in motion when its position is changing. Because the sun's position changes relative to objects on Earth throughout the day, it <u>appears</u> to be moving across the sky.</p> <p>4. Changes in the sun's position throughout the day can be measured by observing changes in shadows outdoors.</p> <p>5. Shadows occur when light is blocked by an object. An object's shadow appears opposite the light source. Shadow lengths depend on the position of the light source.</p> <p>KEY CONCEPT WORDS: position, motion, shadow, push, pull, force</p>	<p>of shadows and analyze how shadows change as the relative position of the sun (or an artificial light source) changes.</p>	
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Structure and Function — How are organisms structured to ensure efficiency and survival?

GRADE 1

1.2 — Living things have different structures and behaviors that allow them to meet their basic needs.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	Assessment
<p>1.2.a. Animals need air, water and food to survive.</p> <p>1.2.b. Plants need air, water and sunlight to survive.</p>	<p>GRADE-LEVEL CONCEPT 1.2.a.</p> <ol style="list-style-type: none"> All living things (organisms) need air, water and food to stay alive and grow; they meet these needs in different ways. Most animals move from place to place to find food and water. Some animals have two legs, four legs, six legs or more for moving. Other animals move using fins, wings or by slithering. Animals get air in different ways. For example, humans breathe with lungs, while fish breathe with gills. Animals get food in different ways. Some animals eat parts of plants and others catch and eat other animals. Animals get water in different ways. Some animals have special body parts, such as noses, tongues or beaks that help them get water. Fictional animals and plants can have structures and behaviors that are different than real animals and plants. <p>GRADE-LEVEL CONCEPT 1.2.b.</p> <ol style="list-style-type: none"> Plants absorb sunlight and air through their leaves and water through their roots. Plants use sunlight to make food from the air and water they absorb. Plants have various leaf shapes and sizes that help them absorb sunlight and air. Plant roots grow toward a source of water. Plant stems grow toward sunlight. 	<ol style="list-style-type: none"> Infer from direct observation and print or electronic information that most animals and plants need water, food and air to stay alive. Identify structures and behaviors used by mammals, birds, amphibians, reptiles, fish and insects to move around, breathe and obtain food and water (e.g., legs/wings/fins, gills/lungs, claws/fingers, etc.) Sort and classify plants (or plant parts) by observable characteristics (e.g., leaf shape/size, stem or trunk covering, flower or fruit). Use senses and simple measuring tools to measure the effects of water and sunlight on plant growth. Compare and contrast information about animals and plants found in fiction 	<p>A12. Describe the different ways that animals, including humans, obtain water and food.</p> <p>A13. Describe the different structures plants have for obtaining water and sunlight.</p> <p>A14. Describe the structures that animals, including humans, use to move around.</p>

	KEY CONCEPT WORDS: organism, plant, animal, energy, breathe, lungs, gills, absorb	and nonfiction sources.	
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Structure and Function — How are organisms structured to ensure efficiency and survival?

GRADE 1

1.3 — Organisms change in form and behavior as part of their life cycles.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	Assessment
<p>1.3.a. Some organisms undergo metamorphosis during their life cycles; other organisms grow and change, but their basic form stays essentially the same.</p>	<ol style="list-style-type: none"> 1. Plants and animals have life cycles that include a predictable sequence of stages: they begin life, develop into adults, reproduce and eventually die. 2. Plants and animals produce offspring of their own kind. Offspring closely resemble their parents, but individuals vary in appearance and behavior. 3. Animals are either born alive (for example, humans, dogs and cows) or hatched from eggs (for example, chickens, sea turtles or crocodiles). 4. Animals change during their life cycle. Many animals begin life as smaller, less capable forms of the adult. As they develop, they grow larger and become more independent (for example, humans, dogs or robins). 5. Some animals change dramatically in structure and function during their life cycle in a process called metamorphosis. 6. Frogs are amphibians that undergo metamorphosis during their life cycle. As they grow, frogs develop different structures that help them meet their basic needs in water and then on land: <ol style="list-style-type: none"> a. Tadpoles hatch from eggs, live in water, breathe using gills, and swim using a tail. As they metamorphose into frogs, tadpoles lose their gills and their tails. b. Adult frogs live on land <u>and</u> in water. They breathe air using lungs and develop webbed feet and hinged legs for swimming in water and hopping on land. After a female frog 	<ol style="list-style-type: none"> 1. Explain that living things experience a life cycle that includes birth, growth, reproduction and death. 2. Distinguish between animals that are born alive (e.g., humans, dogs, cows) and those that hatch from eggs (e.g., chickens, sea turtles, crocodiles). 3. Compare and contrast the changes in structure and behavior that occur during the life cycles of animals that undergo metamorphosis with those that do not. 4. Analyze recorded observations to compare the metamorphosis stages of different animals and make predictions based on observed patterns. 	<p>A15. Describe the changes in organisms, such as frogs and butterflies, as they undergo metamorphosis.</p> <p>A16. Describe the life cycles of organisms that grow but do not metamorphose.</p>

	<p style="text-align: center;">mates, she lays her eggs, and the cycle begins again.</p> <p>7. Butterflies are insects that undergo metamorphosis during their life cycle. As they go through egg, larva, pupa and adult stages, butterflies develop different structures that help them meet their basic needs on land and in the air:</p> <ul style="list-style-type: none"> a. Caterpillars hatch from eggs, live on plants, get food by chewing leaves and move about using legs. As they metamorphose into butterflies inside a chrysalis, they develop wings, antennae and different mouth parts. b. Butterflies live on land <u>and</u> in the air. They get food by sucking nectar from flowers and move around primarily using wings to fly. After a female butterfly mates, she searches for the proper host plant to lay her eggs, and the cycle begins again. <p>8. Comparing the life cycle stages of different organisms shows how they are alike in some ways and unique in other ways.</p> <p>KEY CONCEPT WORDS: life cycle, egg, metamorphosis, structures (body parts), amphibian, tadpole, gills, lungs, insect, caterpillar</p>		
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Science and Technology in Society — How do science and technology affect the quality of our lives?

GRADE 1

1.4 — The properties of materials and organisms can be described more accurately through the use of standard measuring units.

This content standard should be integrated within all PK–5 standards.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	Assessment
<p>1.4.a. Various tools can be used to measure, describe and compare different objects and organisms.</p>	<ol style="list-style-type: none"> 1. Observations can be expressed in words, pictures or numbers. Measurements add accuracy to observations. 2. Objects and organisms can be described using nonstandard measurement units, such as hand-lengths, pencil-lengths, handfuls, etc. 3. Standard measurement units are more accurate than nonstandard units because they have consistent values agreed on by everyone. For example, “My caterpillar is one finger long” is much less accurate than “My caterpillar is 4 centimeters long.” 4. Scientists and nonscientists all over the world use the metric system of measurement. In the United States, the customary measurement system is used in daily life. Equivalent values between the two systems can be estimated (for example, 1 inch is a little more than 2 centimeters). 5. Specific tools are used to measure different quantities: <ol style="list-style-type: none"> a. Metric rulers are used to measure length, height or distance in centimeters and meters; customary rulers measure length, height or distance in inches, feet or yards. b. Balances and scales are used to compare and measure the heaviness of objects. Grams and kilograms are units that express mass; ounces and pounds are units that express weight. c. Graduated cylinders, beakers and measuring cups are tools used to measure the volume of liquids. Volume can be expressed in milliliters (mL), liters (L), cups or ounces. d. Thermometers are tools used to measure temperature; thermometers 	<ol style="list-style-type: none"> 1. Use nonstandard and standard measurements to describe and compare the weight, length, and size of objects and organisms. 2. Show approximate size of a centimeter, meter, inch, foot and yard using referents such as a finger, a hand or a book. 3. Select appropriate tools for measuring length, height, weight or liquid volume. 4. Use metric and customary rulers to measure length, height or distance in centimeters, meters, inches, feet and yards. 5. Use balances and scales to compare and measure the heaviness of objects and organisms in kilograms, grams, pounds and ounces. 6. Use graduated cylinders, beakers and measuring cups to measure the volume of 	<p>A17. Estimate, measure and compare the sizes and weights of different objects and organisms using standard and nonstandard measuring tools.</p>

	<p>can indicate temperature in degrees Celsius or degrees Fahrenheit, or both.</p> <p>KEY CONCEPT WORDS: centimeter, meter, gram, kilogram, milliliter, liter, graduated cylinder, thermometer, Celsius, Fahrenheit</p>	<p>liquids in milliliters, liters, cups and ounces.</p> <p>7. Use thermometers to measure air and water temperature in degrees Celsius and degrees Fahrenheit.</p> <p>8. Make graphs to identify patterns in recorded measurements such as growth or temperature over time.</p>	
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Properties of Matter — How does the structure of matter affect the properties and uses of materials?

GRADE 2

2.1 — Materials can be classified as solid, liquid or gas based on their observable properties.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	Assessment
<p>2.1.a. Solids tend to maintain their own shapes, while liquids tend to assume the shapes of their containers, and gases fill their containers fully.</p>	<ol style="list-style-type: none"> 1. Materials can be classified as solid, liquid or gas. All forms of matter have weight and take up space, but each form has unique properties. 2. Solids are the only form of matter that have a definite shape. A solid’s shape can be changed by hammering, twisting or stretching, but its weight remains the same. Solids can be hard, soft, bouncy, stretchy or grainy. 3. Solids take up a definite amount of space (volume); the volume does not change if the solid is placed in different containers. 4. Liquids do not have a definite shape; they flow to the bottom of a container and take on the shape of the part of the container they occupy. Liquids pour and flow from a higher point to a lower point; some liquids flow faster than others. 5. Liquids have a definite volume. When a liquid is poured into different containers, the shape of the liquid may change, but the volume does not. 6. Gases are made of particles too small to see, but they still take up space and have weight. Gases do not have a definite shape; they take on the shape of whatever container they occupy. For example, the air in an inflated balloon can be squeezed and reshaped. 7. Gases do not have a definite volume; they spread out in all directions to fill any size container, or they keep spreading in all directions if there is no container. For example, blowing even a small amount of air into a balloon immediately fills the entire balloon; the smell of baking bread eventually fills the entire house and even outside. <p>KEY CONCEPT WORDS: property, classify, matter, state of matter, solid, liquid, gas, volume</p>	<ol style="list-style-type: none"> 1. Compare and contrast the properties that distinguish solids, liquids and gases. 2. Classify objects and materials according to their state of matter. 3. Measure and compare the sizes of different solids. 4. Measure and compare the volume of a liquid poured into different containers. 5. Design a fair test to compare the flow rates of different liquids and granular solids. 	<p>A18. Describe differences in the physical properties of solids and liquids.</p>

Structure and Function — How are organisms structured to ensure efficiency and survival?

GRADE 2

2.2 — Plants change their forms as part of their life cycles.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	Assessment
<p>2.2.a. The life cycles of flowering plants include seed germination, growth, flowering, pollination and seed dispersal.</p>	<ol style="list-style-type: none"> 1. Flowering plants progress through a sequenced life cycle. First, seeds sprout (germinate), then seedlings grow into adult plants with leaves and flowers. If the flowers are pollinated, seeds develop that will grow into new plants to continue the life cycle. 2. Roots, stems, leaves, flowers and seeds are structures that develop during different stages of the plant’s life cycle. 3. Seeds contain the beginnings of a new plant (embryo) and the food (energy source) the new plant needs to grow until it is mature enough to produce its own food. Different plant varieties produce seeds of different size, color and shape. 4. Environmental conditions, such as temperature, amount of light, amount of water and type of soil, affect seed germination and plant development. 5. A plant’s seed will grow into a new plant that resembles but is not identical to the parent plant or to other new plants. For example, marigold plants produce marigold seeds that grow into new marigold plants. Individual marigolds, however, vary in height, number of leaves, etc. 6. Seedlings are young plants that produce the structures that will be needed by the plant to survive in its environment: Roots and leaves begin to grow and take in nutrients, water and air; and the stem starts to grow towards sunlight. 7. Adult plants form more leaves that help the plant collect sunlight and air to make its food. They produce flowers that are the structures responsible for reproduction. 	<ol style="list-style-type: none"> 1. Use senses and simple tools to observe and describe the roots, stems, leaves, flowers and seeds of various plants (including trees, vegetables and grass.) 2. Use magnifiers to observe and diagram the parts of a flower. 3. Describe the functions of roots, stems, leaves, flowers and seeds in completing a plant’s life cycle. 4. Record observations and make conclusions about the sequence of stages in a flowering plant’s life cycle. 5. Compare and contrast how seeds of different plants are adapted for dispersal by water, wind or animals. 6. Conduct a fair test to explore factors that affect seed germination and plant growth. 	<p>A19. Describe the life cycles of flowering plants as they grow from seeds, proceed through maturation and produce new seeds.</p> <p>A20. Explore and describe the effects of light and water on seed germination and plant growth.</p>

	<p>8. Flowers have structures that produce pollen, attract pollinators and produce seeds that can grow into new plants. Some flowers have structures that develop into fruits, berries or nuts that contain the seeds that can grow into new plants.</p> <p>9. Some seeds fall to the ground and germinate close to the parent plant other seeds are carried (dispersed) by wind, animals, or water to places far away. The structure of the seed is related to the way it is dispersed.</p> <p>KEY CONCEPT WORDS: life cycle, structures (body parts), seed, germinate, reproduce, flower, pollen, pollinator, seed dispersal</p>		
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The Changing Earth — How do materials cycle through the earth's systems?

GRADE 2

2.3 — Earth materials have varied physical properties that make them useful in different ways.

