





Colorado Academic Standards for Science Correlation to *PhD Science*[™]

 Green indicates that *PhD Science*[™] fully addresses the standard within the grade level.

 Blue indicates that *PhD Science* covers the standard but in a different grade level.

 Yellow indicates that *PhD Science* partially covers the standard within the grade level.

 Red indicates that *PhD Science* does not cover the standard.

Key: Module (M), Lesson (L)

PhD Science Level 3

The Grade 3 Colorado Academic Standards are fully covered by the Level 3 *PhD Science* curriculum. A detailed analysis of alignment appears in the table below.

Grade 3 Standards: Evidence Outcomes		Aligned <i>PhD Science</i> Lessons
Standard 1 Physical Science		
Grade Level Expectation: 1. Patterns of motion can be used to predict future motion.		
3.1.1a	Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.	Level 3 M4 L10–L18 Level 3 M4 L28–L30
3.1.1b	Make observations and/or measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion.	Level 3 M4 L1–L9 Level 3 M4 L28–L30
Grade Level Expectation: 2. Objects in contact exert forces on each other; electric and magnetic forces between a pair of objects do not require contact.		
3.1.2a	Ask questions to determine cause-and-effect relationships of electric or magnetic interactions between two objects not in contact with each other.	Level 3 M4 L19–L21 Level 3 M4 L28–L30
3.1.2b	Define a simple design problem that can be solved by applying scientific ideas about magnets.	Level 3 M4 L22–L30
Standard 2 Life Science		
Grade Level Expectation: 1. Organisms have unique and diverse life cycles.		
3.2.1a	Develop models to describe that organisms have unique and diverse life cycles, but all have in common birth, growth, reproduction, and death.	Level 3 M3 L7–L8 Level 3 M3 L23–L28
Grade Level Expectation: 2. Being part of a group helps animals obtain food, defend themselves and cope with changes.		
3.2.2a	Construct an argument that some animals form groups that help members survive.	Level 3 M2 L13–L15 Level 3 M2 L26–L28
Grade Level Expectation: 3. Different organisms vary in how they look and function because they have different inherited information; the environment also affects the traits that an organism develops.		
3.2.3a	Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.	Level 3 M3 L1–L6 Level 3 M3 L14–L18 Level 3 M3 L26–L28

3.2.3b	Use evidence to support the explanation that traits can be influenced by the environment.	Level 3 M3 L9–L13 Level 3 M3 L19–L20 Level 3 M3 L26–L28
Grade Level Expectation: 4. Some living organisms resemble organisms that once lived on Earth.		
3.2.4a	Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.	Level 3 M2 L1–L8 Level 3 M2 L26–L28
3.2.4b	Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.	Level 3 M3 L21–L28
Grade Level Expectation: 5. Sometimes differences in characteristics between individuals of the same species provide advantages in survival and reproduction.		
3.2.5a	Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.	Level 3 M2 L1–L2 Level 3 M2 L9–L12 Level 3 M2 L16–L19 Level 3 M2 L22–L28
3.2.5b	Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.	Level 3 M2 L16–L28
Standard 3 Earth and Space Science		
Grade Level Expectation: 1. Climate describes patterns of typical weather conditions over different scales and variations; historical weather patterns can be analyzed.		
3.3.1a	Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.	Level 3 M1 L1–L15 Level 3 M1 L19–L20 Level 3 M1 L27–L29
3.3.1b	Obtain and combine information to describe climates in different regions of the world.	Level 3 M1 L11–L15 Level 3 M1 L27–L29
Grade Level Expectation: 2. A variety of weather hazards result from natural process; humans cannot eliminate weather-related hazards but can reduce their impacts.		
3.3.2a	Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.	Level 3 M1 L1–L3 Level 3 M1 L16–L29

Science and Engineering Practices		Aligned PhD Science Lessons
1	Asking Questions and Defining Problems <ul style="list-style-type: none"> Ask questions that can be investigated based on patterns such as cause and effect relationships. Define a simple problem that can be solved through the development of a new or improved object or tool. 	Level 3 M1 L1–L3 Level 3 M1 L21–L26 Level 3 M2 L1–L2 Level 3 M3 L1–L3 Level 3 M3 L12–L13 Level 3 M4 L1–L3 Level 3 M4 L7–L9 Level 3 M4 L15–L16 Level 3 M4 L19–L30
2	Developing and Using Models <ul style="list-style-type: none"> Develop models to describe phenomena. 	Level 3 M1 L1–L3 Level 3 M1 L19–L20 Level 3 M2 L1–L3 Level 3 M2 L6–L12

