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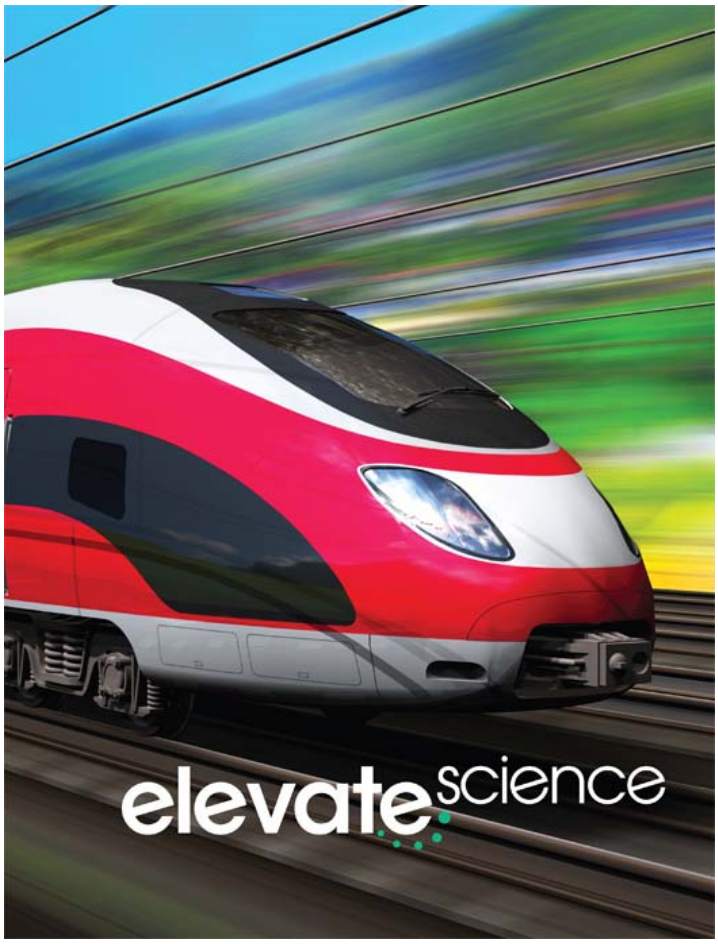

To the

Utah Science and Engineering Education Standards (SEEd)

Grade 4

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To the
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To the
Utah SEEd Standards for Grade 4

Table of Contents

SE = Teacher Edition **TE = Teacher Edition**

Digital Resources: The symbol > indicates a click to reach each digital asset on the Realize platform.

A Correlation of Elevate Science Grade 4, ©2019
To the
Utah SEEd Standards for Grade 4

Utah SEEd Standards Grade 4	Elevate Science ©2019 Grade 4
GRADE 4	
INTRODUCTION	
The fourth-grade SEEd standards provide a framework for students to construct an explanation of how structures support growth, behavior, and survival in both plants and animals. Students analyze and interpret data from fossils to provide evidence of stability and change in ancient organisms and environments. Students plan and carry out an investigation to gather evidence that energy can be transferred from place to place by sound, light, heat, and electrical currents. Students analyze data and construct explanations for how the Sun and Earth interact. Additionally, students design solutions to problems that exist in these areas.	
Strand 4.1: ORGANISMS FUNCTIONING IN THEIR ENVIRONMENT	
Through the study of organisms, inferences can be made about environments both past and present. Plants and animals have both internal and external structures that serve various functions for growth, survival, behavior, and reproduction. Animals use different sense receptors specialized for particular kinds of information to understand and respond to their environment. Some kinds of plants and animals that once lived on Earth can no longer be found. However, fossils from these organisms provide evidence about the types of organisms that lived long ago and the nature of their environments. Additionally, the presence and location of certain fossil types indicate changes that have occurred in environments over time.	
Standard 4.1.1 Construct an explanation from evidence that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. Emphasize how structures support an organism's survival in its environment and how internal and external structures of plants and animals vary within the same and across multiple Utah environments. Examples of structures could include thorns on a stem to prevent predation or gills on a fish to allow it to breathe underwater. (LS1.A)	**SE/TE:** uConnect Lab: How do your eyes respond to differences in lighting?, 280 Structures and Functions, 284-285 Quest Check-In Lab: How can you observe a plant's vascular system in action?, 290-291 uInvestigate Lab: How are leaf coverings different?, 293 uInvestigate Lab: How can you compare the stomachs of cows and dogs?, 301 uInvestigate Lab: How can you design a protective insect shell?, 309 Solve It with Science: Why do animals shed their exoskeletons?, 315 uInvestigate Lab: How can you locate an object using only sound?, 317 Evidence-Based Assessment: Question 5, 331 uInvestigate Lab: How can you model how you breathe?, 341 uInvestigate Lab: How can you test the strength of a bone?, 351 uInvestigate Lab: How are intestines arranged inside your body?, 367