<p>Core Science Curriculum Framework</p>	<p>Grade-Level Concepts <i>Students should understand that...</i></p>	<p>Grade-Level Expectations <i>Students should be able to...</i></p>	<p>Assessment</p>
<p>2.3.a. Soils can be described by their color, texture and capacity to retain water.</p> <p>2.3.b. Soils support the growth of many kinds of plants, including those in our food supply.</p>	<p>GRADE-LEVEL CONCEPT 2.3.a.</p> <ol style="list-style-type: none"> 1. Soil is a mixture of pieces of rock (particles), living and once living things (humus), water and air. The components of soil can be separated using sieves and settlement tests. 2. There are different types of soil that vary from place to place. Soil properties can be observed and compared. Soils can be classified by properties such as color, particle size, or amount of organic material (humus). Digging a deep hole shows that soils are often found in layers that have different colors and textures. 3. The size of the particles in soils gives the soil its texture. Soils can be classified by how they feel: Sandy soils feel gritty, silty soils feel powdery, clay soils feel sticky, and soils with small rocks feel rough and scratchy. 4. The broken rocks that make up soils can be tiny (silt and clay), medium (sand), or large (pebbles). Soils can be classified by the size of their particles. 5. A soil’s texture affects how it packs together; soils that pack together tightly hold less air and water than soils that stay loosely packed. 6. There are different types of soil that vary from place to place. Some soil types are suited for supporting the weight of buildings and highways; other soil types are suited for planting food crops or forest growth. <p>GRADE-LEVEL CONCEPT 2.3.b.</p> <ol style="list-style-type: none"> 1. Many plants need soil to grow. Soil holds water and nutrients that are 	<ol style="list-style-type: none"> 1. Use senses and simple tools (e.g., sieves and settlement tests) to separate soil into components such as rock fragments, water, air and plant remains. 2. Classify soils by properties such as color, particle size (sand, silt or clay), or amount of organic material (loam). 3. Explain the importance of soil to plants, animals and people. 4. Evaluate the quality of different soils in terms of observable presence of air, water, living things and plant remains. 5. Conduct fair tests to investigate how different soil types affect plant growth and write conclusions supported by evidence. 	<p>A21. Sort different soils by properties, such as particle size, color and composition.</p> <p>A22. Relate the properties of different soils to their capacity to retain water and support the growth of certain plants.</p>

	<p>taken in (absorbed) by plant roots.</p> <ol style="list-style-type: none">2. Soil is a habitat for many living things. Some organisms live in the soil and others live on the soil. Worms and other underground animals create spaces for air, water and plant roots to move through soil.3. Plants we eat (“crops”) grow in different soil types. Plant height, root length, number of leaves, and number of flowers can all be affected by how much water, air and organic material the soil holds.4. To support the growth of different plants, people can change the properties of soils by adding nutrients (fertilizing), water (irrigating) or air (tilling). <p>KEY CONCEPT WORDS: soil, property, classify, mixture, particle, humus, sand, silt, clay, texture, nutrients</p>		
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Science and Technology in Society — How do science and technology affect the quality of our lives?

GRADE 2

2.4 — Human beings, like all other living things, have special nutritional needs for survival.

This content standard is an application of the concepts in content standard 2.3 and should be integrated into the same learning unit.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	Assessment
<p>2.4.a. The essential components of balanced nutrition can be obtained from plant and animal sources.</p> <p>2.4.b. People eat different foods in order to satisfy nutritional needs for carbohydrates, proteins and fats.</p>	<p>GRADE-LEVEL CONCEPT 2.4.a.</p> <ol style="list-style-type: none"> 1. People need to eat a variety of foods to get the energy and nutrients they need to grow, move and stay healthy. Foods are classified as grains, fruits, vegetables, dairy, meats and beans, and oils. 2. Some foods people eat come from plants that grow wild or are planted by farmers as crops. A fruit is the ripened ovary of a flower; vegetables are the roots, stems, leaves or flowers of plants. 3. Some foods people eat come from animals that are wild or are raised on ranches. Meat, fish, dairy products and eggs all come from animals. 4. The types of crops that can grow in an area depend on the climate and soil. Some foods are grown and sold by local farms, and some foods are grown far away and transported to local grocery stores. <p>GRADE-LEVEL CONCEPT 2.4.b.</p> <ol style="list-style-type: none"> 1. All people need the same basic nutrients to grow, move and stay healthy; different cultures satisfy these needs by consuming different foods. 2. The level of energy and nutrients individuals need depends on their age, gender and how active they are. 3. Most foods contain a combination of nutrients. Labels on food packages describe the nutrients contained in the food and how much energy the food provides (calories). 4. Breads, cereals, rice and pasta are sources of carbohydrates, which 	<ol style="list-style-type: none"> 1. Explain that food is a source of carbohydrates, protein and fats —nutrients that animals (including humans) convert to energy they use to stay alive and grow. 2. Classify foods into groups based on their source, and relate common foods to the plant or animal from which they come. 3. Give examples of ways people can improve soil quality and crop growth (e.g., irrigation, fertilizer, pest control). 4. Compare and contrast how different cultures meet needs for basic nutrients by consuming various foods. 5. Evaluate the nutritional value of different foods by analyzing package labels. 	<p>A23. Identify the sources of common foods and classify them by their basic food groups.</p> <p>A24. Describe how people in different cultures use different food sources to meet their nutritional needs.</p>

	<p>provide energy.</p> <p>5. Meat, poultry, fish, beans, eggs and nuts are sources of protein, which keeps the body working properly.</p> <p>6. Fruits and vegetables are sources of vitamins and minerals, which keep the body healthy.</p> <p>7. Nuts, meats and fish are sources of fats and oils, which provide energy.</p> <p>KEY CONCEPT WORDS: nutrient, crop, grain, carbohydrate, protein, dairy, fats, oils, energy</p>		
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Scientific knowledge is created and communicated through students' use of the following skills. All of the inquiry skills described below should be utilized by Grade 3-5 students as they learn the content described by each Content Standard on the pages that follow.

Grades 3-5 Core Scientific Inquiry, Literacy and Numeracy

How is scientific knowledge created and communicated?

Expected Performances

- B INQ.1** Make observations and ask questions about objects, organisms and the environment.
- B INQ.2** Seek relevant information in books, magazines and electronic media.
- B INQ.3** Design and conduct simple investigations.
- B INQ.4** Employ simple equipment and measuring tools to gather data and extend the senses.
- B INQ.5** Use data to construct reasonable explanations.
- B INQ.6** Analyze, critique and communicate investigations using words, graphs and drawings.
- B INQ.7** Read and write a variety of science-related fiction and nonfiction texts.
- B INQ.8** Search the Web and locate relevant science information.
- B INQ.9** Use measurement tools and standard units (e.g., centimeters, meters, grams, kilograms) to describe objects and materials.
- B INQ.10** Use mathematics to analyze, interpret and present data.

Properties of Matter — How does the structure of matter affect the properties and uses of materials?

GRADE 3

3.1 — Materials have properties that can be identified and described through the use of simple tests.

<p>Core Science Curriculum Framework</p>	<p>Grade-Level Concepts <i>Students should understand that...</i></p>	<p>Grade-Level Expectations <i>Students should be able to...</i></p>	<p>CMT Expected Performances</p>
<p>3.1.a. Heating and cooling cause changes in some of the properties of materials.</p>	<ol style="list-style-type: none"> 1. Materials have properties that are directly observable; examples include its state of matter, or its size, shape, color or texture. Other properties can only be observed by doing something to the material (simple tests). Materials can be sorted and classified based on their testable properties. 2. Some materials dissolve (disappear) when mixed in water; others accumulate on the top or the bottom of the container. The temperature of water can affect whether, and at what rate, materials dissolve in it. 3. Some materials, such as sponges, papers and fabrics, absorb water better than others. 4. Some materials float when placed in water (or other liquids such as cooking oil or maple syrup); others sink to the bottom of the container. 5. Some materials conduct heat better than others. Materials that are poor heat conductors are useful for keeping things cold or hot. 6. Some materials are attracted to magnets. Magnetic materials contain iron. 7. The physical properties of a material can be changed, but the material remains the same. For example, a block of wood can be cut, sanded or painted, but it is still wood. 8. Heating and cooling cause materials to change from one state of matter to another and back again. Adding heat can cause solids to melt into liquids (for example, chocolate, ice cream, butter or wax); removing heat (cooling) can cause liquids to harden into solids (for example, hot candle wax hardens as it cools). 9. Adding heat can cause water to boil and evaporate into a gas in the air (for 	<ol style="list-style-type: none"> 1. Compare and contrast the properties of solids, liquids and gases. 2. Demonstrate that solids, liquids and gases are all forms of matter that take up space and have weight. 3. Carry out simple tests to determine if materials dissolve, sink or float in water, conduct heat or attract to magnets. 4. Classify materials based on their observable properties, including state of matter. 5. Design and conduct fair tests to investigate the absorbency of different materials, write conclusions based on evidence, and analyze why similar investigations might produce different results. 6. Explain the role of heating and cooling in changing 	<p>B1. Sort and classify materials based on properties such as dissolving in water, sinking and floating, conducting heat, and attracting to magnets.</p> <p>B2. Describe the effect of heating on the melting, evaporation, condensation and freezing of water.</p>

	<p>example, steam rises from heated water); removing heat (cooling) can cause water vapor to condense into liquid water (for example, warm steam hitting a cold mirror). Water outdoors or in an open container evaporates without boiling (for example, puddles, ponds, fish tanks, etc.)</p> <p>10. Water may exist as a solid, liquid or gas, depending on its temperature. If water is turned into ice and then the ice is allowed to melt, the amount of water is the same as it was before freezing.</p> <p>11. Liquid water becomes solid water (ice) when its temperature cools to 0 degrees Celsius (32 degrees Fahrenheit). Warming ice to a temperature above 0 degrees Celsius causes it to melt into liquid water.</p> <p>KEY CONCEPT WORDS: physical property, state of matter, solid, liquid, gas, dissolve, absorb, conduct, attract, melt, freeze, boil, evaporate, condense</p>	<p>matter from one state to another during freezing, melting, evaporation and condensation.</p>	
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Heredity and Evolution — What processes are responsible for life’s unity and diversity?

GRADE 3

3.2 — Organisms can survive and reproduce only in environments that meet their basic needs.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>3.2.a. Plants and animals have structures and behaviors that help them survive in different environments.</p>	<ol style="list-style-type: none"> Plants and animals have physical and behavioral adaptations that allow them to survive in certain environments. Adaptations are passed from parents to offspring. Individuals that happen to be bigger, stronger or faster can have an advantage over others of the same kind for finding food and mates. Animals have behavioral and structural adaptations for getting food. Structural adaptations include things such as specialized teeth for tearing meat or grinding grasses; specialized beaks for cracking seeds, snatching insects, tearing meat or spearing fish; sharp claws for grasping; keen sense of smell, or long, sticky tongues for reaching food. Behavioral adaptations include actions such as following herds of prey animals, spinning webs or stalking. Animals have behavioral and structural adaptations for protection from predators. Some animals have camouflage that allows them to stay concealed by blending in with their surroundings; some animals look like other animals to avoid being eaten. Structural adaptations include things such as sharp quills, hard shells or antlers. Behavioral adaptations include actions such as staying absolutely still, producing a bad odor, appearing or sounding scary, or fleeing. Animals have behavioral and structural adaptations for surviving harsh environmental conditions. Animals that live in cold climates have insulating body coverings such as blubber, down or thick undercoats that keep them warm. Animals that live in hot climates keep cool by releasing heat from big ears or by panting, or by living underground. Some animals survive seasonal changes by slowing down body functions (hibernating in dens, tunnels or mud) or moving to more favorable 	<ol style="list-style-type: none"> Compare and contrast the external features and behaviors that enable different animals and plants (including those that are extinct) to get food, water and sunlight; find mates; and be protected in specific land and water habitats. Explain how behaviors such as hibernation, dormancy and migration give species advantages for surviving unfavorable environmental conditions. Give examples of ways animals benefit from camouflage. Evaluate whether an adaptation gives a plant or animal a survival advantage in a given environment. Design a model of an 	<p>B3. Describe how different plants and animals are adapted to obtain air, water, food and protection in specific land habitats.</p> <p>B4. Describe how different plants and animals are adapted to obtain air, water, food and protection in water habitats.</p>

	<p>conditions (migrating).</p> <ol style="list-style-type: none"> 5. Plants have adaptations for getting the sunlight they need to survive. Examples include growing or facing toward sunlight and sending out chutes or tendrils to get taller than neighboring plants. 6. Plants have adaptations for protection from predators. Examples include spines, thorns and toxins (for example, poison ivy). 7. Plants have adaptations for surviving in different environmental conditions. Examples include dropping leaves in winter when sunlight and water are limited, having needle-shaped leaves that shed snow, or surviving drought by storing water in thick stems. <p>KEY CONCEPT WORDS: adaptation, advantage, camouflage, hibernation, migration</p>	<p>organism whose adaptations give it an advantage in a specific environment.</p>	
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The Changing Earth — How do materials cycle through the earth's systems?

GRADE 3

3.3 — Earth materials have different physical and chemical properties.

<p>Core Science Curriculum Framework</p>	<p>Grade-Level Concepts <i>Students should understand that...</i></p>	<p>Grade-Level Expectations <i>Students should be able to...</i></p>	<p>CMT Expected Performances</p>
<p>3.3.a. Rocks and minerals have properties that may be identified through observation and testing; these properties determine how earth materials are used.</p>	<ol style="list-style-type: none"> 1. Earth is mainly made of rock. Rocks on the earth’s surface are constantly being broken down into smaller and smaller pieces, from mountains to boulders, stones, pebbles and small particles that make up soil. 2. Rocks can be sorted based on properties, such as shape, size, color, weight or texture. 3. Properties of rocks can be used to identify the conditions under which they were formed. 4. Igneous rocks are formed when melted rock cools, hardens and forms crystals. Melted rock that cools slowly inside a volcano forms large crystals as it cools. Melted rock that cools rapidly on the earth’s surface forms small crystals (or none at all). 5. Sedimentary rocks are formed underwater when small particles of sand, mud, silt or ancient shells/skeletons settle to the bottom in layers that are buried and cemented together over a long period of time. They often have visible layers or fossils. 6. Metamorphic rocks are formed when igneous or sedimentary rocks are reheated and cooled or pressed into new forms. They often have bands, streaks or clumps of materials. 7. Rock properties make them useful for different purposes. Rocks that can be cut into regular shapes are useful for buildings and statues; rocks that crumble easily are useful for making mixtures such as concrete and sheetrock. 8. All rocks are made of materials called minerals that have properties that may 	<ol style="list-style-type: none"> 1. Differentiate between rocks and minerals. 2. Use the senses and simple measuring tools to gather data about various rocks and classify them based on observable properties (e.g., shape, size, color, weight, visible markings). 3. Conduct simple tests to determine properties of different minerals (e.g. color, odor, streak, luster, hardness, magnetism), organize data in a table, and use the data and other resources to identify unknown mineral specimens. 4. Summarize nonfiction text to compare and contrast the conditions under which igneous, metamorphic and sedimentary rocks are formed. 5. Observe and analyze rock 	<p>B5. Describe the physical properties of rocks and relate them to their potential uses.</p> <p>B6. Relate the properties of rocks to the possible environmental conditions during their formation.</p>

	<p>be identified by testing. Mineral properties include color, odor, streak, luster, hardness and magnetism.</p> <p>9. Minerals are used in many ways, depending on their properties. For example, gold is a mineral that is easily shaped to make jewelry; talc is a mineral that breaks into tiny grains useful for making powders.</p> <p>KEY CONCEPT WORDS: property, classify, texture, igneous, sedimentary, metamorphic, fossil, crystal, mineral</p>	<p>properties (e.g., crystal size or layers) to infer the conditions under which the rock was formed.</p> <p>6. Evaluate the usefulness of different rock types for specific applications (e.g., buildings, sidewalks, stone walls, statues or monuments).</p>	
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Science and Technology in Society — How do science and technology affect the quality of our lives?