		<p>Level 3 M2 L22–L25 Level 3 M3 L7–L11 Level 3 M3 L21–L25 Level 3 M4 L1–L3 Level 3 M4 L17–L18 Level 3 M4 L23–L27</p>
3	<p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. Plan and conduct investigations that control variables and provide evidence to support explanations or design solutions. 	<p>Level 3 M2 L4–L5 Level 3 M3 L12–L13 Level 3 M4 L7–L18 Level 3 M4 L23–L30</p>
4	<p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Analyze and interpret data to make sense of phenomena using logical reasoning. Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. 	<p>Level 3 M1 L4–L15 Level 3 M1 L19–L20 Level 3 M1 L27–L29 Level 3 M2 L3–L8 Level 3 M2 L16–L19 Level 3 M3 L4–L8 Level 3 M3 L14–L20 Level 3 M4 L4–L9</p>
6	<p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> Use evidence (e.g., observations, patterns) to construct an explanation. Use evidence (e.g., observations, patterns) to support an explanation. Use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Use evidence to construct an explanation. 	<p>Level 3 M1 L13–L15 Level 3 M1 L18 Level 3 M1 L21–L29 Level 3 M2 L6–L8 Level 3 M2 L22–L28 Level 3 M3 L9–L11 Level 3 M3 L14–L15 Level 3 M3 L21–L28 Level 3 M4 L10–L14 Level 3 M4 L19–L21 Level 3 M4 L28–L30</p>
7	<p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Critiqu[e] the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Construct an argument with evidence. Construct an argument with evidence, data, and/or a model. Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. 	<p>Level 3 M1 L21–L26 Level 3 M2 L9–L15 Level 3 M2 L20–L21 Level 3 M3 L16–L20 Level 3 M4 L10–L14</p>
8	<p>Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> Obtain and combine information from books and other reliable media to explain phenomena. 	<p>Level 3 M1 L16–L17 Level 3 M2 L13–L15 Level 3 M2 L20–L21 Level 3 M4 L22</p>

Disciplinary Core Ideas	Aligned <i>PhD Science</i> Lessons
--------------------------------	---

PS2 Motion and Stability: Forces and Interactions		
PS2.A	Forces and Motion	
	Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.	Level 3 M4 L10–L18 Level 3 M4 L28–L30
	The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.	Level 3 M4 L1–L9 Level 3 M4 L28–L30
PS2.B	Type of Interactions	
	Objects in contact exert forces on each other.	Level 3 M4 L10–L18 Level 3 M4 L28–L30
	Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.	Level 3 M4 L19–L30
LS1 From Molecules to Organisms: Structures and Processes		
LS1.B	Growth and Development of Organisms	
	Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.	Level 3 M3 L7–L8 Level 3 M3 L23–L28
LS2 Ecosystems: Interactions, Energy, and Dynamics		
LS2.C	Ecosystem Dynamics, Functioning, and Resilience	
	When the environment changes in ways that affect a place's physical characteristics, temperature or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.	Level 3 M2 L16–L28
LS2.D	Social Interactions and Group Behavior	
	Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.	Level 3 M2 L13–L15 Level 3 M2 L22–L28
LS3 Heredity: Inheritance and Variation of Traits		
LS3.A	Inheritance of Traits	
	Many characteristics of organisms are inherited from their parents. Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.	Level 3 M3 L1–L6 Level 3 M3 L9–L20 Level 3 M3 L23–L28
LS3.B	Variation of Traits	
	Different organisms vary in how they look and function because they have different inherited information. The environment also affects the traits that an organism develops.	Level 3 M3 L1–L6 Level 3 M3 L9–L20 Level 3 M3 L23–L28
LS4 Biological Evolution: Unity and Diversity		
LS4.A	Evidence of Common Ancestry and Diversity	
	Some kinds of plants and animals that once lived on Earth are no longer found anywhere. Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.	Level 3 M2 L1–L8 Level 3 M2 L26–L28
LS4.B	Natural Selection	


	Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.		Level 3 M3 L21–L28
LS4.C	Adaptation		
	For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.		Level 3 M2 L1–L2 Level 3 M2 L9–L12 Level 3 M2 L16–L19 Level 3 M2 L22–L28
LS4.D	Biodiversity and Humans		
	Populations live in a variety of habitats, and change in those habitats affects the organisms living there.		Level 3 M2 L16–L21 Level 3 M2 L26–L28
ESS2 Earth's Systems			
ESS2.D	Weather and Climate		
	Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.		Level 3 M1 L1–L15 Level 3 M1 L19–L20 Level 3 M1 L27–L29
ESS3 Earth and Human Activity			
ESS3.B	Natural Hazards		
	A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.		Level 3 M1 L1–L3 Level 3 M1 L16–L29