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Utah SEEd Standards Grade 4	Elevate Science ©2019 Grade 4
(Continued)	(Continued) uDemonstrate Lab: How do your sensory organs gather information? 382-383 **Realize™ Digital Resources:** **Structures and Functions** >Topic Launch>STEM Quest Kickoff>Video: Let Plants and Animals Inspire You! >Lesson 1, Internal Structures and Functions of Plants>Video Internal Structures and Functions of Plants;> Interactivity: The Structure of Flowers >Lesson 2, External Structures and Functions of Plants>Video: External Structures and Functions of Plants;> Virtual Lab: Partners in Pollination;> Interactivity: Leaves, Roots, and Stems >Lesson 3, Internal Structures and Functions of Animals>Video: Internal Structures and Functions of Animals;>Interactivity: Eating and Making Food >Lesson 4: External Structures and Functions of Animals>Video: External Structures and Functions of Animals;> Interactivity: External and Internal Structures of Plants and Animals >Topic Close>Quest Findings: Let Plants and Animals Inspire You

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To the
Utah SEEd Standards for Grade 4

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Standard 4.1.2 Develop and use a model of a system to describe how animals receive different types of information from their environment through their senses, process the information in their brain, and respond to the information. Emphasize how animals are able to use their perceptions and memories to guide their actions. Examples could include models that explain how animals sense and then respond to different aspects of their environment such as sounds, temperature, or smell. (LS1.D) (Continued)	**SE/TE:** uInvestigate Lab: How can you locate an object using only sound?, 317 Visual Literacy Connection: How do elephants respond to stimuli?, 318-319 uDemonstrate Lab: How do earthworms respond to stimuli?, 332-333 uEngineer It Model STEM: Eye See You!, 324-325 uDemonstrate Lab: How do earthworms respond to stimuli?, 332-333 Quest Kickoff: Make a Human Body Road Map, 336-337 uInvestigate Lab: Which parts of the body are more sensitive?, 359 STEM Quest Check-In Lab: How can you test signals to and from your brain?, 364-365 (Continued) Science and Engineering Practices Handbook: Science Practices, Developing and Using Models, EM6 **Realize™ Digital Resources:** **Structures and Functions** >Lesson 5, Plant and Animal Responses to the Environment>Video: Plant and Animal Responses to the Environment;>Interactivity: Plants and Animals Respond to the Environment;> Video: Eye see you!

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To the
Utah SEEd Standards for Grade 4

