North Dakota Science Content Standards 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.

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Key: Module (M), Lesson (L)

PhD Science Level 3

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

Grade 3 Performance Expectations			**Aligned *PhD Science* Lessons**
3-PS2 Motion & Stability: Forces & Interactions			
3-PS2-1	Plan and conduct an investigation to prove the effects of balanced and unbalanced forces on the motion of an object.	Green	Level 3 M4 L10–L18 Level 3 M4 L28–L30
3-PS2-2	Make observations and metric measurements of an object's motion to prove that a pattern can be used to predict future motion.	Green	Level 3 M4 L1–L9 Level 3 M4 L28–L30
3-PS2-3	Ask questions to determine cause and effect relationships of static electricity or magnetic interactions between two objects not in contact with each other.	Green	Level 3 M4 L19–L21 Level 3 M4 L28–L30
3-PS2-4	Define a simple design problem that can be solved by applying scientific ideas about magnets.	Green	Level 3 M4 L22–L30
3-LS1 From Molecules to Organisms: Structures and Processes			
3-LS1-1	Develop models to describe that organisms have unique and diverse life cycles but all experience birth, growth, reproduction, and death.	Green	Level 3 M3 L7–L8 Level 3 M3 L23–L28
3-LS2 Ecosystems: Interactions, Energy, Dynamics			
3-LS2-1	Construct an argument that some animals form groups that help members survive.	Green	Level 3 M2 L13–L15 Level 3 M2 L26–L28
3-LS3 Heredity: Inheritance & Variation of Traits			
3-LS3-1	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.	Green	Level 3 M3 L1–L6 Level 3 M3 L14–L18 Level 3 M3 L26–L28
3-LS3-2	Use evidence to support the explanation that the environment can influence the expression of traits.	Green	Level 3 M3 L9–L13 Level 3 M3 L19–L20 Level 3 M3 L26–L28
3-LS4 Biological Evolution: Unity & Diversity			
3-LS4-1	Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.	Green	Level 3 M2 L1–L8 Level 3 M2 L26–L28

3-LS4-2	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
3-LS4-3	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-ESS2 Earth's Systems			
3-ESS2-1	Represent data in tables and graphical displays to describe and predict typical weather conditions expected during a particular season.		Level 3 M1 L1–L15 Level 3 M1 L19–L20 Level 3 M1 L27–L29
3-ESS2-2	Obtain and combine information to describe climates in different regions of the world.		Level 3 M1 L11–L15 Level 3 M1 L27–L29
3-ESS3 Earth & Human Activity			
3-ESS3-1	Evaluate the feasibility of a design solution that reduces the impacts of a weather-related hazard.		Level 3 M1 L1–L3 Level 3 M1 L16–L29
3–ET1 Engineering & Technology			
3-ET1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.		Level 3 M1 L21–L26 Level 3 M4 L23–L27
3-ET1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.		Level 4 M1 L12–L17 Level 5 M3 L19–L23
3-ET1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.		Level 3 M2 L23–L27 Level 3 M4 L23–L27

Science & Engineering Practices			**Aligned *PhD Science* Lessons**
1	Asking Questions and Defining Problems • 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. • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.		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 • 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 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
3	Planning and Carrying Out Investigations • 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. • Science findings are based on recognizing patterns.		Level 3 M2 L4–L5 Level 3 M3 L12–L13 Level 3 M4 L7–L18 Level 3 M4 L23–L30
4	Analyzing and Interpreting Data • 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.		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
6	Constructing Explanations and Designing Solutions • Use evidence (e.g., observations, patterns) to support an explanation. • Use evidence (e.g., observations, patterns) to construct an explanation. • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.		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
7	Engaging in Argument from Evidence • 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.		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
8	Obtaining, Evaluating, and Communicating Information • Obtain and combine information from books and other reliable media to explain phenomena.		Level 3 M1 L16–L17 Level 3 M2 L13–L15 Level 3 M2 L20–L21 Level 3 M4 L22