Crosscutting Concepts		Aligned PhD Science Lessons
1	Patterns <ul style="list-style-type: none"> Patterns of change can be used to make predictions. Similarities and differences in patterns can be used to sort and classify natural phenomena. 	Level 3 M1 L11–L15 Level 3 M1 L19–L20 Level 3 M1 L27–L29 Level 3 M2 L3–L8 Level 3 M2 L13–L15 Level 3 M3 L1–L8 Level 3 M3 L14–L18 Level 3 M3 L26–L28 Level 3 M4 L1–L9 Level 3 M4 L28–L30
2	Cause and Effect <ul style="list-style-type: none"> Cause – and – effect relationships are routinely identified. Cause – and – effect relationships are routinely identified and used to explain change. Cause – and – effect relationships are routinely identified, tested, and used to explain change. 	Level 3 M1 L1–L3 Level 3 M1 L16–L18 Level 3 M1 L21–L29 Level 3 M2 L9–L12 Level 3 M2 L16–L28 Level 3 M3 L9–L13 Level 3 M3 L19–L25 Level 3 M4 L1–L3 Level 3 M4 L10–L30
3	Scale, Proportion, and Quantity <ul style="list-style-type: none"> Observable phenomena exist from very short to very long time periods. 	Level 3 M1 L4–L10 Level 3 M2 L1–L2 Level 3 M3 L1–L3 Level 3 M3 L14–L15

4	<p>Systems and System Models</p> <ul style="list-style-type: none"> A system can be described in terms of its components and their interactions. 	<p>Level 3 M1 L1–L3 Level 3 M1 L16–L20 Level 3 M2 L6–L15 Level 3 M2 L20–L28 Level 3 M3 L9–L11 Level 3 M4 L1–L30</p>
---	---	--

Connections to Engineering, Technology, and Applications of Science	Aligned <i>PhD Science</i> Lessons
<p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none"> Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. 	<p>Level 3 M4 L23–L27</p>

Colorado Academic Standards for Science Correlation to *PhD Science*[™]

 Green indicates that *PhD Science*[™] fully addresses the standard within the grade level.

 Blue indicates that *PhD Science* covers the standard but in a different grade level.








 Yellow indicates that *PhD Science* partially covers the standard within the grade level.

 Red indicates that *PhD Science* does not cover the standard.

Key: Module (M), Lesson (L)

PhD Science Level 4

The Grade 4 Colorado Academic Standards are fully covered by the Level 4 *PhD Science* curriculum. A detailed analysis of alignment appears in the table below.

Grade 4 Standards: Evidence Outcomes		Aligned <i>PhD Science</i> Lessons
Standard 1 Physical Science		
Grade Level Expectation: 1. The faster an object moves the more energy it has.		
4.1.1a	Use evidence to construct an explanation relating the speed of an object to the energy of that object.	 Level 4 M2 L6–L7 Level 4 M2 L24–L26
Grade Level Expectation: 2. Energy can be moved from place to place.		
4.1.2a	Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	 Level 4 M2 L1–L5 Level 4 M2 L10–L11 Level 4 M2 L24–L26
Grade Level Expectation: 3. When objects collide contact forces transfer so as to change objects' motion.		
4.1.3a	Ask questions and predict outcomes about the changes in energy that occur when objects collide.	 Level 4 M2 L8–L9 Level 4 M2 L24–L26
Grade Level Expectation: 4. Energy can be produced, used, or released by converting stored energy.		
4.1.4a	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	 Level 4 M2 L12–L14 Level 4 M2 L24–L26
Grade Level Expectation: 5. Waves are regular patterns of motion.		
4.1.5a	Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.	 Level 4 M3 L7–L14 Level 4 M3 L29–L31
Grade Level Expectation: 6. An object can be seen when light reflected from its surface enters the eyes.		
4.1.6a	Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.	 Level 4 M4 L1–L17 Level 4 M4 L25–L27
Grade Level Expectation: 7. Patterns can encode, send, receive, and decode information.		
4.1.7a	Generate and compare multiple solutions that use patterns to transfer information.	 Level 4 M4 L18–L27