Utah SEEd Standards Grade 4	Elevate Science ©2019 Grade 4
Standard 4.1.3 Analyze and interpret data from fossils to provide evidence of the stability and change in organisms and environments from long ago. Emphasize using the structures of fossils to make inferences about ancient organisms. Examples of fossils and environments could include comparing a trilobite with a horseshoe crab in an ocean environment or using a fossil footprint to determine the size of a dinosaur. (LS4.A)	**SE/TE:** Quest Kickoff: Dig for the Truth, 244-245 uInvestigate Lab: What patterns do fossils follow?, 249 Rock Formations, 251 Rock Strata Can Change, 251 Interactivity, 252 STEM Math Connection: Canyonlands, 255 uInvestigate Lab: How can rock layers show change?, 259 Fossil Clues on Earth, 260 Index Fossils, 261 Crosscutting Concepts Toolbox, Patterns, 261 Visual Literacy Connection: How can layers of rock change?, 262-263 Interactivity, 263 Comparing Rock Layers, 264 Quest Findings: Dig for the Truth, 268 Assessment: The Essential Question, 271 Evidence-Based Assessment: Questions 1-6, 272-273 uDemonstrate Lab: How can you correlate rock layers?, 274-275 **Realize™ Digital Resources:** **The History of Planet Earth** > Topic Launch>Quest Kickoff: Dig for the Truth > Lesson 1: Patterns in Fossils and Rock Formations>Video: Patterns in Fossils and Rock Formations;>Interactivity: Patterns in Fossils and Rock Formations >Lesson 2, Evidence of Change from Fossils and Rock Formations>Video: Evidence of Change in Fossils and Rock Formations;>Interactivity: How can layers of rock change?;> Virtual Lab: Layers of Time >Topic Close> Quest Findings: Dig for the Truth

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To the
Utah SEEd Standards for Grade 4

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Standard 4.1.4 Engage in argument from evidence based on patterns in rock layers and fossils found in those layers to support an explanation that environments have changed over time. Emphasize the relationship between fossils and past environments. Examples could include tropical plant fossils found in Arctic areas and rock layers with marine shell fossils found above rock layers with land plant fossils. (ESS1.C)	**SE/TE:** uConnect Lab: Where are fossils found in rock layers?, 246 uInvestigate Lab: What patterns do fossils follow?, 249 Fossils, 250 Rock Formations, 251 STEM Math Connection: Canyonlands, 255 uInvestigate Lab: How can rock layers show change?, 259 Visual Literacy Connection: How can layers of rock change?, 262-263 uBe a Scientist: Be a Rock Hound, 264 Quest Findings: Dig for the Truth, 268 uDemonstrate Lab: How can you correlate rock layers?, 274-275 Science and Engineering Practices Handbook: Science Practices, Constructing Explanations, EM6 Science and Engineering Practices Handbook: Science Practices, Engaging in Arguments from Evidence, EM7 **Realize™ Digital Resources:** **The History of Planet Earth** > Topic Launch>Quest Kickoff: Dig for the Truth >Lesson 1: Patterns in Fossils and Rock Formations>Video: Patterns in Fossils and Rock Formations;>Interactivity: Patterns in Fossils and Rock Formations >Lesson 2, Evidence of Change from Fossils and Rock Formations>Video: Evidence of Change from Fossils and Rock Formations;>Virtual Lab: Layers of Time;>Interactivity: Evidence of Change from Fossils and Rock Formations >Topic Close>Quest Findings: Dig for the Truth

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To the
Utah SEEd Standards for Grade 4

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Strand 4.2: ENERGY TRANSFER	
Energy is present whenever there are moving objects, sound, light, or heat. The faster a given object is moving, the more energy it possesses. When objects collide, energy can be transferred from one object to another causing the objects' motions to change. Energy can also be transferred from place to place by electrical currents, heat, sound, or light. Devices can be de- signed to convert energy from one form to another.	
Standard 4.2.1 Construct an explanation to describe the cause and effect relationship between the speed of an object and the energy of that object. Emphasize using qualitative descriptions of the relationship between speed and energy like fast, slow, strong, or weak. An example could include a ball that is kicked hard has more energy and travels a greater distance than a ball that is kicked softly. (PS3.A)	**SE/TE:** Quest Kickoff: Energy Changes in Collisions, How can you design a safe car?, 2-3 uConnect Lab: How can you compare the energy of objects?, 4 uInvestigate Lab: How does starting height affect an object's energy?, 7 Motion and Energy, 12 uBe a Scientist, Force and Speed, 12 Quest Check-In: Energy, Speed, and Motion, 13 uInvestigate Lab: How does energy transfer between objects?, 17 uInvestigate Lab: How does electric energy flow in circuits?, 35 Evidence-Based Assessment: Questions 3, 5, 47 uDemonstrate Lab: What affects energy transfer?, 48-49 **Realize™ Digital Resources:** **Energy and Motion** > Topic Launch>Quest Kickoff: Energy Changes in Collisions >Lesson 1, Energy, Speed, and Moving Objects > Virtual Lab: Propeller Speed and Thrust >Topic Close>Quest Findings: Energy Changes in Collisions