Disciplinary Core Ideas		Aligned *PhD Science* Lessons
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	**Types 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.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.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.A	**Inheritance of Traits**	
	Many characteristics of organisms are inherited from their parents.	Level 3 M3 L14–L18 Level 3 M3 L26–L28
	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 L9–L13 Level 3 M3 L19–L20 Level 3 M3 L26–L28
LS3.B	**Variation of Traits**	
	Different organisms vary in how they look and function because they have different inherited information.	Level 3 M3 L1–L6 Level 3 M3 L14–L18 Level 3 M3 L23–L28
	Environmental factors such as toxins may affect the traits that an organism develops.	Level 3 M3 L9–L13 Level 3 M3 L19–L20 Level 3 M3 L26–L28
LS4.A	**Evidence of Common Ancestry and Diversity**	
	Some kinds of plants and animals that once lived on Earth are no longer found anywhere.	Level 3 M2 L6–L8 Level 3 M2 L26–L28
	Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.	Level 3 M2 L1–L5 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 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
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.		Level 3 M1 L1–L15 Level 3 M1 L19–L20 Level 3 M1 L27–L29
	Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.		Level 3 M1 L11–L15 Level 3 M1 L27–L29
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
ET1.A	**Defining and Delimiting Engineering Problems**		
	Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.		Level 3 M1 L21–L26
ET1.B	**Developing Possible Solutions**		
	Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.		Level 3 M1 L21–L26
	At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.		Level 3 M2 L23–L27
	Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.		Level 3 M4 L23–L27
ET1.C	**Optimizing the Design Solution**		
	Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.		Level 3 M4 L23–L27

Crosscutting Concepts			Aligned *PhD Science* Lessons
1	Patterns • Similarities and differences in patterns can be used to sort and classify natural phenomena. • Patterns of change can be used to make predictions.		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 • 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 • Observable phenomena exists 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

Connections to Nature of Science		Aligned *PhD Science* Lessons
Scientific Knowledge Is Based on Empirical Evidence • Science findings are based on recognizing patterns.		Level 3 M3 L7–L8 Level 3 M4 L4–L6

PhD SCIENCE™

GREAT MINDS

North Dakota Science Content Standards Correlation to *PhD Science*™

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Key: Module (M), Lesson (L)

PhD Science Level 4

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

Grade 4 Performance Expectations			**Aligned *PhD Science* Lessons**
4-PS3 Energy			
4-PS3-1	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
4-PS3-2	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
4-PS3-3	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
4-PS3-4	Using the engineering design process build a device that converts energy from one form to another.		Level 4 M2 L12–L26
4-PS4 Waves and Their Applications in Technologies for Information Transfer			
4-PS4-1	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
4-PS4-3	Construct a code to convey information by researching past and present methods of transmitting information.		Level 4 M4 L14–L19 Level 4 M4 L24–L26
4-LS1 From Molecules to Organisms: Structures and Processes			
4-LS1-1	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-LS1-2	Form an explanation 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
4-ESS1 Earth's Place in the Universe			
4-ESS1-1	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 L1–L5 Level 4 M1 L19–L20 Level 4 M1 L25–L27

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GREAT MINDS

4-ESS2 Earth & Space Science			
4-ESS2-1	Make observations and metric measurements to provide evidence of the effects of weathering and the rate of erosion by water, ice, wind, or vegetation.		Level 4 M1 L6–L11 Level 4 M1 L25–L27
4-ESS2 Earth's Systems			
4-ESS2-2	Analyze and interpret data from maps to describe patterns of Earth's features.		Level 4 M1 L18–L20 Level 4 M1 L25–L27
4-ESS3 Earth and Human Activity			
4-ESS3-1	Obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment.		Level 4 M1 L21–L27
4-ESS3-2	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
4-ET1 Engineering & Technology			
4-ET1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.		Level 4 M2 L17–L23
4-ET1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.		Level 4 M1 L12–L17
4-ET1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.		Level 3 M2 L23–L27 Level 3 M4 L23–L27 Level 5 M1 L18–L22

Science & Engineering Practices			**Aligned *PhD Science* Lessons**
1	Asking Questions and Defining Problems • Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.		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 • Develop a model using an analogy, example, or abstract representation to describe a scientific principle. • Use a model to test interactions concerning the functioning of a natural system.		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 • Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. • 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.		Level 4 M1 L6–L11 Level 4 M1 L21–L22 Level 4 M2 L6–L7 Level 4 M2 L10–L14 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 • 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 • Use evidence (e.g. observations or patterns) to construct an explanation. • 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.		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 • Construct an argument with evidence, data, and/or a model.		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 • 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 *PhD Science* Lessons**
PS3.A	**Definitions of Energy**		
	The faster a given object is moving, the more energy it possesses.		Level 4 M2 L6–L9 Level 4 M2 L12–L16 Level 4 M2 L24–L26
	Energy can be transferred from place to place by moving objects or through sound, light, or electric currents.		Level 4 M2 L1–L3 Level 4 M2 L10–L11 Level 4 M2 L15–L16 Level 4 M2 L24–L26
	Energy can be moved from place to place by moving objects or through sound, light, or electric currents.		Level 4 M2 L1–L3 Level 4 M2 L10–L11 Level 4 M2 L15–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.		Level 4 M2 L1–L5 Level 4 M2 L8–L9 Level 4 M2 L24–L26
	Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred causing a change		Level 4 M2 L1–L5 Level 4 M2 L8–L9 Level 4 M2 L24–L26