Standard 2 Life Science		
Grade Level Expectation: 1. Organisms have both internal and external structures that serve various functions.		
4.2.1a	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	Level 4 M3 L1–L6 Level 4 M3 L20 Level 4 M3 L26–L31
4.2.1b	Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.	Level 4 M3 L1–L6 Level 4 M3 L15–L25 Level 4 M3 L29–L31
Standard 3 Earth and Space Science		
Grade Level Expectation: 1. Earth has changed over time.		
4.3.1a	Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.	Level 4 M1 L6–L11 Level 4 M1 L25–L27
Grade Level Expectation: 2. Four major earth systems interact.		
4.3.2a	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.	Level 4 M1 L6–L11 Level 4 M1 L25–L27
Grade Level Expectation: 3. Earth’s physical features occur in patterns.		
4.3.3a	Analyze and interpret data from maps to describe patterns of Earth’s features.	Level 4 M1 L1–L5 Level 4 M1 L19–L20 Level 4 M1 L25–L27
Grade Level Expectation: 4. Energy and fuels that humans use are derived from natural sources and their use affects the environment in multiple ways.		
4.3.4a	Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.	Level 4 M1 L21–L27
Grade Level Expectation: 5. A variety of hazards result from natural process; humans cannot eliminate natural hazards but can reduce their impacts’ effect.		
4.3.5a	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	Level 4 M1 L12–L17 Level 4 M1 L25–L27

Science and Engineering Practices		Aligned <i>PhD</i> Science Lessons
1	Asking Questions and Defining Problems <ul style="list-style-type: none"> Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause - and - effect relationships. 	Level 4 M1 L1–L2 Level 4 M2 L1–L3 Level 4 M2 L8–L9 Level 4 M3 L1–L3 Level 4 M3 L15–L19 Level 4 M4 L1–L2
2	Developing and Using Models <ul style="list-style-type: none"> Develop a model using an analogy, example, or abstract representation to describe a scientific principle. Develop a model to describe phenomena. 	Level 4 M1 L1–L2 Level 4 M2 L1–L3 Level 4 M2 L8–L11 Level 4 M2 L15–L16 Level 4 M3 L1–L3 Level 4 M3 L7–L11 Level 4 M4 L1–L8 Level 4 M4 L10–L23
3	Planning and Carrying Out Investigations <ul style="list-style-type: none"> Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. 	Level 4 M1 L6–L11 Level 4 M1 L21–L22 Level 4 M2 L6–L7 Level 4 M2 L10–L14

	<ul style="list-style-type: none"> Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. 	Level 4 M3 L15–L19 Level 4 M4 L7–L9 Level 4 M4 L14–L16 Level 4 M4 L20–L23
4	Analyzing and Interpreting Data <ul style="list-style-type: none"> Analyze and interpret data to make sense of phenomena using logical reasoning. 	Level 4 M1 L12–L20 Level 4 M1 L23–L24 Level 4 M4 L10–L13
6	Constructing Explanations and Designing Solutions <ul style="list-style-type: none"> Apply scientific ideas to solve design problems. Identify the evidence that supports particular points in an explanation. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. Use evidence (e.g., measurements, observations, patterns) to construct an explanation. 	Level 4 M1 L3–L7 Level 4 M1 L12–L18 Level 4 M1 L21–L22 Level 4 M1 L25–L27 Level 4 M2 L4–L5 Level 4 M2 L15–L26 Level 4 M3 L24–L25 Level 4 M3 L29–L31 Level 4 M4 L14–L26
7	Engaging in Argument from Evidence <ul style="list-style-type: none"> Construct an argument with evidence, data, and/or a model. Use a model to test interactions concerning the functioning of a natural system. 	Level 4 M3 L4–L5 Level 4 M3 L21–L23 Level 4 M3 L26–L28 Level 4 M4 L7–L8
8	Obtaining, Evaluating, and Communicating Information <ul style="list-style-type: none"> Obtain and combine information from books and other reliable media to explain phenomena. 	Level 4 M1 L3–L5 Level 4 M1 L23–L24 Level 4 M3 L4–L6 Level 4 M3 L10–L11 Level 4 M3 L20–L23 Level 4 M3 L26–L28 Level 4 M4 L17–L19

Disciplinary Core Ideas		Aligned <i>PhD Science</i> Lessons
PS3 Energy		
PS3.A	Definitions of Energy	
	The faster a given object is moving, the more energy it possesses. Energy can be moved from place to place by moving objects or through sound, light, or electric currents.	Level 4 M2 L1–L16 Level 4 M2 L24–L26
PS3.B	Conservation of Energy and Energy Transfer	
	Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. Light also transfers energy from place to place. Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.	Level 4 M2 L1–L16 Level 4 M2 L24–L26