GRADE 3

3.4 — Earth materials provide resources for all living things, but these resources are limited and should be conserved.

This content standard is an application of the concepts in content standards 3.1 and 3.3 should be integrated within one of those units.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>3.4.a. Decisions made by individuals can affect the global supply of many resources.</p>	<ol style="list-style-type: none"> 1. Earth materials that occur in nature include rocks, minerals, soils, water and the gases of the atmosphere. Earth materials are natural resources that provide us with things we need to live, including food, clothing, water, air, shelter, land and energy. 2. Some natural resources are useful to people in their raw form (for example, fresh water, soil or air); other natural resources must be modified to meet human needs (for example, petroleum must be extracted from rocks and refined into gasoline, heating oil or plastics; wood from trees must be processed to make paper). 3. The supply of many natural resources such as fossil fuels, metals, fresh water and fertile soil is limited; once they are used up or contaminated they are difficult or impossible to replace. 4. Human actions can affect the survival of plants and animals. The products of the fuels people burn affect the quality of the air. Waste and chemicals from factories, farms, lawns and streets affect the quality of the water and soil. 5. Humans can extend the use of some natural resources by <u>reducing</u> the amounts they use (for example, driving less to reduce the amount of gasoline used; turning off faucets when not in use). 6. Humans can extend the use of some natural resources by <u>recycling</u>, or collecting used materials and processing them into new materials (for example, collecting waste paper or plastic bottles and making them into new products). 	<ol style="list-style-type: none"> 1. Describe ways people use earth materials, such as fossil fuels, trees, water, soils and rocks as natural resources to improve their lives. 2. Summarize nonfiction text to explain how humans use technology to access and use natural resources to produce electricity or other products (e.g., paper or concrete). 3. Explain advantages and disadvantages of renewable and nonrenewable energy sources that can be used for making electricity, fueling cars or heating homes. 4. Design and conduct experiments to evaluate the effectiveness of different insulating materials for keeping a substance (or space) warm or cold (i.e., conducting heat). 	<p>B7. Describe how earth materials can be conserved by reducing the quantities used, and by reusing and recycling materials rather than discarding them.</p>

	<p>7. Humans can extend the use of some natural resources by <u>reusing</u> products instead of buying new ones (for example, washing containers that food is packaged in and using them again to store different foods or objects).</p> <p>8. Humans can extend the use of some natural resources by <u>replacing</u> what they use (for example, planting new trees to replace those that are cut for lumber or paper; purifying dirty water from storm drains and discharging clean water back into a river).</p> <p>KEY CONCEPT WORDS: natural resources, renewable/nonrenewable, recycle, conserve</p>	<p>5. Use mathematics to estimate, measure and graph the quantity of a natural resource (e.g., water, paper) used by an individual (or group) in a certain time period.</p> <p>6. Evaluate the environmental advantages and disadvantages of reducing, reusing, recycling and replacing as conservation methods.</p>	
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Forces and Motion — What makes objects move the way they do?

GRADE 4

4.1 — The position and motion of objects can be changed by pushing or pulling.

<p align="center">Core Science Curriculum Framework</p>	<p align="center">Grade-Level Concepts <i>Students should understand that...</i></p>	<p align="center">Grade-Level Expectations <i>Students should be able to...</i></p>	<p align="center">CMT Expected Performances</p>
<p>4.1.a. The size of the change in an object’s motion is related to the strength of the push or pull.</p> <p>4.1.b. The more massive an object is, the less effect a given force will have on its motion.</p>	<p>GRADE-LEVEL CONCEPT 4.1.a.</p> <ol style="list-style-type: none"> 1. An object is in motion when its position is changing. Speed describes how far an object moves in a given amount of time (for example, miles per hour). 2. A force is a push or pull that can cause an object to move, stop, or change speed or direction. 3. The greater the force, the greater the change in motion. For example, two people can push a heavy box that could not be pushed by one person alone. 4. Given an object, changing the amount of force applied to it causes measurable effects. 5. When an object does not move in response to a push or a pull, it is because another equal-sized force is counteracting the push or pull. Gravity (the earth’s pulling force) and friction are common forces that affect motion. Friction and air resistance are forces that oppose motion. <p>GRADE-LEVEL CONCEPT 4.1.b.</p> <ol style="list-style-type: none"> 1. The amount of force needed to move an object is related to the object’s mass. 2. The greater the object’s mass, the greater the force needed to move it, stop it or change its speed or direction. 3. An object with a small mass is easier to stop or cause a change in 	<ol style="list-style-type: none"> 1. Demonstrate that a force can cause an object to start moving, stop, or change speed or direction. 2. Use measurement tools and standard units to compare and contrast the motion of common objects such as toy cars, balls, model rockets or planes in terms of change in position, speed and direction. 3. Design and conduct experiments to determine how the motion of an object is related to the mass of the object and the strength of the force applied. 4. Describe how friction forces caused by air resistance or interactions between surface materials affect the motion of objects. 5. Predict the effect of an 	<p>B8. Describe the effects of the strengths of pushes and pulls on the motion of objects.</p> <p>B9. Describe the effect of the mass of an object on its motion.</p>

	<p>motion than an object with a large mass.</p> <p>4. Given the same amount of force, changing the mass of an object has measurable effects.</p> <p>KEY CONCEPT WORDS: motion, force, speed, gravity, friction, mass</p>	<p>object's mass on its motion.</p>	
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Matter and Energy in Ecosystems — How do matter and energy flow through ecosystems?

GRADE 4

4.2 — All organisms depend on the living and nonliving features of the environment for survival.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>4.2.a. When the environment changes, some organisms survive and reproduce, and others die or move to new locations.</p>	<ol style="list-style-type: none"> Living and nonliving things interact in land and water environments called ecosystems. Every ecosystem has certain conditions (“abiotic factors”) and a variety of living things (“organisms”) that are adapted for survival in those conditions. Abiotic factors include the quality and amount of air, sunlight, water and soil, as well as the terrain and climate. Organisms depend on other organisms and on the nonliving things in an ecosystem to meet their basic needs for food, water and protection. Plants use energy from the sun to produce their own food from air and water. The type of soil, amount of water and temperature range in an area determine the plants that grow there. Animals that live in an area get their energy and nutrients either directly or indirectly from plants that grow there: herbivores consume only plants, carnivores consume animals, and omnivores consume both animals and plants. Decomposers consume plant and animal waste and remains, returning nutrients to the soil where they are used again by plants. Some of the sun’s energy is transferred from one organism to another when a plant or animal is consumed by another animal. A food chain is a simple model that illustrates the passage of energy from one organism to another. Food webs are more realistic models that show the varied energy-passing relationships among plants and animals in an ecosystem. Environments are always changing. Some changes occur naturally 	<ol style="list-style-type: none"> Give examples of ways that living and nonliving things are interdependent within an ecosystem. Draw diagrams showing how the sun’s energy enters and is transferred from producers to consumers in a local land or aquatic food chain. Design and conduct simple investigations to record interactions among producers, consumers, herbivores, carnivores, omnivores and decomposers in an ecosystem. Analyze food webs to describe how energy is transferred from plants to various animals in an ecosystem. Distinguish between naturally occurring changes 	<p>B10. Describe how animals, directly or indirectly, depend on plants to provide the food and energy they need to grow and survive.</p> <p>B11. Describe how natural phenomena and some human activities may cause changes to habitats and their inhabitants.</p>

	<p>(examples include droughts, disease outbreaks, or forest fires sparked by lightning). Other changes are caused by human activity (examples include establishing conservation areas, passing laws to control pollution, clearing forests for agriculture or construction, applying chemicals to lawns and crops, burning fossil fuels, etc.).</p> <p>7. Changes in an environment are sometimes beneficial to organisms and sometimes harmful. For example, a newly created beaver pond provides habitat that attracts frogs and raccoons to an area; but trees, earthworms and moles are no longer able to survive in the area.</p> <p>8. When environments change, some organisms can accommodate the change by eating different foods or finding different shelters (for example, hawks nest on city buildings and consume pigeons and rats). Those organisms that can no longer meet their basic needs die or move to new locations.</p> <p>KEY CONCEPT WORDS: ecosystem, organism, abiotic factors, nutrient, producer, consumer, herbivore, carnivore, omnivore, decomposer, food chain, food web</p>	<p>in ecosystems and those caused by human activity.</p> <p>6. Predict the effect an environmental change, such as drought or forest destruction, might have on the community of living things.</p>	
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Energy in the earth's systems — How do external and internal sources of energy affect the earth's systems?

GRADE 4

4.3 — Water has a major role in shaping the earth's surface.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>4.3.a. Water circulates through the earth's crust, oceans and atmosphere.</p>	<ol style="list-style-type: none"> 1. Water is continuously moving between Earth’s surface and the atmosphere in a process called the water cycle. Heat energy from the sun causes water on Earth to change to a gas and rise into the atmosphere, where it cools, condenses into tiny droplets in clouds, and eventually falls to Earth as precipitation. 2. Most precipitation that falls to Earth goes directly into oceans. Some precipitation falls on land and gravity causes it to flow downhill in streams. 3. Rain or snowmelt in high elevations flows downhill in many streams which collect in lower elevations to form a river that flows downhill to an ocean, a lake or a sea. 4. Water moving across the earth pushes along soil particles (sediment) and wears away pieces of rock in a process called erosion. Streams and rivers carry away rock and sediment from some areas and deposit them in other areas, creating new landforms or changing the course of a stream or river. 5. The amount of erosion in an area, and the type of earth material that is moved, are affected by the amount of moving water, the speed of the moving water, and by how much vegetation covers the area. 6. The speed of a river’s flow depends on the slope of the land, the amount of sediment it carries, and the shape of its channel (straight or meandering). 7. The speed of a river’s flow affects the amount of earth material that is 	<ol style="list-style-type: none"> 1. Describe the role of heat energy (i.e., heating and cooling) in the continuous cycling of water between the earth and the atmosphere through evaporation, condensation and precipitation. 2. Use models to demonstrate that topography causes precipitation landing on Earth to move in streams and rivers from higher to lower elevations. 3. Design and conduct simple investigations to determine how moving water (flowing downhill or in ocean waves) causes changes to the land, the coastline or the course of a stream or river. 4. Pose testable questions and employ simple equipment and measuring tools to collect data about factors that affect 	<p>B12. Describe how the sun’s energy impacts the water cycle.</p> <p>B13. Describe the role of water in erosion and river formation.</p>

	<p>pushed along or left behind in floodplains and deltas. Rivers flow through and reshape valleys as they move between mountains or hills.</p> <p>8. Water moving in ocean waves carries sand, shells and debris away from some coastal areas and deposits them in new areas, changing the shape of the coastline.</p> <p>9. Erosion is constantly reshaping the earth’s land surface. Sometimes the effects of erosion are immediate (for example, a flash flood or a hurricane) and sometimes the effects of erosion take a long time (for example, the changing course of a river or the carving of the Grand Canyon).</p> <p>KEY CONCEPT WORDS: water cycle, evaporate, condense, precipitation, erosion, sediment, valley, floodplain, delta</p>	<p>erosion (e.g., type of earth material in an area, volume of moving water, slope of land, vegetation coverage).</p> <p>5. Present evidence to support a scientific claim about the relationship between the amount and speed of moving water and the size of earth materials moved (e.g., sand, silt, pebbles, boulders).</p>	
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Energy Transfer and Transformations — What is the role of energy in our world?

GRADE 4

4.4 — Electrical and magnetic energy can be transferred and transformed.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>4.4.a. Electricity in circuits can be transformed into light, heat, sound and magnetic effects.</p> <p>4.4.b. Magnets can make objects move without direct contact between the object and the magnet.</p>	<p>GRADE-LEVEL CONCEPT 4.4.a.</p> <ol style="list-style-type: none"> 1. Electric current flows (is transferred) from an energy source (battery) through a continuous loop (circuit) and back to the source. A complete circuit (also called a closed circuit) forms a closed loop that allows electric current to flow; an incomplete circuit (also called an open circuit) has a break in the loop that prevents the flow of electric current. 2. Complete circuits can be made by connecting wires, batteries and bulbs in certain sequences. Circuits are completed only when certain parts of a battery, a bulb or a wire are touching (making contact). Circuit diagrams show the relative positions of batteries, bulbs and wires in complete circuits. 3. Conductors are materials that allow electric current to flow through them in an electric circuit. An open circuit can be completed by inserting a conductive material. If a bulb stays lit when an object is added to an electric circuit, the material is a conductor. 4. Insulators are materials that do not allow electric current to flow through them in an electric circuit. If a bulb does not stay lit when an object is added to an electric circuit, the material is an insulator. 5. Conductors can be tested to compare how easily they allow electricity to flow through them. 6. Electrical energy is changed (transformed) into light and heat energy as it passes through a bulb in a circuit. Electrical energy can be transformed into sound energy as it passes through a bell or a radio in a circuit. 	<ol style="list-style-type: none"> 1. Construct complete (closed) and incomplete (open) series circuits in which electrical energy is transformed into heat, light, sound and/or motion energy. 2. Draw labeled diagrams of complete and incomplete circuits, explain necessary components and how components can be arranged to make a complete circuit. 3. Predict whether diagrammed circuit configurations will light a bulb. 4. Develop a method for testing conductivity and analyze data to generalize that metals are generally good electrical conductors and nonmetals are not. 5. Observe magnetic effects associated with electricity and investigate factors that affect the strength of an 	<p>B14. Describe how batteries and wires can transfer energy to light a bulb.</p> <p>B15. Explain how simple electrical circuits can be used to determine which materials conduct electricity.</p> <p>B16. Describe the properties of magnets, and how they can be used to</p>

	<p>7. Adding batteries or bulbs to a circuit can produce observable changes.</p> <p>8. Electricity flowing through an electrical circuit produces magnetic effects in the wires. The electromagnet can be turned on and off, and its strength can be varied and measured.</p> <p>GRADE-LEVEL CONCEPT 4.4.b.</p> <p>1. Magnets pull on (“attract”) objects made of iron or that have iron in them. Materials can be identified using magnets, and mixtures of materials can be separated using magnets.</p> <p>2. Some areas of a magnet have stronger magnetic attraction than other areas.</p> <p>3. Magnets can pull (attract) or push (repel) other magnets.</p> <p>4. The ends of a magnet are called “poles.” A magnet’s poles are often referred to as “north” and “south.” When the <u>north</u> pole of one magnet is placed near the <u>north</u> pole of another magnet, they repel each other; when the <u>south</u> pole of one magnet is placed near the <u>south</u> pole of another magnet, they repel each other; when the <u>north</u> pole of one magnet is placed near the <u>south</u> pole of another magnet, they attract each other.</p> <p>5. A magnet’s push or pull can cause a magnetic object or another magnet to move without direct contact. The strength of a magnet’s attractive force can be measured by recording the number or mass of the objects it attracts or the distance across which it attracts objects.</p> <p>6. When a magnet, or a magnetized object such as a compass needle, is allowed to swing freely, its ends will point toward the earth’s magnetic north and south poles.</p> <p>7. Magnets and electromagnets have many uses in everyday life. Examples may include paper clip containers, refrigerator door seals, shower curtain weights, or a compass.</p> <p>KEY CONCEPT WORDS: magnet, attract (attraction), repel (repulsion), iron, pole, force, electric current, energy source, battery, contact, complete (closed) circuit, incomplete (open) circuit, conductor, insulator</p>	<p>electromagnet.</p> <p>6. Describe materials that are attracted by magnets.</p> <p>7. Design procedures to move objects and separate mixtures of solids using magnets.</p> <p>8. Investigate how magnets react with other magnets and analyze findings to identify patterns in the interactions between north and south poles of magnets.</p> <p>9. Give examples of uses of magnets (e.g., motors, generators, household devices).</p>	<p>identify and separate mixtures of solid materials.</p>
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Energy Transfer and Transformations — What is the role of energy in our world?