	in motion. In such collisions, some energy is also transferred to the surrounding air as heat or sound.		
	Energy can also be transferred from place to place by electric currents to produce motion, sound, heat, or light.		Level 4 M2 L1–L3 Level 4 M2 L10–L26
	Energy can also be transferred from place to place by electric currents, which can be used to produce motion, sound, heat, or light.		Level 4 M2 L1–L3 Level 4 M2 L10–L26

PS3.C	**Relationship between Energy and Forces**		
	When objects collide, the contact forces transfer energy 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.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 a beach.		Level 4 M3 L7–L11
	Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).		Level 4 M3 L7–L11 Level 4 M3 L29–L31
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.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 information, which may be 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.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.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.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 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.		Level 4 M1 L18–L20 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
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 (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.		Level 4 M1 L12–L17 Level 4 M1 L25–L27
ET1.A	**Defining and Delimiting Engineering Problems**		
	Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.		Level 4 M2 L17–L26
ET1.B	**Developing Possible Solutions**		
	Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.		Level 4 M1 L12–L17 Level 4 M4 L20–L23
	Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.		Level 4 M1 L12–L17 Level 4 M4 L20–L23
ET1.C	**Optimizing the Design Solution**		
	Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.		Level 4 M1 L12–L17 Level 4 M4 L20–L23

Crosscutting Concepts			Aligned *PhD Science* Lessons
1	Patterns • 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	Cause and Effect • 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 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	Systems and System Models • 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	Energy and Matter • Energy can be transferred in various ways and between objects.		Level 4 M2 L1–L3 Level 4 M2 L8–L26 Level 4 M3 L1–L3 Level 4 M3 L10–L19

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PhD Science Level 5

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

Grade 5 Performance Expectations			Aligned *PhD Science* Lessons
5-PS1 Matter and Its Interactions			
5-PS1-1	Develop a model to describe that matter is made of particles too small to be seen.	Green	Level 5 M1 L5–L10 Level 5 M1 L23–L26
5-PS1-2	Measure and graph metric quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total mass of matter is conserved.	Green	Level 5 M1 L9–L17 Level 5 M1 L23–L26
5-PS1-3	Make observations and measurements to identify materials based on their properties.	Green	Level 5 M1 L1–L4 Level 5 M1 L11–L17 Level 5 M1 L23–L26
5-PS1-4	Conduct an investigation to determine whether the mixing of two or more substances results in new substances.	Green	Level 5 M1 L1–L2 Level 5 M1 L13–L26
5-PS3 Energy			
5-PS3-1	Use models to describe how energy from the sun is converted into food (used for body repair, growth, motion, and to maintain body warmth).	Green	Level 5 M2 L15–L19 Level 5 M2 L24–L26
5-LS1 From Molecules to Organisms: Structures and Processes			
5-LS1-1	Support an argument that plants get the materials they need for growth chiefly from air and water.	Green	Level 5 M2 L3–L5 Level 5 M2 L20–L26
5-LS2 Ecosystems: Interactions, Energy, and Dynamics			
5-LS2-1	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	Green	Level 5 M2 L1–L2 Level 5 M2 L6–L14 Level 5 M2 L24–L26

5-ESS1 Earth's Place in the Universe			
5-ESS1-1	Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth.		Level 5 M4 L18–L19 Level 5 M4 L24–L26
5-ESS1-2	Construct a graph to reveal patterns of daily changes in length (metric) and direction of shadows, length of 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
5-ESS2 Earth's Systems			
5-ESS2-1	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.		Level 5 M3 L1–L3 Level 5 M3 L6–L13 Level 5 M3 L19–L27
5-ESS2-2	Describe and graph the amounts and percentages of [salt] water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.		Level 5 M3 L4–L5 Level 5 M3 L19–L27
5-ESS3 Earth and Human Activity			
5-ESS3-1	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.		Level 5 M3 L14–L18 Level 5 M3 L24–L27
5 Engineering & Technology			
5-ET1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.		Level 3 M1 L21–L26 Level 3 M4 L23–L27 Level 4 M2 L17–L23
5-ET1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.		Level 5 M3 L19–L23
5-ET1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.		Level 5 M1 L18–L22