PS3.C	Relationship Between Energy and Forces	
	When objects collide, the contact forces transfer energy so as to change the objects' motions.	Level 4 M2 L8–L9 Level 4 M2 L24–L26
PS3.D	Energy in Chemical Processes and Everyday Life	
	The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use.	Level 4 M2 L12–L14 Level 4 M2 L24–L26
PS4 Waves and Their Applications in Technologies for Information Transfer		
PS4.A	Wave Properties	
	Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets the beach. Waves of the same type can differ in amplitude (height of waves) and wavelength (spacing between wave peaks).	Level 4 M3 L7–L11 Level 4 M3 L29–L31
PS4.B	Electromagnetic Radiation	
	An object can be seen when light reflected from its surface enters the eyes.	Level 4 M4 L1–L13 Level 4 M4 L20–L26
PS4.C	Information Technologies and Instrumentation	
	Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa.	Level 4 M4 L14–L19 Level 4 M4 L24–L26
LS1 From Molecules to Organisms: Structures and Processes		
LS1.A	Structure and Function	
	Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.	Level 4 M3 L1–L6 Level 4 M3 L20 Level 4 M3 L26–L31
LS1.D	Information Processing	
	Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.	Level 4 M3 L1–L6 Level 4 M3 L15–L25 Level 4 M3 L29–L31 Level 4 M4 L10–L13
ESS1 Earth's Place in the Universe		
ESS1.C	The History of Planet Earth	
	Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.	Level 4 M1 L1–L5 Level 4 M1 L19–L20 Level 4 M1 L25–L27
ESS2 Earth's Systems		
ESS2.A	Earth Materials and Systems	
	Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms and gravity break rocks, soils, and sediments into smaller particles and move them around	Level 4 M1 L6–L11 Level 4 M1 L25–L27
ESS2.E	Biogeology	
	Living things affect the physical characteristics of their regions.	Level 4 M1 L6–L11 Level 4 M1 L25–L27
ESS2.B	Plate Tectonics and Large-Scale System Interactions	
	The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most	Level 4 M1 L18–L20 Level 4 M1 L25–L27

	earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth.	
ESS3 Earth and Human Activity		
ESS3.A	Natural Resources	
	Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.	Level 4 M1 L21–L27
ESS3.B	Natural Hazards	
	A variety of hazards result from natural processes. Humans cannot eliminate the hazards but can take steps to reduce their impacts.	Level 4 M1 L12–L17 Level 4 M1 L25–L27


Crosscutting Concepts		Aligned <i>PhD Science</i> Lessons
1	<p>Patterns</p> <ul style="list-style-type: none"> Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena. Similarities and differences in patterns can be used to sort and classify designed products. Patterns can be used as evidence to support an explanation. 	Level 4 M1 L1–L5 Level 4 M1 L18–L22 Level 4 M2 L4–L5 Level 4 M2 L8–L11 Level 4 M2 L24–L26 Level 4 M3 L1–L3 Level 4 M3 L7–L11 Level 4 M3 L20 Level 4 M3 L24–L28 Level 4 M4 L1–L4 Level 4 M4 L7–L8 Level 4 M4 L17–L23
2	<p>Cause and Effect</p> <ul style="list-style-type: none"> Cause - and - effect relationships are routinely identified. Cause - and - effect relationships are routinely identified, tested, and used to explain change. Cause - and - effect relationships are routinely identified and used to explain change. 	Level 4 M1 L6–L17 Level 4 M1 L19–L20 Level 4 M1 L23–L27 Level 4 M2 L1–L7 Level 4 M2 L10–L14 Level 4 M2 L24–L26 Level 4 M3 L6–L11 Level 4 M3 L15–L23 Level 4 M4 L3–L16 Level 4 M4 L24–L26
4	<p>Systems and System Models</p> <ul style="list-style-type: none"> A system can be described in terms of its components and their interactions. 	Level 4 M1 L1–L2 Level 4 M1 L12–L17 Level 4 M1 L21–L24 Level 4 M2 L1–L11 Level 4 M2 L15–L26 Level 4 M3 L4–L5 Level 4 M3 L7–L9 Level 4 M3 L15–L19 Level 4 M3 L21–L23 Level 4 M3 L26–L31 Level 4 M4 L1–L8 Level 4 M4 L10–L23


5	<p>Energy and Matter</p> <ul style="list-style-type: none"> Energy can be transferred in various ways and between objects. 	<p>Level 4 M2 L1–L3 Level 4 M2 L8–L26 Level 4 M3 L1–L3 Level 4 M3 L10–L19</p>
---	---	---