GRADE 5

5.1 — Sound and light are forms of energy.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>5.1.a. Sound is a form of energy that is produced by the vibration of objects and is transmitted by the vibration of air and objects.</p> <p>5.1.b. Light is a form of energy that travels in a straight line and can be reflected by a mirror, refracted by a lens, or absorbed by objects.</p>	<p>GRADE-LEVEL CONCEPT 5.1.a.</p> <ol style="list-style-type: none"> There are a variety of sounds in our environment. Sounds have characteristics, such as loudness, pitch and quality (or “timbre”), that allow them to be identified. For sound to occur, there must be a vibrating object, a material through which the vibrations are transferred (for example, air or water), and a receiver (for example, an ear) to perceive the sound. Objects can be caused to vibrate by actions such as striking, strumming, bowing, plucking or blowing. Sounds can vary in loudness (“volume”). Volume is affected by the strength of the force causing the vibration. For example, striking a drum forcefully or gently produces sounds with different volumes. Sounds can have a high or low tone (“pitch”). The pitch of a sound depends on the speed of the vibration. Objects that vibrate quickly have a high pitch, while those that vibrate slowly have a low pitch. Pitch is affected by characteristics such as the shape, length, tension or thickness of the vibrating material (for example, the vibrating material may be a string, a glass, a wire or a drum). Sound travels (is “transmitted”) through materials by causing them to vibrate. Sound is not transmitted if there are no materials to vibrate. Solids, liquids and gases (air) transmit sound differently. Sounds can be reflected or absorbed, depending on the properties of the material it hits. Sound tends to bounce off smooth, hard surfaces, producing an echo; sound tends to be absorbed by soft, porous surfaces, 	<ol style="list-style-type: none"> Generalize that vibrating objects produce sound if the vibrations are transferred from the object through another material (e.g., air, a solid, or a liquid). Demonstrate how the loudness, pitch and quality/timbre of sound can be varied. Design and conduct investigations to determine factors that affect pitch. Describe the properties of materials that reflect or absorb sound. Analyze properties of materials that cause sound to be reflected or absorbed, then apply findings to design a device that reflects or absorbs sound. Construct simple musical instruments (e.g., rubber band guitars, drums, etc.) that produce sounds with various 	<p>B17. Describe the factors that affect the pitch and loudness of sound produced by vibrating objects.</p> <p>B18. Describe how sound is transmitted, reflected and/or absorbed by different materials.</p> <p>B19. Describe how light is absorbed and/or reflected by different surfaces.</p>

	<p>producing a muffled sound.</p> <p>GRADE-LEVEL CONCEPT 5.1.b.</p> <ol style="list-style-type: none"> 1. Light travels in straight paths away from a source of illumination in all directions until it hits an object. Some sources of illumination produce their own light (for example, the sun, fire, light bulb); other sources of illumination reflect light produced by something else (for example, the moon or a mirror). 2. Light interacts with objects in various ways; it can be reflected off the object, absorbed by the object, or refracted through the object. 3. Materials can be classified based on how much light passes through them. Transparent materials allow most light to pass through them. Translucent materials allow some light to pass through them. Opaque materials do not allow any light to pass through them. 4. Objects that have flat, smooth surfaces reflect light and produce a mirror-like image. Objects that have curved or uneven surfaces scatter the reflected light and produce distorted or blurry images. 5. Light always reflects away from a mirror at the same angle that it hits the mirror. The angle of incoming light equals the angle of reflected light. 6. Objects that block light traveling from a source produce shadows. The shape, length, direction and clarity of a shadow depend on the shape and position of the object, and the location of the light source. 7. Light changes direction (“refracts”) as it passes from one transparent material to another (for example, as it passes from air to water or through lenses). <p>KEY CONCEPT WORDS: reflect, absorb, refract, transparent, translucent, opaque, angle, vibration, transfer, volume, pitch, transmit, reflect, absorb</p>	<p>pitches, volume and timbres.</p> <ol style="list-style-type: none"> 7. Provide evidence that light travels in straight lines away from a source in all directions. 8. Investigate how light is refracted as it passes through a lens or through one transparent material to another. 9. Demonstrate that white light is composed of many colors. 10. Explain that all visible objects are reflecting some light to the human eye. 11. Contrast the way light is reflected by a smooth, shiny object (e.g., mirror or pool of water) and how light is reflected by other objects. 12. Measure angles to predict the path of light reflected by a mirror. 13. Determine whether a material is opaque, transparent or translucent based on how light passes through it. 14. Design and conduct light absorption experiments that vary the size, length, direction and clarity of a shadow by changing the position of the light-blocking object or the light source. 	
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Structure and Function — How are organisms structured to ensure efficiency and survival?

GRADE 5

5.2 —Perceiving and responding to information about the environment is critical to the survival of organisms.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>5.2.a The sense organs perceive stimuli from the environment and send signals to the brain through the nervous system.</p>	<ol style="list-style-type: none"> 1. Animals have sense organs that are structured to gather information about their environment. Information perceived by the senses allows animals to find food, water, mates and protection. 2. Each sense organ perceives specific kinds of stimuli. Some human senses are more or less developed than the senses of other animals. 3. Sense organs transfer information through a network of nerves to the brain where it is interpreted and responded to. The brain responds by sending messages to all parts of the body. The type of response and the amount of time it takes for the response to occur vary depending on the stimulus. 4. The human ear is structured to collect sound vibrations from the environment and pass them through the middle ear (eardrum and small bones) and inner ear (hair-lined tubes) to the auditory nerve where they are transformed into electrical signals that are sent to different parts of the brain. 5. The human eye is structured to collect light through the cornea and the pupil. The amount of light that enters the eye is controlled by the iris. The cornea and the lens refract the light and focus it onto the retina and the optic nerve where it is transformed into electrical signals that are sent to different parts of the brain. 6. For anything to be visible, light must be present. For a person to see an object, the light it reflects or produces must have a straight, unobstructed path to the eye. 7. Human eyes have receptors for perceiving shades of red, orange, yellow, green, blue, indigo and violet. 	<ol style="list-style-type: none"> 1. Explain the role of sensory organs in perceiving stimuli (e.g., light/dark, heat/cold, flavors, pain, etc.) 2. Pose testable questions and design experiments to determine factors that affect human reaction time. 3. Conduct simple tests to explore the capabilities of the human senses. 4. Summarize nonfiction text to explain the role of the brain and spinal cord in responding to information received from the sense organs. 5. Identify the major structures of the human eye, ear, nose, skin and tongue, and explain their functions. 6. Draw diagrams showing the straight path of light rays from a source to a reflecting object to the eye, allowing objects to be seen. 	<p>B20. Describe how light absorption and reflection allow one to see the shapes and colors of objects.</p> <p>B21. Describe the structure and function of the human senses and the signals they perceive.</p>

	<p>8. Sunlight (or “white light”) is a combination of colors. White light passed through prisms, water droplets or diffraction gratings can be refracted to show its component colors: red, orange, yellow, green, blue, indigo and violet.</p> <p>9. The perceived color of an object depends on the color of the light illuminating it and the way the light interacts with the object. The color humans see is the color that is reflected by the object. For example, an object that appears green is absorbing all colors except green, which is reflected to the eye.</p> <p>10. Human skin is structured to detect information related to texture, temperature, pressure and vibration. Each sensation has different receptors distributed around the body; some areas of the body have greater concentrations of receptors for certain sensations, making those areas more sensitive than others to texture, temperature, or pressure.</p> <p>11. Human noses are structured to collect and detect chemicals floating in the air (odors). Tiny hairs behind the nose have special receptors that respond to airborne chemicals and produce electrical signals that are transmitted to different parts of the brain by the olfactory nerve.</p> <p>12. Human tongues are sense organs that are structured for detecting chemicals dissolved in saliva (flavors). Taste buds respond to 4 basic tastes: salty, sweet, sour and bitter. Special receptors in taste buds respond to tastes and produce electrical signals that transmit information through nerves to different parts of the brain.</p> <p>KEY CONCEPT WORDS: sense organ, receptor, stimulus, response, nervous system, vibration, reflect, refract, cornea, pupil, iris, lens, retina, white light, absorb</p>	<p>7. Describe the properties of different materials and the structures in the human eye enable humans to perceive color.</p>	
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Earth in the Solar System — How does the position of Earth in the solar system affect conditions on our planet?

GRADE 5

5.3 — Most objects in the solar system are in a regular and predictable motion.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>5.3.a. The positions of the earth and moon relative to the sun explain the cycles of day and night, and the monthly moon phases.</p>	<ol style="list-style-type: none"> 1. The sun, Earth and its moon are spherical objects that move in two ways: they spin (rotate) and they change positions relative to each other (revolve). 2. The sun is a star that produces light that travels in straight lines away from the sun in all directions. Light from the sun illuminates objects that reflect light, including Earth and its moon. The side of the earth that is facing the sun experiences daylight; the side of the earth facing away from the sun experiences night. All parts of the earth experience a cycle that includes both day and night, providing evidence that the earth is rotating on its axis. 3. The amount of time it takes for the earth to rotate once on its axis is regular and predictable (24 hours), and is called “a day.” Earth’s rotation makes it appear as if the sun is moving across the sky from east to west. 4. The moon is a rocky object that revolves around the earth in a circular path called an orbit. The amount of time it takes for the moon to revolve once around the earth is about 29 days and is called a “lunar month.” 5. Half of the moon is always illuminated by the sun. Phases of the moon occur because a different portion of the lit half of the moon is visible from Earth each day as the moon revolves around the earth. 6. The changes in the moon’s phases occur in a regular and predictable sequence. At predictable periods during the lunar cycle, the moon is visible in either the daytime or the nighttime sky. 7. At the beginning of a lunar month, no lit part of the moon is visible 	<ol style="list-style-type: none"> 1. Explain the motion of the earth relative to the sun that causes Earth to experience cycles of day and night. 2. Construct models demonstrating Earth’s rotation on its axis, the moon’s revolution around the earth, and the earth and moon revolving around the sun. 3. Distinguish between the sun as a source of light and the moon as a reflection of that light. 4. Observe and record the moon’s appearance over time and analyze findings to describe the cyclical changes in its appearance from Earth (moon phases). 5. Relate the moon phases to changes in the moon’s position relative to the earth and sun during its 29-day revolution around the earth. 	<p>B22. Explain the cause of day and night based on the rotation of Earth on its axis.</p> <p>B23. Describe the monthly changes in the appearance of the moon, based on the moon’s orbit around the earth.</p>

	<p>from Earth (new moon). As the moon progresses through the first two quarters of its complete trip around the earth, larger portions of the right side of the moon are illuminated each day. When the moon has completed half its trip around the earth, the full moon is illuminated. During the third and fourth quarters of the moon's trip around the earth, the illuminated portion gradually decreases so only the left side is illuminated and finally no lit portion of the moon is visible from Earth again.</p> <p>8. Like the sun, the moon appears to rise at the eastern horizon and set at the western horizon due to the earth's rotation. From one day to the next, when observed at the same time from the same location, the moon's position in the sky varies in predictable ways.</p> <p>KEY CONCEPT WORDS: sphere, illuminate, reflect, rotate, day/night cycle (24-hour rotation period), horizon, orbit, revolve, month (one lunar cycle), moon phase, new moon</p>		
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Science and Technology in Society — How do science and technology affect the quality of our lives?

GRADE 5

5.4 — Humans have the capacity to build and use tools to advance the quality of their lives.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>5.4.a. Advances in technology allow individuals to acquire new information about the world.</p>	<ol style="list-style-type: none"> 1. People design optical tools (for example, binoculars, telescopes, eyeglasses or periscopes) that enable them to see things better or to see what cannot be seen by human eyes alone. Optical tools change the path of light by reflecting or refracting it. 2. Throughout history new optical technologies have led to new discoveries and understandings that change people’s lives. 3. Periscopes allow people to see things that are not within their line of sight (for example, around corners, over walls, under a table, or above the ocean’s surface from a submerged submarine). 4. Telescopes make distant objects appear larger (and therefore closer). 5. Magnifiers, such as hand lenses, microscopes or make-up mirrors, make objects appear larger. 6. The shape of a lens or mirror (concave, convex or flat) affects the direction in which light travels: <ol style="list-style-type: none"> a. Telescopes focus light using a lens that refracts the light (refracting telescope) or a curved mirror that reflects the light (reflecting telescope). b. Periscopes use flat mirrors to reflect light to change its path. c. Magnifying glasses use convex lenses to refract light so that objects appear larger. 7. Some human eyes do not focus light properly onto the retina. Eyeglasses are lenses that improve vision by changing the path of light (refracting it) so it forms an image on the retina. 	<ol style="list-style-type: none"> 1. Generalize that optical tools, such as binoculars, telescopes, eyeglasses or periscopes, change the path of light by reflecting or refracting it. 2. Construct simple periscopes and telescopes, and analyze how the placement of their lenses and mirrors affects the quality of the image formed. 3. Evaluate the best optical instrument to perform a given task. 4. Design and conduct simple investigations to determine how the shape of a lens or mirror (concave, convex, flat) affects the direction in which light rays travel. 5. Explain how eyeglasses or contact lenses improve vision by changing the path of light to the retina. 6. Analyze the similarities and differences between structures 	<p>B24. Compare and contrast the structures of the human eye with those of the camera.</p> <p>B25. Describe the uses of different instruments, such as eye glasses, magnifiers, periscopes and telescopes, to enhance our vision.</p>

8. Cameras have parts that function similarly to the human eye:

HUMAN	CAMERA	FUNCTION
Eyelid	Lens cap	Protect interior parts
Pupil	Lens opening	Allow light to enter
Cornea,	Lens	Focus light rays on a point
Retina	Film (or digital medium)	Respond to light resulting in an image

KEY CONCEPT WORDS: optical tool, hand lens, magnifying glass, telescope, periscope, lens, mirror, concave, convex, reflect, refract, focus, camera and eye parts (see chart above)

of the human eye and those of a simple camera.