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To the
Utah SEEd Standards for Grade 4

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Standard 4.2.2 Ask questions and make observations about the changes in energy that occur when objects collide. Emphasize that energy is transferred when objects collide and may be converted to different forms of energy. Examples could include changes in speed when one moving ball collides with another or the transfer of energy when a toy car hits a wall. (PS3.B, PS3.C)	**SE/TE:** uInvestigate Lab: How does energy transfer between objects?, 17 Visual Literacy Connection: Energy Changes in a Collision, 18-19 Other Energy Changes, 20-21 STEM Quest Check-In Lab: How does modeling help you understand a collision?, 22-23 Science and Engineering Practices Handbook: Science Practices, Ask Questions, 294 **Realize™ Digital Resources:** **Energy and Motion** > Lesson 2: Collisions>Quiz: Collisions >Lesson 3: Energy Transfer>Virtual Lab: Propeller Speed and Thrust;> Interactivity: How Does Energy Move?
Standard 4.2.3 Plan and carry out an investigation to gather evidence from observations that energy can be transferred from place to place by sound, light, heat, and electrical currents. Examples could include sound causing objects to vibrate and electric currents being used to produce motion or light. (PS3.A, PS3.B)	**SE/TE:** uInvestigate Lab: How does energy transfer between objects?, 17 Visual Literacy Connection: Energy Changes in a Collision, 18-19 Other Energy Changes, 20-21 uInvestigate Lab: How does heat move?, 25 Sound Energy, 30 Quest Check-In: Crash It!, 32 Sound Energy, 30 Quest Check-In: Crash It!, 32 uInvestigate Lab: How does electric energy flow in circuits?, 35 Quest Findings: STEM Energy Changes in Collisions, 42 uDemonstrate Lab: What affects energy transfer?, 48-49

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Utah SEEd Standards Grade 4	Elevate Science ©2019 Grade 4
(Continued)	(Continued) **Realize™ Digital Resources:** **Energy and Motion** >Lesson 2: Collisions>Video: Collisions;> Interactivity: The Transfer of Kinetic Energy;> Quiz: Collisions Lesson 3: Energy Transfer>Video: Energy Transfer;> Video: Sound Energy;> Virtual Lab: Propeller Speed and Thrust;> Interactivity: How Does Thermal Energy Move? >Lesson 4: Electric Circuits>Video: Electric Circuits;> Interactivity: Choosing the Best Circuit Design;> Interactivity: Making an Electric Circuit
Standard 4.2.4 Design a device that converts energy from one form to another. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data from testing solutions, and propose modifications for optimizing a solution. Emphasize identifying the initial and final forms of energy. Examples could include solar ovens that convert light energy to heat energy or a simple alarm system that converts motion energy into sound energy. (PS3.B, PS3.D, ETS1.A, ETS1.B, ETS1.C)	**SE/TE:** STEM Quest Check-In Lab: How can an electric circuit help prevent collisions?, 40-41 STEM uInvestigate Lab: How can a potato provide energy to a light bulb?, 57 STEM uInvestigate Lab: How does a windmill capture wind energy?, 75 STEM Quest Check-In Lab: How can the Sun make a motor work?, 80 uDemonstrate Lab: How can energy resource usage change?, 98-99 **Realize™ Digital Resources:** **Human Uses of Energy** >Topic Launch>Quest Kickoff: Power from the People >Lesson 1, Energy Conversions> Video: Natural Resources and Energy **>**Topic Close>Quest Findings: Power to the People