Connections to Nature of Science	Aligned <i>PhD Science Lessons</i>
<p>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</p> <ul style="list-style-type: none"> Science assumes consistent patterns in natural systems. 	<p>Level 4 M1 L6–L7</p>
<p>Science Is a Human Endeavor</p> <ul style="list-style-type: none"> Science affects everyday life. Most scientists and engineers work in teams. 	<p>Level 4 M2 L1–L3 Level 4 M2 L17–L23</p>

Connections to Engineering, Technology, and Applications of Science	Aligned <i>PhD Science Lessons</i>
<p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none"> Knowledge of relevant scientific concepts and research findings is important in engineering. 	<p>Level 4 M1 L12–L17</p>
<p>Influence of Engineering, Technology, and Science on Society and the Natural World</p> <ul style="list-style-type: none"> Engineers improve existing technologies or develop new one. Over time, people’s needs and wants change, as do their demands for new and improved technologies. Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks and to meet societal demands. 	<p>Level 4 M1 L12–L17 Level 4 M1 L23–L24 Level 4 M2 L15–L23</p>

Colorado Academic Standards for Science Correlation to *PhD Science*™

 Green indicates that *PhD Science*™ fully addresses the standard within the grade level.

 Blue indicates that *PhD Science* covers the standard but in a different grade level.








 Yellow indicates that *PhD Science* partially covers the standard within the grade level.

 Red indicates that *PhD Science* does not cover the standard.

Key: Module (M), Lesson (L)

PhD Science Level 5

The Grade 5 Colorado Academic Standards are fully covered by the Level 5 *PhD Science* curriculum. A detailed analysis of alignment appears in the table below.

Grade 5 Standards: Evidence Outcomes		Aligned <i>PhD Science</i> Lessons
Standard 1 Physical Science		
Grade Level Expectation: 1. Matter exists as particles that are too small to be seen; measurements of a variety of observable properties can be used to identify particular materials.		
5.1.1a	Develop a model to describe that matter is made of particles too small to be seen.	 Level 5 M1 L5–L10 Level 5 M1 L23–L26 Level 5 M3 L24–L27
5.1.1b	Make observations and measurements to identify materials based on their properties.	 Level 5 M1 L1–L4 Level 5 M1 L11–L17 Level 5 M1 L23–L26
Grade Level Expectation: 2. Chemical Reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.		
5.1.2a	Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.	 Level 5 M1 L9–L17 Level 5 M1 L23–L26
5.1.2b	Conduct an investigation to determine whether the mixing of two or more substances results in new substances.	 Level 5 M1 L1–L2 Level 5 M1 L13–L26
Grade Level Expectation: 3. The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.		
5.1.3a	Support an argument that the gravitational force exerted by Earth on objects is directed down.	 Level 5 M4 L3–L4 Level 5 M4 L24–L26
Grade Level Expectation: 4. The energy released from food was once energy from the sun.		
5.1.4a	Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun.	 Level 5 M2 L15–L19 Level 5 M2 L24–L26
Standard 2 Life Science		
Grade Level Expectation: 1. Plants acquire their material from growth chiefly from air and water.		
5.2.1a	Support an argument that plants get the materials they need for growth chiefly from air and water.	 Level 5 M2 L3–L5

Grade Level Expectation: 2. Matter cycles between air and soil and among plants, animals and microbes as these organisms live and die.		
5.2.2a	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	Level 5 M2 L8–L14 Level 5 M2 L20 Level 5 M2 L24–L26
Standard 3 Earth and Space Science		
Grade Level Expectation: 1. Stars range greatly in size and distance from Earth, and this can explain their relative brightness.		
5.3.1a	Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.	Level 5 M4 L18–L19 Level 5 M4 L24–L26
Grade Level Expectation: 2. Earth’s orbit and rotation and the orbit of the moon around earth cause observable patterns.		
5.3.2a	Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.	Level 5 M4 L1–L2 Level 5 M4 L5–L17 Level 5 M4 L20–L26
Grade Level Expectation: 3. Earth’s major systems interact in multiple ways to affect Earth’s surface materials and processes.		
5.3.3a	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	Level 5 M3 L6–L11
Grade Level Expectation: 4. Most of Earth’s water is in the ocean and much of Earth’s freshwater in glaciers or underground.		
5.3.4a	Describe and graph the amounts and percentages of saltwater and freshwater in various reservoirs to provide evidence about the distribution of water on Earth.	Level 5 M3 L4–L5 Level 5 M3 L19–L27
Grade Level Expectation: 5. Societal activities have had major effects on land, ocean, atmosphere, and even outer space.		
5.3.5a	Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.	Level 5 M3 L14–L27