Scientific knowledge is created and communicated through students' use of the following skills. All of the inquiry skills described below should be used by Grade 6-8 students as they learn the content described by each Content Standard on the pages that follow.

Grades 6-8 Core Scientific Inquiry, Literacy and Numeracy

How is scientific knowledge created and communicated?

Expected Performances

- C INQ.1** Identify questions that can be answered through scientific investigation.
- C INQ.2** Read, interpret and examine the credibility of scientific claims in different sources of information.
- C INQ.3** Design and conduct appropriate types of scientific investigations to answer different questions.
- C INQ.4** Identify independent and dependent variables, and those variables that are kept constant, when designing an experiment.
- C INQ.5** Use appropriate tools and techniques to make observations and gather data.
- C INQ.6** Use mathematical operations to analyze and interpret data.
- C INQ.7** Identify and present relationships between variables in appropriate graphs.
- C INQ.8** Draw conclusions and identify sources of error.
- C INQ.9** Provide explanations to investigated problems or questions.
- C INQ.10** Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.

Properties of Matter — How does the structure of matter affect the properties and uses of materials?

GRADE 6

6.1 — Materials can be classified as pure substances or mixtures, depending on their chemical and physical properties.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>6.1.a. Mixtures are made of combinations of elements and/or compounds, and they can be separated by using a variety of physical means.</p> <p>6.1.b. Pure substances can be either elements or compounds, and they cannot be broken down by physical means.</p>	<p>GRADE-LEVEL CONCEPT 6.1.a.</p> <ol style="list-style-type: none"> 1. Everything is made of matter. All matter has mass and takes up space (volume). Mass differs from weight in that it is unrelated to gravitational forces. 2. Characteristic properties of matter, such as magnetic attraction, conductivity, density, boiling point, melting point and solubility, can be used to identify substances. Characteristic properties do not vary with the amount of the substance. 3. Mixtures are combinations of substances in which each substance keeps its individual properties. In some mixtures, individual components can be seen (for example, rocks, twigs, insects and leaves are visible components of soil); in other mixtures, the individual substances blend so well that they appear to be a single substance (for example, oxygen, nitrogen and carbon dioxide are mixed together to form air). 4. Mixtures can be separated using different methods, depending on the physical properties of the component substances. Filtering, evaporating, distilling, floating/settling, dissolving, and using magnets are all methods for separating mixtures based on the properties of their components. 5. Solutions consist of solvents and solutes where the particles of the solute have dissolved and spread evenly throughout the solvent. The capacity of a solvent to hold solute is usually limited. 	<ol style="list-style-type: none"> 1. Distinguish between mass and density. 2. Explain that density is a ratio of mass to volume. Use density to identify elements or separate mixtures. 3. Demonstrate that different substances float or sink in water depending on their density. 4. Compare and contrast the properties of a metals, nonmetals and metalloids. 5. Differentiate between a mixture and an element or compound and identify examples. 6. Conduct and report on an investigation that uses physical means such particle size, density, solubility or 	<p>C1. Describe the properties of common elements, such as oxygen, hydrogen, carbon, iron and aluminum.</p> <p>C2. Describe how the properties of simple compounds, such as water and table salt, are different from the properties of the elements of which they are made.</p> <p>C3. Explain how mixtures can be</p>

	<p>GRADE-LEVEL CONCEPT 6.1.b.</p> <ol style="list-style-type: none"> All matter is made of pure substances called elements. Each element consists of tiny particles called atoms. The atoms of an individual element are similarly structured and have the same mass, while the atomic structure of every one of the elements is unique. The Periodic Table of Elements is used to organize the elements into groups or families that have similar properties. Element names are represented by letter symbols on the Periodic Table. Some elements, such as iron (“Fe”) and aluminum (“Al”), are classified as <i>metals</i> because they have similar properties. Most metals are solid, lustrous and good conductors of heat and electricity. Some elements, such as carbon (“C”), hydrogen (“H”), oxygen (“O”) and chlorine (“Cl”), are classified as <i>nonmetals</i>. Nonmetals can be solids, liquids or gases and are usually not conductors of heat or electricity. Carbon is a common nonmetal that occurs in several different forms (graphite, diamond, and coal), each of which has distinct properties. Hydrogen and oxygen are nonmetals that are similar in that they are both gases; however, each gas has distinct properties such as reactivity or flammability. Some elements, such as silicon or arsenic, are classified as <i>metalloids</i>. These elements have some properties of metals and some properties of nonmetals. Atoms can bond together to make a molecule of a new substance called a compound. A molecule is the smallest part of a compound and is made of atoms of different elements in specific amounts. Unlike mixtures, compounds cannot be separated into their component elements using physical methods. Compounds have different properties than the individual elements of which they are made. For example, table salt (NaCl) and water (H₂O) are compounds with different properties from the elements from which they are made. Chemical changes differ from physical changes in that atoms are rearranged to form new substances or compounds. Some common chemical reactions include rusting, burning, photosynthesis and the 	<p>magnetism to separate substances in a mixture.</p> <ol style="list-style-type: none"> Use the patterns in the Periodic Table to locate metals, metalloids and nonmetals and to predict the general characteristics of an element. Compare and contrast physical and chemical changes, and use evidence to support or refute a claim that a chemical reaction has occurred. 	<p>separated by using the properties of the substances from which they are made, such as particle size, density, solubility and boiling point.</p>
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	<p>reaction between vinegar and baking soda.</p> <p>9. In a chemical reaction, the same amount of matter (mass) is present at the start and the end.</p> <p>KEY CONCEPT WORDS: Characteristic property, mass, weight, volume, density, solubility, saturated solution, boiling point, melting point, homogeneous and heterogeneous mixtures, solution, solvent, solute, particle, atom, element, molecule, compound, metal, nonmetal, metalloid, physical change, chemical change.</p>		
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Matter and Energy in Ecosystems — How do matter and energy flow through ecosystems?

GRADE 6

6.2 — An ecosystem is composed of all the populations that are living in a certain space and the physical factors with which they interact.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>6.2.a. Populations in ecosystems are affected by biotic factors, such as other populations, and abiotic factors, such as soil and water supply.</p> <p>6.2.b. Populations in ecosystems can be categorized as producers, consumers and decomposers of organic matter.</p>	<p>GRADE-LEVEL CONCEPT 6.2.a.</p> <ol style="list-style-type: none"> 1. Ecosystems are complex interactions among living things and the features of the environment they inhabit. The environmental (abiotic) features of an environment determine the living (biotic) things that can survive there. Environmental features include things such as soil, minerals, climate, water, sunlight, and wind. 2. Interactions among biotic and abiotic factors support the flow of energy and cycling of materials such as oxygen, carbon dioxide and nitrogen in ecosystems. 3. Soil is a mixture of materials that includes weathered rocks and decomposed organic material, as well as air and water. Soils vary from place to place. The composition of soils affects how air and water move through the soil, and this influences the varieties of plants that can grow in it. 4. Water is a mixture of materials that includes dissolved oxygen and minerals as well as suspended sediments and debris. 5. The quality and quantity of soil and water in an ecosystem affect the numbers and variety of plants and animals. 6. Plants and animals within an ecosystem interact in various ways as they compete for limited resources (e.g., food, water, living space). Relationships among organisms can be beneficial or harmful to one or both organisms. 7. Populations of species within an ecosystem are affected by the availability and quality of resources such as food, water, living space, or mates. 	<ol style="list-style-type: none"> 1. Explain the interdependence between biotic and abiotic factors within a given ecosystem. 2. Design and conduct a scientific investigation to explore the porosity and permeability of soils and their ability to support different plant life. 3. Present an oral or written argument to support the claim that “The sun is the source of energy to support life on Earth.” 4. Investigate and report on the effects of abiotic factors on a plant’s ability to carry out photosynthesis. 5. Compare and contrast the energy transfers and matter 	<p>C4. Describe how abiotic factors, such as temperature, water and sunlight, affect the ability of plants to create their own food through photosynthesis.</p> <p>C5. Explain how populations are affected by predator-prey relationships.</p> <p>C6. Describe common food webs in different Connecticut ecosystems.</p>

	<p>8. Predator-prey relationships contribute to controlling populations in an ecosystem. Increases or decreases in prey populations result in corresponding increases or decreases in predator populations. A balanced population of predators and prey increases the variety of species (biodiversity) in an area.</p> <p>9. Populations can be reduced or increased by environmental changes caused by nature (e.g., droughts, forest fires or disease) and by humans (climate change, land development or overhunting).</p> <p>10. All organisms cause changes to the environment in which they live. Some of the changes caused by organisms can be helpful to the ecosystem and others can be harmful.</p> <p>GRADE-LEVEL CONCEPT 6.2.b.</p> <p>1. The sun is the main source of energy on Earth. During photosynthesis, green plants use the energy of sunlight to change the elements in carbon dioxide (CO₂) and water (H₂O) into materials (simple carbohydrates) that are a source of energy for the plant to carry on its life processes.</p> <p>2. Photosynthesis is affected by abiotic factors such as amount of sunlight, availability of water and air temperature.</p> <p>3. Green plants are the producers in an ecosystem; they rely directly on sunlight to produce the materials they use for energy.</p> <p>4. Plants are a source of energy (food) and nutrients for animals that consume them. Energy passed to consumers that eat plants came indirectly from the sun as a result of photosynthesis. Some animals consume plants, and other animals consume animals that eat plants in predator-prey relationships.</p> <p>5. Consumers are adapted for eating different foods: <i>herbivores</i> are consumers that eat only plants; <i>carnivores</i> are consumers that eat only animals; <i>omnivores</i> are consumers that eat both plants and animals.</p> <p>6. Decomposers (mainly bacteria and fungi) consume dead plants and animals and break down organic materials, returning nutrients to the environment for reuse by other organisms.</p> <p>7. Food chains are models that show how materials and energy are</p>	<p>cycling among producers, consumers and decomposers in varied Connecticut ecosystems.</p> <p>6. Create and interpret graphs that illustrate relationships between predator-prey populations over time.</p> <p>7. Evaluate the impacts of environmental changes caused by nature and by humans.</p>	
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	<p>transferred from producers to different levels of consumers in an ecosystem. The basis of every food chain is the energy stored in green plants.</p> <p>8. Food webs are models that show the complex variety of energy sources available to most consumers in an ecosystem.</p> <p>9. Connecticut has forest and park ecosystems, as well as fresh water and marine ecosystems that include a variety of plants and animals.</p> <p>10. An energy pyramid is a model that shows the availability and use of energy in an ecosystem. A large number of producers and primary consumers support a smaller number of higher-level consumers due to the consumption and loss of energy at each consumer level.</p> <p>KEY CONCEPT WORDS: ecosystem, interdependence, biodiversity, organism, population, biotic factor, abiotic factor, food chain, photosynthesis, producer, consumer, herbivore, carnivore, omnivore, food web, predator, prey</p>		
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Energy in the earth's systems — How do external and internal sources of energy affect the earth's systems?

GRADE 6

6.3 — Variations in the amount of the sun's energy hitting the earth's surface affects daily and seasonal weather patterns.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>6.3.a. Local and regional weather are affected by the amount of solar energy the area receives and proximity to a large body of water.</p>	<ol style="list-style-type: none"> 1. Earth is surrounded by layers of gases (atmosphere) that influence the environmental conditions on its surface. Earth's atmosphere (air) is a mixture of different amounts of gases (mainly nitrogen and oxygen, along with small amounts of carbon dioxide, water vapor and other gases). 2. Weather on Earth is caused by the daily changes in the temperature, pressure and amount of moisture in the lower atmosphere. 3. Climate is the long-term conditions experienced by different regions on earth, and is influenced by the amount of solar energy penetrating the atmosphere to reach Earth's surface. 4. The atmosphere allows solar energy to pass through it and reach Earth's surface. Carbon dioxide and water vapor in the atmosphere absorb some of the outgoing heat energy, preventing it from going back into space. 5. The molecules that make up all matter are in constant motion. Solids, liquids and gases differ in the movement and arrangements of their molecules. Molecules in gases move randomly and independently of one another. Molecules in liquids move around each other randomly, but are loosely held together by an attraction force. Molecules in solids are closely locked in a patterned position and can only vibrate back and forth. The closer the molecules, the greater their density. 6. When heat energy is added to a substance, its molecules move faster and spread apart from each other. When heat energy is removed, molecules move slower and come closer together. 7. Matter changes state (phase change) due to the absorption or release of heat energy. If enough heat energy is absorbed, the molecules of a solid 	<ol style="list-style-type: none"> 1. Compare the composition and functions of the earth's atmospheric layers. 2. Explain how changes in temperature, pressure, moisture and density of air create weather. 3. Describe differences between climate and weather. 4. Demonstrate the arrangement and motion of atoms or molecules in solids, liquids and gases. 5. Predict the phase change that will result from the absorption or release of heat energy by solids, liquids or gases. 6. Create models or diagrams that demonstrate how solar energy drives different phases of the water cycle. 7. Design, conduct and report in writing an investigation to compare the heat absorption and release rates of water and 	<p>C7. Describe the effect of heating on the movement of molecules in solids, liquids and gases.</p> <p>C8. Explain how local weather conditions are related to the temperature, pressure and water content of the atmosphere and the proximity to a large body of water.</p> <p>C9. Explain how the</p>