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Strand 4.3: WAVE PATTERNS	
Waves are regular patterns of motion that transfer energy and have properties such as amplitude (height of the wave) and wavelength (spacing between wave peaks). Waves in water can be directly observed. Light waves cause objects to be seen when light reflected from objects enters the eye. Humans use waves and other patterns to transfer information.	
Standard 4.3.1 Develop and use a model to describe the regular patterns of waves. Emphasize patterns in terms of amplitude and wavelength. Examples of models could include diagrams, analogies, and physical models such as water or rope. (PS4.A)	**SE/TE:** uInvestigate Lab: How does a wave carry energy?, 107 Wave Characteristics, 109 Interactivity, 109 uInvestigate Lab: What patterns can waves make?, 117 Visual Literacy Connection: How do wave patterns move?, 120-121 Interactivity, 121 uInvestigate Lab: How can information from waves be translated?, 135 uDemonstrate Lab: How can you model a light or sound wave?, 148-149 Science and Engineering Practices Handbook: Science Practices, Developing and Using Models, EM6 **Realize™ Digital Resources:** **Waves and Information** > Lesson 1: Properties of Waves,>Video: Properties of Waves;>Interactivity: Sound >Lesson 2: Patterns of Waves>Video: Patterns of Waves;> Interactivity: The Doppler Effect

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To the
Utah SEEd Standards for Grade 4

Utah SEEd Standards Grade 4	Elevate Science ©2019 Grade 4
Standard 4.3.2 Develop and use a model to describe how visible light waves reflected from objects enter the eye causing objects to be seen. Emphasize the reflection and movement of light. The structure and function of organs and organ systems and the relationship between color and wavelength will be taught in Grades 6 through 8. (PS4.B)	**SE/TE:** uInvestigate Lab: How is light reflected?, 125 Assessment: Question 6, 145 Science and Engineering Practices Handbook: Science Practices, Developing and Using Models, EM6 **Realize™ Digital Resources:** **Waves and Information** > Lesson 3: Waves and the Electromagnet Spectrum> Video: Light Waves;>Interactivity: Light Energy and Vision
Standard 4.3.3 Design a solution to an information transfer problem using wave patterns. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data from testing solutions, and propose modifications for optimizing a solution. Examples could include using light to transmit a message in Morse code or using lenses and mirrors to see objects that are far away. (PS4.C, ETS1.A, ETS1.B, ETS1.C)	**SE/TE:** uEngineer It! Design STEM: Crack the Code, 114-115 STEM Quest Check-In Lab: How can you send a message with light?, 132-133 How do cell phone calls work?, Write About It, 137 Lesson 4 Check: Question 2, 139 Quest Findings, STEM, 142 Science and Engineering Practices Handbook: Engineering Practices, Optimizing Solutions, EM13 **Realize™ Digital Resources:** **Waves and Information** > Lesson 1: Properties of Waves>uEngineer It! Interactivity: Code Breakers > Lesson 4: Waves and Information>Virtual Lab: Call the Galactic Neighbors

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To the
Utah SEEd Standards for Grade 4

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Strand 4.4: OBSERVABLE PATTERNS IN THE SKY	
The Sun is a star that appears larger and brighter than other stars because it is closer to Earth. The rotation of Earth on its axis and orbit of Earth around the Sun cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the Sun and stars at different times of the day, month, and year.	
Standard 4.4.1 Construct an explanation that differences in the apparent brightness of the Sun compared to other stars is due to the relative distance (scale) of stars from Earth. Emphasize relative distance from Earth. (ESS1.A)	Please see Grade 5 Topic 6: Solar System, Lesson 1: Brightness of the Sun and Other Stars, 236-245
Standard 4.4.2 Analyze and interpret data of observable patterns to show that Earth rotates on its axis and revolves around the Sun. Emphasize patterns that provide evidence of Earth's rotation and orbits around the Sun. Examples of patterns could include day and night, daily changes in length and direction of shadows, and seasonal appearance of some stars in the night sky. Earth's seasons and its connection to the tilt of Earth's axis will be taught in Grades 6 through 8. (ESS1.B)	Please see Grade 5 Topic 6: Solar System, Lesson 2: Earth's Movements in Space, 284-293; Lesson 3: Patterns Over Time, 294-313.