Science and Engineering Practices		Aligned <i>PhD Science Lessons</i>
2	Developing and Using Models <ul style="list-style-type: none"> Use models to describe phenomena. Develop a model to describe phenomena. Develop a model using an example to describe a scientific principle. 	Level 5 M1 L1–L2 Level 5 M1 L5–L10 Level 5 M1 L13–L14 Level 5 M1 L23–L26 Level 5 M2 L1–L2 Level 5 M2 L6–L7 Level 5 M2 L14 Level 5 M2 L20 Level 5 M3 L1–L3 Level 5 M3 L6–L16 Level 5 M3 L19–L27 Level 5 M4 L1–L4 Level 5 M4 L7–L18 Level 5 M4 L20–L26
3	Planning and Carrying Out Investigations	Level 5 M1 L13–L14 Level 5 M1 L18–L22

	<ul style="list-style-type: none"> Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. 	Level 5 M2 L3–L5 Level 5 M3 L10–L11 Level 5 M4 L5–L6 Level 5 M4 L18–L19
4	Analyzing and Interpreting Data <ul style="list-style-type: none"> Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. 	Level 5 M1 L15–L17 Level 5 M2 L3–L5 Level 5 M2 L8–L13 Level 5 M2 L15–L17 Level 5 M3 L4–L5 Level 5 M3 L14–L16 Level 5 M4 L14–L15
5	Using Mathematics and Computational Thinking <ul style="list-style-type: none"> Measure and graph quantities such as weight to address scientific and engineering questions and problems. Describe and graph quantities such as area and volume to address scientific questions. 	Level 5 M1 L3–L4 Level 5 M1 L15–L22 Level 5 M3 L10–L11 Level 5 M3 L24–L27 Level 5 M4 L5–L6
6	Constructing Explanations and Designing Solutions <ul style="list-style-type: none"> Support an argument with evidence, data, or a model. 	Level 5 M1 L5–L6 Level 5 M1 L11–L12 Level 5 M1 L23–L26 Level 5 M2 L12–L13 Level 5 M2 L15–L17 Level 5 M2 L21–L26 Level 5 M3 L17–L23 Level 5 M4 L3–L4 Level 5 M4 L9–L12 Level 5 M4 L20–L26
7	Engaging in Argument from Evidence <ul style="list-style-type: none"> Support an argument with evidence, data, or a model. 	Level 5 M1 L3–L4 Level 5 M2 L3–L5 Level 5 M2 L8–L11 Level 5 M2 L21–L23 Level 5 M3 L19–L23 Level 5 M4 L5–L6 Level 5 M4 L13–L17 Level 5 M4 L20–L21
8	Obtaining, Evaluating, and Communicating Information <ul style="list-style-type: none"> Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. 	Level 5 M2 L6–L7 Level 5 M2 L10–L11 Level 5 M2 L18–L20 Level 5 M3 L9 Level 5 M3 L14–L16 Level 5 M3 L19–L27 Level 5 M4 L18–L19

Disciplinary Core Ideas		Aligned <i>PhD Science</i> Lessons
PS1 Matter and Its Interactions		
PS1.A	Structure and Properties of Matter	

	Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. Measurements of a variety of properties can be used to identify materials.		Level 5 M1 L1–L17 Level 5 M1 L23–L26
PS1.B	Chemical Reactions		
	No matter what reaction or change in properties occurs, the total weight of the substances does not change. When two or more different substances are mixed, a new substance with different properties may be formed.		Level 5 M1 L1–L2 Level 5 M1 L9–L26
PS2 Motion and Stability: Forces and Interactions			
PS2.B	Types of Interactions		
	The gravitational force of Earth acting on an object near Earth’s surface pulls that object toward the planet’s center.		Level 5 M4 L3–L4 Level 5 M4 L24–L26
PS3 Energy			
PS3.D	Energy in Chemical Processes and Everyday Life		
	The energy released from food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).		Level 5 M2 L6–L7 Level 5 M2 L15–L19 Level 5 M2 L24–L26
LS1 From Molecules to Organisms: Structures and Processes			
LS1.C	Organization for Matter and Energy Flow in Organisms		
	Plants acquire their material for growth chiefly from air and water.		Level 5 M2 L3–L5 Level 5 M2 L8–L9 Level 5 M2 L15–L19 Level 5 M2 L24–L26
LS2 Ecosystems: Interactions, Energy, and Dynamics			
LS2.A	Interdependent Relationships in Ecosystems		
	The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plant parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.		Level 5 M2 L1–L2 Level 5 M2 L8–L14 Level 5 M2 L20 Level 5 M2 L24–L26
LS2.B	Cycles of Matter and Energy Transfer in Ecosystems		
	Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.		Level 5 M2 L6–L7 Level 5 M2 L10–L14 Level 5 M2 L24–L26
ESS1 Earth’s Place in the Universe			
ESS1.A	The Universe and Its Stars		
	The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.		Level 5 M4 L18–L19 Level 5 M4 L24–L26