	<p>overcome the forces holding them together, move farther apart and change to a liquid state (melt); molecules of a liquid may change to a gas (vaporize). Conversely, if enough heat energy is released to the surroundings, then molecules of gases will move closer together and become liquid (condensation) or solid (freezing).</p> <p>8. Solar energy is absorbed by different surfaces on the earth and radiated back to warm the atmosphere. Land absorbs solar energy at a faster rate, and releases it at a faster rate, than water. Air temperature above the land or water depends on the amount of solar radiation absorbed.</p> <p>9. Air molecules constantly press on and around objects on Earth (air pressure). Due to the pull of Earth's gravity, air pressure close to Earth's surface is always greater than air higher in the atmosphere. Temperature of air molecules affects their density. Cool, dense air molecules sink and exert greater pressure on Earth; warm, less dense air molecules exert less pressure on Earth's surface and rise.</p> <p>10. Wind is caused by air moving from areas of high pressure to low pressure. Local winds result from air pressure differences caused by uneven heating of land and water. Near coastal areas, land and sea breezes change predictably during the day/night cycle due to temperature differences above land and water.</p> <p>11. Global winds are caused by the rising of warm equatorial air and the sinking of cold polar air.</p> <p>12. Water on Earth evaporates into the atmosphere (humidity) driven by energy from the sun. Higher temperature causes more evaporation. Clouds form when warm, moist air evaporates, rises and cools, causing its molecules to condense onto tiny dust particles suspended in the air. Different cloud formations are associated with different weather.</p> <p>13. Weather on Earth is caused by daily variations in the temperature, pressure and humidity of different bodies of air (air masses). Decreasing air pressure usually indicates that cloudy, wet weather is approaching. Increasing air pressure usually indicates that clear, dry weather is approaching.</p> <p>14. Areas of warm air meet areas of cold air at a "front." Precipitation generally results where a cold and a warm air mass meet. Areas of cold air move under areas of warm air, forcing the warm air to rise, cool and</p>	<p>earth materials.</p> <p>8. Compare and contrast conditions that cause local sea breezes/land breezes and global wind patterns.</p> <p>9. Predict the type of weather that may result given certain cloud types, warm and cold fronts and air pressure.</p> <p>10. Explain the causes of temperature differences between coastal and inland areas.</p>	<p>uneven heating of the earth's surface causes winds and affects the seasons.</p>
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	<p>condense to form clouds; areas of warm air move above areas of cold air, causing warm air to rise, cool and condense to form clouds.</p> <p>15. Connecticut weather is influenced by its closeness to the Atlantic Ocean and Long Island Sound. Water temperature causes coastal temperatures to be cooler in summer and warmer in winter than temperatures inland.</p> <p>16. Connecticut often has rapidly changing weather because three patterns of moving air interact here: cold, dry air from the north, warm, moist air from the Atlantic Ocean coastline, and air moving across the US from west to east.</p> <p>KEY CONCEPT WORDS: molecule, dense, solid, liquid, gas, phase change, condense, evaporate, air pressure, humidity, air mass, cold/warm front, precipitation, global wind, sea breeze, land breeze</p>		
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Science and Technology in Society — How do science and technology affect the quality of our lives?

GRADE 6

6.4 — Water moving across and through earth materials carries with it the products of human activities.

This content standard is an application of the concepts in content standard 6.2 and should be integrated into the same learning unit.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>6.4.a Most precipitation that falls on Connecticut eventually reaches Long Island Sound.</p>	<ol style="list-style-type: none"> 1. Water is essential for life and is a distinguishing feature of Earth among the planets in our solar system. Humans and other organisms use water in various ways. 2. The surface of Earth is largely covered with water, most of which is saltwater found in oceans. Only freshwater is drinkable, and it is found on the land (surface water), beneath the ground (groundwater), and frozen in glaciers. 3. Water is a universal solvent that dissolves and carries many substances through the environment (for example, acid rain, calcium, carbon dioxide, oxygen, salt, metals, etc.). Many substances that are dissolved in water may be either harmful (pollutants) or beneficial to organisms (minerals, oxygen, nutrients). Water temperature affects its ability to dissolve substances such as oxygen and salt. 4. Some water that falls to Earth as precipitation soaks into the ground, some evaporates almost immediately, and some moves across earth's surfaces filling streams, rivers and reservoirs. Factors affecting whether water seeps into the ground include the amount of rainfall, the length of time it falls, the permeability of the ground surface and subsurface, the saturation of the soil, and the steepness (slope) of the land. 5. Water moving beneath the earth's surface is influenced by size of and spaces between the particles in rock and soils. 6. Water moving across the earth's surface is affected by the shape and slope of the land and the properties of the surface materials it encounters. 	<ol style="list-style-type: none"> 1. Discuss and chart the reasons why water is essential for life. 2. Observe, analyze and record the unique physical and chemical properties of water. 3. Research the differences in quantities between fresh water (solid and liquid) and salt water covering the earth's surface and report on the impact to humans. 4. Investigate and explain in writing how substances, both harmful and beneficial, dissolve in and are carried by surface and ground water. 5. Use appropriate maps to locate and identify the major watersheds that drain into Long Island Sound and analyze how the topography influences the way water moves in the Long Island 	<p>C10. Explain the role of septic and sewage systems on the quality of surface and ground water.</p> <p>C11. Explain how human activity may impact water resources in Connecticut, such as ponds, rivers and the Long Island Sound ecosystem.</p>

	<p>The area draining into a river system or other body of water is a watershed. Folds and faults in Connecticut’s landform cause water to move generally from north to south, eventually draining into Long Island Sound.</p> <ol style="list-style-type: none"> 7. Water moving through a watershed picks up, suspends or dissolves various substances produced by nature and by human activities. The quality and usability of water depend on what materials have been picked up, carried and concentrated in the water. 8. Water quality is important to support a variety of aquatic life and for human consumption. Water quality is evaluated by measuring indicators such as levels of dissolved oxygen, pH, turbidity and the presence of other dissolved substances. Substances such as heavy metals (e.g., lead and aluminum), sulfur, fertilizers, and road salt are pollutants that may be dissolved in surface water or ground water, making the water unhealthy. 9. Water entering Long Island Sound carries with it the products of human use. These pollutants negatively impact the aquatic life, commercial and recreational uses of the Sound. 10. Point source pollution, such as untreated sewage, industrial or recreational waste, can be discharged directly into the Sound if it is not regulated and controlled. 11. Nonpoint source pollution is difficult to trace or control because it originates across the large watershed area that drains into Long Island Sound. A major contaminant reaching Long Island Sound by way of watersheds is nitrogen. 12. Drinking water may come from groundwater sources accessed by drilling wells, or from surface water reservoirs. 13. People’s use of water adds waste products and harmful materials to the water which must be removed before returning the water to the environment. Wastewater can be purified using various physical, biological and chemical processes. 14. Septic systems use settling and bacterial digestion to break down wastes in a holding tank; then the water is further purified as it is spread across 	<p>Sound watershed.</p> <ol style="list-style-type: none"> 6. Research and evaluate in writing the effects of common point and nonpoint water pollutants in Connecticut. 7. Compare and contrast the general structures, processes and limitations of a septic system to a secondary wastewater treatment plant. 8. Debate the effectiveness of a law designed to protect water resources. 	
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	<p>a leaching field and percolates through layers of soil.</p> <p>15. Sewage treatment facilities are required in densely populated areas. Sewage treatment facilities use multiple filtration, biological and chemical methods to purify water before returning the water to the environment.</p> <p>16. Laws, regulations and remedial actions have helped to protect and restore water resources.</p> <p>KEY CONCEPT WORDS: surface water, ground water, fresh water, salt water, pollutant, watershed, point source pollution, nonpoint source pollution, well, septic system, wastewater</p>		
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Energy Transfer and Transformations — What is the role of energy in our world?

GRADE 7

7.1 — Energy provides the ability to do work and can exist in many forms.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>7.1.a. Work is the process of making objects move through the application of force.</p> <p>7.1.b. Energy can be stored in many forms and can be transformed into the energy of motion.</p>	<p>GRADE-LEVEL CONCEPT 7.1.a.</p> <ol style="list-style-type: none"> In order for an object to change its motion, a push/pull (force) must be applied over a distance. Work is a scientific concept that expresses the mathematical relationship between the amount of force needed to move an object and how far it moves. For work to be done, a force must be applied for a distance in the same direction as the motion. An object that does not move has no work done on it, even if forces are being applied. Work (measured in joules) is calculated by multiplying the force (measured in newtons) times the distance (measured in meters). When an object is lifted, the work done is the product of the force of gravity (weight) times the height the object is lifted. The amount of work done is increased if more force is applied or if the object is moved a greater distance. Simple machines can be used to do work. People do “input” work on a simple machine which, in turn, does “output” work in moving an object. Simple machines are not used to change the amount of work to move or lift an object; rather, simple machines change the amount of effort force and distance for the simple machine to move the object. Simple machines work on the principle that a small force applied over a long distance is equivalent work to a large force applied over a short distance. Some simple machines are used to move or lift an object over a greater output distance (snow shovel), or change direction of an object’s motion, 	<ol style="list-style-type: none"> Calculate work done on an object as force or distance varies. Explain in writing how the six simple machines make work easier but do not alter the amount of work done on an object. Determine ways to modify a simple machine (inclined plane, pulley and lever) to improve its mechanical advantage. Defend the statement, “Work output of a machine is always less than work input because of energy lost due to friction.” Design and create a working compound machine from several simple machines. Use a diagram or model of a moving object (roller coaster, pendulum, etc.) to describe the conversion of potential energy into kinetic energy and vice 	<p>C12. Explain the relationship among, force, distance and work, and use the relationship ($W = F \times D$) to calculate work done in lifting heavy objects.</p> <p>C13. Explain how simple machines, such as inclined planes, pulleys and levers, are used to create mechanical advantage.</p> <p>C14. Describe how different types of stored (potential)</p>

	<p>but most are used to reduce the amount of effort (input force) required to lift or move an object (output force).</p> <ol style="list-style-type: none"> 7. An inclined plane is a simple machine that reduces the effort force needed to raise an object to a given height. The effort force and distance and output force and distance depend on the length and height (steepness) of the inclined plane. 8. A pulley is a simple machine that reduces the effort force needed to lift a heavy object by applying the force through a greater distance (pulling more rope through the pulley). The effort force and distance, output force and distance, and direction of motion all depend on the number of pulleys and their position. 9. A lever is a simple machine that reduces the effort force needed to lift a heavy object by applying the force at a greater distance from the fulcrum of the lever. The effort force and distance, output force and distance, and direction of motion all depend on the position of the fulcrum in relationship to the input and output forces. 10. The mechanical advantage of a simple machine indicates how useful the machine is for performing a given task by comparing the output force to the input force. The mechanical advantage is the number of times a machine multiplies the effort force. The longer the distance over which the effort force is applied, the greater the mechanical advantage of the machine. 11. The mechanical advantage of a machine can be calculated by dividing the resistance force by the effort force. Usually, the resistance force is the weight of the object in newtons. 12. Simple machines always produce less work output than work put in because some motion energy is converted to heat and sound energy by friction. <p>GRADE-LEVEL CONCEPT 7.1.b.</p> <ol style="list-style-type: none"> 1. Energy is indirectly observed as the ability to exert pulls or pushes. 2. Potential energy is the capacity for doing work that a body possesses because of its position or condition. It is evident as gravitational 	<p>versa.</p> <ol style="list-style-type: none"> 7. Discuss different forms of energy and describe how they can be converted from one form to another for use by humans (e.g., thermal, electrical, light, chemical, mechanical). 8. Trace energy conversions that occur in the human body. 9. Calculate potential and kinetic energy and relate those quantities to total energy in a system. 	<p>energy can be used to make objects move.</p>
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	<p>potential energy (an object about to roll down a hill), elastic potential energy (a stretched rubber band) or chemical potential energy (carbohydrates in foods).</p> <ol style="list-style-type: none"> 3. Kinetic energy is energy a body possesses because it is in motion. 4. Energy can be changed (transformed) from one form to another. For example, potential chemical energy of foods, which is often measured in calories, is transformed by cells into heat, electrical and kinetic energy used in the body. 5. When energy is transformed, the total amount of energy stays constant (is conserved). 6. Work is done to lift an object, giving it gravitational potential energy (weight x height). The gravitational potential energy of an object moving down a hill is transformed into kinetic energy as it moves, reaching maximum kinetic energy at the bottom of the hill. 7. Some kinetic energy is always transformed into heat by friction; therefore, the object will never reach the same height it started from again without added energy. <p>KEY CONCEPT WORDS: force, friction, gravity, weight, newton, scale, work, joule, effort (input) force, output force, simple machine, lever, fulcrum, pulley, inclined plane, mechanical advantage, energy, potential energy, kinetic energy, energy transformation, conservation of energy</p>		
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Structure and Function — How are organisms structured to ensure efficiency and survival?

GRADE 7

7.2 — Many organisms, including humans, have specialized organ systems that interact with each other to maintain dynamic internal balance.