Science and Engineering Practices			Aligned *PhD Science* Lessons
1	Asking Questions and Defining Problems • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.		Level 5 M1 L1–L2 Level 5 M2 L1–L2 Level 5 M2 L21–L23 Level 5 M3 L1–L3 Level 5 M3 L19–L23 Level 5 M4 L1–L2 Level 5 M4 L13

2	Developing and Using Models • Develop a model using an example to describe a scientific principle. • Develop a model to describe phenomena. • Use models to describe phenomena.		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 • Make observations and metric measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. • 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. • 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.		Level 5 M1 L13–L14 Level 5 M1 L18–L22 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 • 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 Mathematical and Computational Thinking • Measure (metric) and graph quantities such as mass to address scientific and engineering questions and problems. • Describe and graph quantities such as area and volume to address scientific quantities.		Level 5 M1 L3–L4 Level 5 M1 L15-L17 Level 5 M3 L10–11 Level 5 M3 L24–L27 Level 5 M4 L5–L6 Level 5 M4 L14–L15
6	Constructing Explanations and Designing Solutions • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.		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 • 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 • 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 *PhD Science* Lessons**
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.		Level 5 M1 L5–L10 Level 5 M1 L23–L26
	The mass of matter is conserved when it changes form, even in transitions in which it seems to vanish.		Level 5 M1 L9–L17 Level 5 M1 L23–L26
	Measurements of a variety of properties can be used to identify materials.		Level 5 M1 L1–L4 Level 5 M1 L11–L17 Level 5 M1 L23–L26
PS1.B	**Chemical Reactions**		
	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 L15–L26
	No matter what reaction or change in properties occurs, the total mass of the substances does not change.		Level 5 M1 L9–L17 Level 5 M1 L23–L26
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.C	**Organization for Matter and Energy Flow in Organisms**		
	Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion.		Level 5 M2 L8–L9 Level 5 M2 L15–L19 Level 5 M2 L24–L26
	Plants acquire their material for growth from carbon dioxide, the sun, and water through photosynthesis.		Level 5 M2 L3–L5 Level 5 M2 L24–L26
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		Level 5 M2 L1–L2 Level 5 M2 L8–L14

	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. A healthy ecosystem is a balanced ecosystem. Newly introduced species can damage the balance of an ecosystem.		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.		Level 5 M2 L6–L7 Level 5 M2 L10–L14 Level 5 M2 L24–L26
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**		
	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.		Level 5 M4 L1–L2 Level 5 M4 L5–L18 Level 5 M4 L20–L26
ESS2.A	**Earth Materials and Systems**		
	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.		Level 5 M3 L1–L13 Level 5 M3 L24–L27
ESS2.C	**The Roles of Water in Earth's Surface Processes**		
	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.		Level 5 M3 L4–L5 Level 5 M3 L24–L27
ESS3.C	**Human Impacts on Earth Systems**		
	Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. However, individuals and communities are doing things to help protect Earth's resources and environments.		Level 5 M3 L14–L27

ET1.A	**Defining and Delimiting Engineering Problems**		
	Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.		Level 5 M2 L21–L23
ET1.B	**Developing Possible Solutions**		
	Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.		Level 5 M3 L18–L22
	At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.		Level 5 M2 L21–L23 Level 5 M3 L19–L23
	Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.		Level 5 M1 L19–L23
ET1.C	**Optimizing the Design Solution**		
	Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.		Level 5 M1 L18–L22

Crosscutting Concepts			**Aligned *PhD Science* Lessons**
1	Patterns • 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 • Cause and effect relationships are routinely identified 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 • Natural objects exist from the very small to the immensely large. • Metric units are used to measure and describe physical quantities such as mass, length, temperature, and volume. • Metric units are used to measure and describe physical quantities such as weight, temperature, and volume. • Metric system is used to measure and describe physical quantities such as length, mass, and volume.		Level 5 M1 L3–L4 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	Systems and System Models • A system can be described in terms of its components and their interactions.		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	Energy and Matter • Energy can be transferred in various ways and between objects. • Matter is transported into, out of, and within systems.		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