ESS1.B	Earth and the Solar System		Level 5 M4 L1–L2 Level 5 M4 L5–L18 Level 5 M4 L20–L26
	The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.		
ESS2 Earth's Systems			
ESS2.A	Earth Materials and Systems		Level 5 M3 L1–L13 Level 5 M3 L24–L27
	Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.		
ESS2.C	The Roles of Water in Earth's Surface Processes		Level 5 M3 L4–L5 Level 5 M3 L24–L27
	Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.		
ESS3 Earth and Human Activity			
ESS3.C	Human Impacts on Earth Systems		Level 5 M3 L14–L27
	Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.		

Crosscutting Concepts		Aligned PhD Science Lessons
1	Patterns <ul style="list-style-type: none"> Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena. 	Level 5 M1 L7–L8 Level 5 M2 L1–L5 Level 5 M2 L8–L9 Level 5 M2 L15–L17 Level 5 M3 L6–L9 Level 5 M4 L1–L17 Level 5 M4 L20–L26
2	Cause and Effect <ul style="list-style-type: none"> Cause – and – effect relationships are routinely identified, tested, and used to explain change. 	Level 5 M1 L1–L2 Level 5 M1 L5–L6 Level 5 M1 L9–L10 Level 5 M1 L18–L22 Level 5 M2 L3–L7 Level 5 M2 L12–L13 Level 5 M2 L18–L23 Level 5 M3 L6–L8 Level 5 M3 L12–L18 Level 5 M4 L5–L6 Level 5 M4 L24–L26
3	Scale, Proportion, and Quantity	Level 5 M1 L3–L4

	<ul style="list-style-type: none"> Natural objects exist from the very small to the immensely large. Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. 	<ul style="list-style-type: none"> Level 5 M1 L13–L17 Level 5 M1 L23–L26 Level 5 M2 L10–L11 Level 5 M3 L1–L5 Level 5 M3 L10–L11 Level 5 M3 L24–L27 Level 5 M4 L18–L19 Level 5 M4 L24–L26
4	<p>Systems and System Models</p> <ul style="list-style-type: none"> A system can be described in terms of its components and their interactions. 	<ul style="list-style-type: none"> Level 5 M1 L3–L4 Level 5 M1 L15–L17 Level 5 M2 L1–L2 Level 5 M2 L6–L11 Level 5 M2 L14 Level 5 M2 L18–L19 Level 5 M2 L24–L26 Level 5 M3 L1–L9 Level 5 M3 L12–L13 Level 5 M3 L19–L27 Level 5 M4 L1–L2 Level 5 M4 L7–L23
5	<p>Energy and Matter</p> <ul style="list-style-type: none"> Energy can be transferred in various ways and between objects. Matter is transported into, out of, and within systems. 	<ul style="list-style-type: none"> Level 5 M1 L5–L8 Level 5 M1 L13–L14 Level 5 M1 L23–L26 Level 5 M2 L6–L11 Level 5 M2 L14–L19 Level 5 M2 L24–L26 Level 5 M3 L10–L11 Level 5 M4 L3–L4

Connections to Nature of Science	Aligned <i>PhD Science Lessons</i>
<p>Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena</p> <ul style="list-style-type: none"> Science explanations describe the mechanisms for natural events. 	<ul style="list-style-type: none"> Level 5 M4 L1–L2 Level 5 M4 L7–L8 Level 5 M4 L13
<p>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</p> <ul style="list-style-type: none"> Science assumes consistent patterns in natural systems. 	<ul style="list-style-type: none"> Level 5 M1 L7–L8 Level 5 M4 L14–L15
<p>Science Addresses Questions about the Natural and Material World</p> <ul style="list-style-type: none"> Science findings are limited to questions that can be answered with empirical evidence. 	<ul style="list-style-type: none"> Level 5 M3 L10–L11 Level 5 M4 L5–L6