<p>Core Science Curriculum Framework</p>	<p align="center">Grade-Level Concepts <i>Students should understand that...</i></p>	<p align="center">Grade-Level Expectations <i>Students should be able to...</i></p>	<p align="center">CMT Expected Performances</p>
<p>7.2.a. All organisms are composed of one or more cells; each cell carries on life-sustaining functions.</p> <p>7.2.b. Multicellular organisms need specialized structures and systems to perform basic life functions.</p>	<p>GRADE-LEVEL CONCEPT 7.2.a.</p> <ol style="list-style-type: none"> 1. Living things have characteristics that distinguish them from nonliving things. Living things use energy, respond to their environment, grow and develop, produce waste and reproduce. 2. Organisms are made of tiny cells that perform the basic life functions and keep the organism alive. Many organisms (for example yeast, algae) are single-celled, and many organisms (for example plants, fungi and animals) are made of millions of cells that work in coordination. 3. All cells come from other cells and they hold the genetic information needed for cell division and growth. When a body cell reaches a certain size, it divides into two cells, each of which contains identical genetic information. This cell division process is called mitosis. 4. The cell is filled with a fluid called <i>cytoplasm</i>; cells contain discrete membrane-enclosed structures called <i>organelles</i> that perform specific functions that support the life of the organism. The structure of the organelle is related to its function. <ul style="list-style-type: none"> ▪ The nucleus contains the genetic materials (chromosomes), and it directs the cell activities, growth and division. ▪ The mitochondrion contains enzymes that break down sugars and release chemical energy. One cell can contain hundreds of mitochondria. ▪ The entire cell is surrounded by the plasma membrane that 	<ol style="list-style-type: none"> 1. Compare and contrast living organisms that are single celled with multicellular organisms. 2. Illustrate and describe in writing the structure and the function of the cell membrane, cytoplasm, mitochondria and nucleus in an animal cell. 3. Explain how the structure and function of multicellular organisms (animals) is dependent on the interaction of cells, tissues, organs and organ systems. 4. Investigate and explain in writing the basic structure and function of the human skeletal system. 5. Differentiate between the structures and range of motion associated with ball, socket and hinge joints and relate human joints to simple 	<p>C15. Describe the basic structures of an animal cell, including the nucleus, cytoplasm, mitochondria and cell membrane, and how they function to support life.</p> <p>C16. Describe the structures of the human digestive, respiratory and circulatory systems and explain how they function to bring oxygen and nutrients to the cells and</p>

	<p>controls the flow of materials into and out of the cell.</p> <p>GRADE-LEVEL CONCEPT 7.2.b.</p> <ol style="list-style-type: none"> 1. Systems consist of parts that interact with and influence each other. Parts of a system work together to make the whole entity work. Similarly, each part of an animal body has a specific job to do, and all the different parts work together to support life. 2. Although all cells have similar basic structures, in multicellular organisms cells have specialized shapes that enable them to perform specific roles (for example, muscle, nerve, and skin cells can be identified by their distinct shapes). 3. Groups of similar cells are organized in tissues that have specific functions (for example, providing support, connecting parts, carrying messages, protecting internal and external surfaces). 4. Different tissues work together to form an organ, and organs work together as organ systems to perform essential life functions. 5. The human skeletal system includes bones joined together by ligaments. The skeletal system functions to shape and support the body, protect internal organs, enable movement, form blood cells, and store minerals such as calcium and phosphorous. 6. Joints are places where two bones come together and body movement can occur. The structure of a joint (for example, ball and socket, hinge or pivot) determines the kind of movement possible at that point. 7. The human muscular system includes skeletal, smooth and cardiac muscles. The skeletal muscles are attached to bones by tendons and they are responsible for the movement of the body. The cardiac muscle is responsible for the pumping action of the heart and the smooth muscles are related to the movement of the internal organs. 8. The muscular and skeletal systems interact to support the body and allow movement. 9. The major parts of the human respiratory system are the nose, trachea, bronchi and lungs. This system is responsible for breathing and exchange of gases between the body and its surroundings. 	<p>machines.</p> <ol style="list-style-type: none"> 6. Demonstrate how the muscles, tendons, ligaments and bones interact to support the human body and allow movement. 7. Label the major parts of the human respiratory system and explain in writing the function of each part (nasal cavity, trachea, bronchi, lungs and diaphragm). 8. Label the major parts of the human circulatory system and explain in writing the function of each part (heart, veins, arteries and capillaries). 9. Design and conduct controlled variable experiments to analyze the interaction between the circulatory and respiratory systems as the demand for oxygen changes. 10. Label the major parts of the human digestive system and explain in writing the function of each part in the chemical and physical breakdown of food (mouth, esophagus, stomach, small intestine, large intestine and rectum). 	<p>expel waste materials.</p> <p>C17. Explain how the human musculoskeletal system supports the body and allows movement.</p>
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	<p>10. The major parts of the human circulatory system are the heart, arteries, veins and capillaries. The right side of the heart pumps blood to the lungs for gas exchange; the left side of the heart pumps the oxygenated blood around the body.</p> <p>11. The blood is made of plasma, red and white blood cells, and platelets. Its main role is to carry small food molecules and respiratory gases (oxygen and carbon dioxide) to and from cells. Blood cells are also responsible for destroying invading particles, preventing diseases, and stopping bleeding after injuries.</p> <p>12. The respiratory and circulatory systems work together to provide all cells with oxygen and nutrients. When the body's need for oxygen changes, the circulatory and respiratory systems respond by increasing or decreasing breathing and heart rates. These changes can be measured by counting breaths, heartbeats or pulses per minute.</p> <p>13. The major parts of the human digestive system are the mouth, esophagus, stomach, small intestine and large intestine. This system is responsible for breaking down food, absorbing nutrients and water, and eliminating waste. The liver and pancreas support the functions of the major digestive organs by producing and releasing digestive liquids into the digestive tract.</p> <p>14. The nervous, immune and excretory systems interact with the digestive, respiratory and circulatory systems to maintain the body's dynamic internal balance (homeostasis).</p> <p>KEY CONCEPT WORDS: structure, function, cell, mitosis, organelle, cytoplasm, nucleus, cell membrane, mitochondrion, tissue, organ, system</p>		
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Energy in the earth's systems — How do external and internal sources of energy affect the earth's systems?

GRADE 7

7.3 — Landforms are the result of the interaction of constructive and destructive forces over time.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>7.3.a. Volcanic activity and the folding and faulting of rock layers during the shifting of the earth's crust affect the formation of mountains, ridges and valleys.</p> <p>7.3.b. Glaciation, weathering and erosion change the earth's surface by moving earth materials from place to place.</p>	<p>GRADE-LEVEL CONCEPT 7.3.a.</p> <ol style="list-style-type: none"> 1. Earth's surface features, such as mountains, volcanoes and continents, are the constantly changing result of dynamic processes and forces at work inside the earth. 2. The solid Earth has a core, mantle and crust, each with distinct properties. 3. Earth's crust is broken into different "tectonic plates" that float on molten rock and move very slowly. Continental drift is driven by convection currents in the hot liquid mantle beneath the crust. 4. The presence of plant and animal fossils of the same age found around different continent shores, along with the matching coastline shapes of continental land masses, provides evidence that the continents were once joined. 5. Tectonic plates meet and interact at divergent, convergent or transform boundaries. The way in which the plates interact at a boundary affects outcomes such as folding, faulting, uplift or earthquakes. 6. The folding and faulting of rock layers during the shifting of the earth's crust causes the constructive formation of mountains, ridges and valleys. 7. Mountain formation can be the result of convergent tectonic plates colliding, such as the Appalachians and the Himalayas; mountains may also be formed as a result of divergent tectonic plates moving apart and causing rifting as in East Africa or Connecticut. 8. Most volcanoes and earthquakes are located at tectonic plate boundaries 	<ol style="list-style-type: none"> 1. Illustrate and describe in writing the composition of the three major layers of the earth's interior. 2. Explain how Earth's internal energy is transferred to move tectonic plates. 3. Demonstrate the processes of folding and faulting of the earth's crust. 4. Correlate common geological features/events (deep sea trenches, mountains, earthquakes, volcanoes) with the location of plate boundaries. 5. Examine and compare geological features that result from constructive forces shaping the surface of the earth over time (e.g., mountains, ridges, volcanoes) with geological features that result from destructive forces shaping the surface of the 	<p>C18. Describe how folded and faulted rock layers provide evidence of gradual up and down motion of the earth's crust.</p> <p>C19. Explain how glaciation, weathering and erosion create and shape valleys and floodplains.</p> <p>C20. Explain how the boundaries of tectonic plates can be inferred from the location of</p>

	<p>where plates come together or move apart from each other. A geographic plot of the location of volcanoes and the centers of earthquakes allows us to locate tectonic plate boundaries.</p> <p>9. The geological makeup of Connecticut shows evidence of various earth processes, such as continental collisions, rifting, and folding that have shaped its structure</p> <p>GRADE-LEVEL CONCEPT 7.3.b.</p> <ol style="list-style-type: none"> 1. Earth’s surface is constantly being shaped and reshaped by natural processes. Some of these processes, like earthquakes and volcanic eruptions, produce dramatic and rapid change. Others, like weathering and erosion, usually work less conspicuously over longer periods of time. 2. Glaciers form in areas where annual snowfall is greater than the seasonal melt, resulting in a gradual build-up of snow and ice from one season to the next. 3. Glaciers increase and decrease in size over long periods of time, depending on variations in Earth’s climate. 4. Glaciers move slowly, spreading outward across a region or moving down a slope. 5. Moving glaciers reshape the land beneath them by scraping, carving, transporting and depositing soil and rock. 6. Glacial landforms have identifiable shapes. Connecticut’s landscape provides many examples of glacial movement and deposition. 7. Weathering and erosion work together as destructive natural forces. Both are forces that break down rock into small particles called sediments. 8. Weathering is caused by physical, chemical or biological means. Rock properties, such as hardness, porosity or mineral content, influence susceptibility to weathering. 9. Erosion loosens and transports sediment formed by weathering. Moving water and wind cause changes to existing landforms and create new 	<p>earth over time.</p> <ol style="list-style-type: none"> 6. Analyze and interpret data about the location, frequency and intensity of earthquakes. 7. Compare and contrast the major agents of erosion and deposition of sediments: running water, moving ice, wave action, wind and mass movement due to gravity. 8. Investigate and determine how glaciers form and affect the earth’s surface as they change over time. 9. Distinguish between weathering and erosion. 10. Observe and report on the geological events that are responsible for having shaped Connecticut’s landscape. 	<p>earthquakes and volcanoes.</p>
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	<p>landforms such as valleys, floodplains, plateaus, canyons, caves or dunes.</p> <p>KEY CONCEPT WORDS: erosion, weathering, glacier, valley, floodplain, core, mantle, folds, fault/fault line, continent, tectonic plate, plate boundary, convection, mountains, volcano, earthquake</p>		
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Science and Technology in Society — How do science and technology affect the quality of our lives?

GRADE 7

7.4 — Technology allows us to improve food production and preservation, thus improving our ability to meet the nutritional needs of growing populations.

This content standard is an application of the concepts in content standard 7.2 and should be integrated into the same learning unit.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>7.4.a. Various microbes compete with humans for the same sources of food.</p>	<p>GRADE-LEVEL CONCEPT 7.4.a.</p> <ol style="list-style-type: none"> 1. Microorganisms (microbes) are microscopic organisms, such as bacteria, yeast and mold, that are found almost everywhere: in air, soil and water, inside our bodies and in our foods. 2. Bacteria are single-celled organisms that differ from other single-celled organisms in that they do not have organelles such as a nucleus, mitochondrion or chloroplast. 3. Bacteria are an essential component of any food web because they break down complex organic matter into simple materials used by plants. Some bacteria can produce their own food through photosynthesis and others are consumers that compete for foods that humans eat. 4. Some bacteria can be beneficial to humans. Certain bacteria live symbiotically in the digestive tracts of animals (including humans) and help break down food. Other bacteria are used by humans to purify waste water and to produce foods such as cheese and yogurt. 5. Some bacteria are harmful to humans. They can spoil food, contaminate water supplies and cause infections and illness. 6. Food preservation methods create conditions that kill bacteria or inhibit their growth by interfering with the bacterium’s life processes. Food preservation methods include removing moisture by dehydration or salting, removing oxygen by vacuum-packing, lowering pH by pickling, lowering temperature by refrigerating or freezing, and destroying the 	<ol style="list-style-type: none"> 1. Investigate and describe in writing different types of microbes and the environmental conditions necessary for their survival. 2. Describe the optimum conditions for rapid bacterial growth. 3. Illustrate and describe the structural differences between bacterial and animal cells. 4. Discover and discuss how humans use bacteria to produce food and identify examples. 5. Compare and contrast the role of bacteria in food production and food spoilage. 6. Evaluate and report how each method of food preservation including dehydration, pickling, irradiation and refrigeration works to stop or 	<p>C21. Describe how freezing, dehydration, pickling and irradiation prevent food spoilage caused by microbes.</p>

	<p>bacterial cells by irradiation or heat (pasteurizing and cooking).</p> <p>7. Throughout history, humans have developed different methods to ensure the availability of safe food and water to people around the world.</p> <p>KEY CONCEPT WORDS: microbe, bacteria, single-celled organism, dehydration, pickling, irradiation</p>	<p>inhibit bacterial growth and give examples of each.</p>	
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Force and Motion — What makes objects move the way they do?

GRADE 8

8.1 — An object’s inertia causes it to continue to move the way it is moving unless it is acted upon by a force.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>8.1.a. The motion of an object can be described by its position, direction of motion and speed.</p> <p>8.1.b. An unbalanced force acting on an object changes its speed and/or direction of motion.</p> <p>8.1.c. Objects moving in circles must experience force acting toward the center.</p>	<p>GRADE-LEVEL CONCEPT 8.1.a.</p> <ol style="list-style-type: none"> 1. An object is said to be in motion when its position changes in relation to a point of reference. An object’s motion can be described and represented graphically according to its position, direction of motion, and speed. 2. Speed describes the change in an object’s position over a period of time, and is measured in units such as meters per second or miles per hour. Velocity takes into account an object’s speed and the direction of its motion. 3. Average speed takes into account the different speeds at which an object moves over a period of time. Average speed is calculated by dividing the total distance traveled by the change in time, regardless of any changes in motion or direction during its travel. 4. Motion of objects can be represented on a distance vs. time line graph, with distance traveled as the vertical (“y”) axis and time as the horizontal (“x”) axis. The slope (steepness) at any point of this line depends on the instantaneous speed of the moving object. A straight horizontal line indicates an object at rest. <p>GRADE-LEVEL CONCEPT 8.1.b.</p> <ol style="list-style-type: none"> 1. For an object’s motion to change, a force must be applied over a distance. The change in motion due to this force is acceleration. Acceleration describes the change in an object’s velocity over time. 2. Forces can act between objects that are in direct contact, or they can act 	<ol style="list-style-type: none"> 1. Demonstrate how forces, including friction, act upon an object to change its position over time in relation to a fixed point of reference. 2. Calculate the average speed of an object and distinguish between instantaneous speed and average speed of an object. 3. Create and interpret distance-time graphs for objects moving at constant and nonconstant speeds. 4. Predict the motion of an object given the magnitude and direction of forces acting upon it (net force). 5. Investigate and demonstrate how unbalanced forces cause acceleration (change in speed and/or direction of an object’s motion). 6. Assess in writing the relationship between an 	<p>C22. Calculate the average speed of a moving object and illustrate the motion of objects in graphs of distance over time.</p> <p>C23. Describe the qualitative relationships among force, mass and changes in motion.</p> <p>C24. Describe the forces acting on an object moving in a circular path.</p>

	<p>over a distance. There are forces of attraction and forces of repulsion. Forces are measured in newtons or pounds using scales or other instruments.</p> <ol style="list-style-type: none"> 3. Forces act simultaneously on an object from all directions with different strengths (magnitudes). The net force is the single resultant force when all the forces acting on an object are added together. If the net force is zero (forces are balanced), then the object will not accelerate. Objects accelerate due to an unbalanced net force. Balanced forces keep an object moving with the same velocity, including remaining at rest. 4. There is a proportional relationship between the mass of an object and the magnitude of the force needed to change its velocity. If a net force is applied to objects of different masses, then the object with the larger mass will have a smaller change in velocity. 5. The net force acting on an object can be determined by measuring its mass and change in velocity. <p>GRADE-LEVEL CONCEPT 8.1.c (<i>see Standard 8.3</i>)</p> <ol style="list-style-type: none"> 1. Circular motion results when a net unbalanced force is constant in magnitude and always points toward the center of a circle. 2. Without a net center-pulling (centripetal) force, objects will continue to move in a straight line in a constant direction. 3. Objects in orbit around a larger body maintain their orbits due to the center-pulling gravitational pull of the larger body. <p>KEY CONCEPT WORDS: motion, point of reference, speed, constant speed, average speed, position-time graph, slope, force, friction, gravity, inertia, mass, acceleration, balanced/unbalanced forces, net force, circular motion</p>	<p>object's mass and its inertia when at rest and in motion.</p> <ol style="list-style-type: none"> 7. Express mathematically how the mass of an object and the force acting on it affect its acceleration. 8. Design and conduct an experiment to determine how gravity and friction (air resistance) affect a falling object. 9. Illustrate how the circular motion of an object is caused by a center seeking force (centripetal force) resulting in the object's constant acceleration. 	
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Heredity and Evolution — What processes are responsible for life’s unity and diversity?

GRADE 8

8.2 — Reproduction is a characteristic of living systems and it is essential for the continuation of every species.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>8.2.a. Heredity is the passage of genetic information from one generation to another.</p> <p>8.2.b. Some of the characteristics of an organism are inherited and some result from interactions with the environment.</p>	<p>GRADE-LEVEL CONCEPT 8.2.a.</p> <ol style="list-style-type: none"> 1. Living organisms must reproduce to continue the existence of their species. Through reproduction new individuals that resemble their parents are formed. All the organisms alive today arose from preexisting organisms. 2. All the cells in a multicellular organism result from a single fertilized egg cell, through a process of continuous cell divisions (mitosis). Instructions for how an organism develops are stored in DNA molecules, which are part of the chromosomes inside the cell nucleus. 3. The chromosomes occur in matching pairs, and each cell in a multicellular organism contains the number of chromosomes that are typical of that species. For example, cells in human beings contain 23 pairs of chromosomes. 4. Organisms grow by increasing the number of body cells. During <i>mitosis</i>, a body cell first duplicates the chromosomes and then divides into two identical daughter cells, each one with a complete set of chromosomes. 5. Most multicellular organisms reproduce by <i>sexual</i> reproduction, in which new cells are produced by the combination of two germ cells (gametes). During <i>meiosis</i>, matching chromosomes in each pair separate from each other so that each germ cell contains only half of the chromosomes of the original cell. 6. Mitosis and meiosis are similar processes in that they both result in the separation of existing cells into new ones. They differ in that the germ 	<ol style="list-style-type: none"> 1. Relate the continued existence of any species to its successful reproduction and explain in writing the factors that contribute to successful reproduction. 2. Describe the structure, location and function of chromosomes, genes and DNA and how they relate to each other in the living cell. 3. Illustrate and chart the purpose, cell type (somatic and germ) and resulting chromosome count during cell division in mitosis and meiosis. 4. Identify the major structures in human male and female reproductive systems and explain where meiosis and gamete formation take place. 5. Investigate and report on the role of hormone production as it initiates and regulates the creation of male and female 	<p>C25. Explain the differences in cell division in somatic and germ cells.</p> <p>C26. Describe the structure and function of the male and female human reproductive systems, including the process of egg and sperm development.</p> <p>C27. Describe how genetic information is organized in genes on chromosomes, and explain sex</p>

	<p>cells produced during meiosis have only one copy of each chromosome. When two germ cells unite during fertilization, the resulting zygote has two copies of each chromosome, one from each parent, ensuring maternal and paternal genetic contribution.</p> <p>7. Meiosis and gamete formation take place in the reproductive organs; <i>testes</i> in males produce the sperm and <i>ovaries</i> in females produce the eggs.</p> <p>8. In humans, the reproductive organs are in place at birth, but are readied to perform their reproductive functions by hormones released during adolescence. Males produce millions of sperm over the course of their adult life. Females are born with a finite number of immature eggs in the ovaries that are released one at a time in a monthly cycle.</p> <p>9. In humans, if an egg is fertilized by a sperm in the female’s fallopian tube, the resulting <i>zygote</i> may develop into a fetus in the female uterus. If the egg is not fertilized, it will leave the female’s body in a monthly discharge of the uterine lining (menstrual cycle).</p> <p>10. A segment of DNA that holds the information for a specific trait is called a gene. Each chromosome in a pair carries the same genes in the same place, but there are different versions of each gene.</p> <p>11. In sexual reproduction, offspring of the same parents will have different combinations of genes and traits, creating genetic variability within the species. Sexual reproduction is the basis for the evolution of living organisms.</p> <p>GRADE-LEVEL CONCEPT 8.2.b.</p> <p>1. Gender in humans is a trait determined by genes carried by a special pair of chromosomes identified as “X” and “Y”. Female gametes have only an “X” chromosome; male gametes can have either an “X” or a “Y”. The sperm that fertilizes the egg determines the sex of the offspring: a zygote containing two X chromosomes will develop into a female and a zygote containing X and Y chromosomes will develop into a male.</p> <p>2. Most human traits are inherited from parents, but some are the result of environmental conditions. For example, eating and exercising habits may affect the body mass and shape of individuals in the same family.</p>	<p>germ cells from birth through adolescence and into adulthood.</p> <p>6. Compare and contrast the events and processes that occur when a human egg is fertilized or not fertilized.</p> <p>7. Demonstrate the relationship of corresponding genes on pairs of chromosomes to traits inherited by offspring.</p> <p>8. Describe in writing the role of the germ cells in the formation of the human zygote and its resulting 23 pairs of chromosomes, the 23rd of which determines gender and the other 22 of which determine the characteristics of that offspring.</p>	<p>determination in humans.</p>
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	<p>KEY CONCEPT WORDS: multicellular organism, heredity, trait, chromosome, gene, DNA, species, mitosis, meiosis, gamete, adolescence, hormone, testes, sperm, ovary, egg, fallopian tube, uterus</p>		
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Earth in the Solar System — How does the position of Earth in the solar system affect conditions on our planet?

GRADE 8

8.3 — The solar system is composed of planets and other objects that orbit the sun.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>8.3.a. Gravity is the force that governs the motions of objects in the solar system.</p> <p>8.3.b. The motion of the earth and moon relative to the sun causes daily, monthly and yearly cycles on the earth.</p>	<p>GRADE-LEVEL CONCEPT 8.3.a.</p> <ol style="list-style-type: none"> 1. Earth is part of a system of celestial bodies that are grouped together around a central star, the Sun. This system includes objects of different masses and composition such as planets, moons, asteroids, minor planets, and comets. These objects move in predictable paths determined by gravity. 2. Gravity is a force of attraction between two objects. The strength of gravitational force depends on the total mass of the two objects and the distance between them. The greater the total mass, the greater the force of gravity. The greater the distance between two objects, the less the force of gravity. 3. The difference between an object’s mass and its weight is explained by gravity. Mass is the measure of the amount of matter in an object; weight is the force of gravity between an object and the celestial body it is on. Bodies in the solar system have different masses; therefore the same object has a different weight on each celestial body. 4. Objects in the solar system are held in their predictable paths by the center-pulling gravitational attraction of the very massive sun. The interaction of the center-pulling force of gravity with a moving object’s inertia (tendency to keep moving) keeps a less massive object (e.g., a planet, an asteroid or a moon) in circular motion (revolution) around a more massive object. 5. The earth and other planets move through space in two ways: rotation on an axis and revolution around the sun. Earth revolves around the sun in a near-circular path, explaining cyclical phenomena such as seasons 	<ol style="list-style-type: none"> 1. Describe in writing how gravitational attraction and the inertia of objects in the solar system keep them on a predictable elliptical pathway. 2. Distinguish between rotation of Earth on its axis and its elliptical revolution around the sun. 3. Use models to explain how Earth’s revolution around the sun affects changes in daylight hours and seasonal temperatures. 4. Compare the revolution times of planets and relate them to distance from the sun. 5. Design and conduct a scientific simulation to explore the relationship between the angle of the light source and the temperature on the surface it strikes. 6. Use a model to demonstrate the phases of the moon 	<p>C28. Explain the effect of gravity on the orbital movements of planets in the solar system.</p> <p>C29. Explain how the relative motion and relative position of the sun, Earth and moon affect the seasons, phases of the moon and eclipses.</p>

	<p>and changes in visible star patterns (constellations).</p> <p>6. Revolution period (“year”) depends on the speed at which an orbiting body is moving and the circumference of its orbit. Objects more distant from the sun’s gravitational pull move slower than those that are closer.</p> <p>GRADE-LEVEL CONCEPT 8.3.b.</p> <p>1. Earth rotates around an axis or rotation, a line going through the center of the earth from the north pole to the south pole. The tilt of Earth’s axis relative to its orbital path, combined with the spherical shape of the earth, cause differences in the amount and intensity of the sun’s light striking different latitudes of the earth.</p> <p>2. Earth experiences seasons in northern and southern hemispheres due to the tilt of the earth on its axis and the resulting angle of the sunlight striking Earth’s surface at different points along its 365-day revolution period. Earth’s tilt causes seasonal differences in the height of the perceived path of the sun and the number of hours of sunlight. Seasons are not related to a change in distance between the earth and the sun, since that distance changes very little. Planets without a tilt of axis will experience no seasons in spite of the revolution.</p> <p>3. Earth’s moon is a natural satellite that revolves once around the earth in a period of about 27 days. The same half of the moon faces Earth throughout its revolution period. Phases of the moon as seen from Earth vary depending on the moon’s position relative to the sun and the earth, appearing as a full moon when the sun and moon are on opposite sides of the earth and as a new moon when they are on the same side.</p> <p>4. Eclipses occur when the moon, Earth and sun occasionally align in specific ways. A solar eclipse occurs when the when the moon is directly between the earth and the sun (during new moon phase) and the moon blocks the sun’s light, creating a moving shadow on parts of the earth. A lunar eclipse occurs when the earth is directly between the moon and the sun (full moon phase), the earth blocks the sun’s light, casting a shadow over the moon.</p> <p>5. Tides are the rise and fall of sea levels caused by the combined effects of the gravitational forces exerted by the moon, the sun and the rotation</p>	<p>relative to the position of the sun, Earth and moon.</p> <p>7. Develop a model or illustration to show the relative positions of the earth, sun and moon during a lunar and solar eclipse and explain how those positions influence the view from Earth.</p> <p>8. Describe factors affecting tidal changes and analyze tidal change data for Long Island Sound.</p>	
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	<p>of the earth. The times and amplitude of the tides at the coast are influenced, in part, by the alignment of the sun and moon.</p> <p>KEY CONCEPT WORDS: force, gravity, orbit, revolve, year, period, mass, weight, rotate, hemisphere, season, phase, new moon, satellite, solar eclipse, lunar eclipse, tide</p>		
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Science and Technology in Society — How do science and technology affect the quality of our lives?

GRADE 8

8.4 — In the design of structures there is a need to consider factors such as function, materials, safety, cost and appearance.

This content standard is an application of the concepts in content standard 8.1 and should be integrated into the same learning unit.

Core Science Curriculum Framework	Grade-Level Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
8.4.a Bridges can be designed in different ways to withstand certain loads and potentially destructive forces.	<ol style="list-style-type: none"> 1. Force is a push or a pull and is described by its strength and direction. Forces are measured in newtons or pounds using scales or other instruments. 2. Forces can act simultaneously on an object from all directions with different strengths (magnitudes). When the magnitude and direction of all the forces acting on an object are combined, or added together, the total force (net force) determines the object’s motion. Forces in opposite directions are subtracted; forces in the same direction are added. 3. If the strength of all the forces acting on an object from one direction is equivalent to the strength of the forces from the opposite direction, then the forces cancel each other out, and are said to be balanced. 4. Bridges are elevated structures designed to support the movement of objects over a span. Two important forces at work in bridges are <i>tension</i> and <i>compression</i>. 5. Bridges must support their own weight (dead load) and the weight of those objects that will cross over them or act on them from time to time, such as wind, snow and ice (live load). Bridges are kept stable by balancing the load forces with the supporting forces of the structure. These forces can cause parts of the bridge structure to push together (compression) or pull apart (tension). 6. Different bridge designs distribute tension and compression forces in different ways, depending on the shapes of the parts of the structure. The biggest difference among bridge designs is the distances they can cross in a 	<ol style="list-style-type: none"> 1. Identify the forces acting on a truss, beam and suspension bridge, including compression, tension and gravity using models, pictures or diagrams. 2. Explain in writing the advantages and disadvantages of truss, beam and suspension bridge design and visually identify each bridge. 3. Conduct an experiment to discover and report on a bridge’s ability to support a load based upon the interplay of tension and compression forces that result in a net force of zero. 4. Use technology to simulate how engineers plan, test and revise designs of bridges given parameters, including 	C30. Explain how beam, truss and suspension bridges are designed to withstand the forces that act on them.

	<p>single span. Shapes commonly used in bridge design include arches, triangles and rectangles.</p> <ol style="list-style-type: none"> 7. Bridges are constructed of different materials whose properties and costs vary. Some materials are strong against compression forces but weak against tension forces; some materials resist fire, corrosion or weathering. Materials commonly used in bridge design include wood, rope, aluminum, concrete and steel. 8. A beam bridge balances the load by concentrating it entirely onto the two piers that support the bridge at either end. When a force pushes down on the beam, the beam bends. Its top edge is pushed together (compression), and its bottom edge is pulled apart (tension). The amount of bend depends on the length of the beam. 9. A truss bridge uses rigid, interlocking beams to form a system of triangles that distribute the load among all parts of the structure, increasing the structural strength of the bridge. 10. A suspension bridge uses cables suspended from tall towers to hold up the deck and distribute the load. The tension and compression forces acting on the beam are distributed among the cables (which experience tension) and the towers (which experience compression). 11. Engineers and scientists build models of bridges, conduct controlled experiments to learn how they will withstand various stresses, and consider the benefits and trade-offs of various design alternatives. 12. Bridge design is influenced by the length of the span, the properties of the materials and the environmental conditions, as well as by practical considerations, such as the bridge's appearance, cost of materials or construction site challenges. 13. Bridges can fail because they have faulty parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with. <p>KEY CONCEPT WORDS: balanced/unbalanced forces, net force, load, tension force, compression force, beam bridge, truss bridge, suspension bridge</p>	<p>cost, time, safety and aesthetics.</p>	
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