PhD Science® K–5 Curriculum Correlation to the *Minnesota Academic Standards in Science*

Contents

K–2 Grade Band

3–5 Grade Band

PhD Science® Correlation to the *Minnesota Academic Standards in Science*: Level K

The *PhD Science* Level K curriculum mostly aligns with the Grade K *Minnesota Academic Standards in Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Grade K Standards and Benchmarks

Earth and Space Science (0E)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.1: Asking questions and defining problems

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read.	Level K M1 L1–3, 22–26 Level K M2 L1–3, 9 Level K M3 L1–3, 14–16, 27–29
Benchmark 0E.1.1.1.1 Ask questions to obtain information from weather forecasts to prepare for and respond to severe weather.	Level K M1 L8–9 Level K M3 L4–8, 22
Benchmark 0E.1.1.1.2 Ask questions about how a person may reduce the amount of natural resources the individual uses.	Level K M1 L8–9 Level K M3 L4–8, 22

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.1: Analyzing and interpreting data

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	Level K M3 L4–8, 14–20, 22–26 Level K M4 L25
Benchmark 0E.2.1.1.2 Make daily and seasonal observations of local weather conditions to describe patterns over time.	Level K M1 L1–11, 17–24, 28–30 Level K M4 L25

Physical Science (0P)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.2: Planning and carrying out investigations

Standards and Benchmarks	**Aligned PhD Science Lessons**
Standard 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena.	Level K M2 L7–8, 10–15 Level K M3 L4–8 Level K M4 L3–5
Benchmark 0P.1.2.1.1 Collect and organize observational data to determine the effect of sunlight on Earth's surface. (	Level K M1 L8–11, 28–30

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.1: Analyzing and interpreting data

Standards and Benchmarks	**Aligned PhD Science Lessons**
Standard 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	Level K M3 L4–8, 14–20, 22–26 Level K M4 L25
Benchmark 0P.2.1.1.1 Sort objects in terms of natural/human-made, color, size, shape, and texture, then communicate the reasoning for the sorting system.	Level 2 M1 L1–7

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.2 Using mathematics and computational thinking

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Level K M1 L17–21, 25–30 Level K M2 L17–20
Benchmark 0P.2.2.1.1 Identify and describe patterns that emerge from the effects of different strengths or different directions of pushes and pulls on the motion of an object.	Level K M2 L1–23

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.2: Constructing explanations and designing solutions

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.2.2 Students will be able to use their understanding of scientific principles and the engineering design process to design solutions that meet established criteria and constraints.	Level K M2 L17–20
Standard 0P.3.2.2.1 Design and build a structure to reduce the warming effect of sunlight on Earth's surface.	Level K M1 L8–16, 28–30

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.1: Engaging in argument from evidence

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 4.1.1 Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of others, and present counter arguments.	Level K M3 L17–21, 27–29 Level K M4 L3–5, 11–13
Benchmark 0P.4.1.1.1 Construct an argument supported by evidence for whether a design solution works as intended to change the speed or direction of an object with a push or a pull.	Level K M2 L1–23

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.2: Obtaining, evaluating, and communicating information

Standards and Benchmarks	Aligned *PhD Science* Lessons
Standard 4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	Level K M4 L1–2, 6–10, 14–16, 18–24, 26–28 Level K M1 L12–16, 28–30 Level K M2 L21–23 Level K M3 L27–29
Benchmark 0P.4.2.2.1 Communicate design ideas for a structure that reduces the warming effect of sunlight on Earth's surface.	Level K M1 L12–16

Life Science (0L)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.2: Planning and carrying out investigations

Standards and Benchmarks	Aligned PhD Science Lessons
Standard 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena.	Level 1 M1 L19–20 Level 1 M2 L15–18 Level 2 M2 L8–12 Level 2 M3 L3–7 Level 2 M4 L17–19
Benchmark 0L.1.2.1.2 Make observations of plants and animals to compare the diversity of life in different habitats.	Level K M4 L3–5

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.1: Analyzing and interpreting data

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	Level K M3 L4–8, 14–20, 22–26 Level K M4 L25
Benchmark 0L.2.1.1.3 Record and use observations to describe patterns of what plants and animals (including humans) need to survive.	Level K M3 L4–16, 19–22, 27–29

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.1: Developing and using models

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions, and/or explanations and communicate ideas to others.	Level K M1 L12–16 Level K M3 L1–3, 9–12, 19–20 Level K M4 L1–9, 11–16
Benchmark 0L.3.1.1.1 Develop a simple model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.	Level K M3 L1–3, 9–29 Level K M4 L1–2, 8–9, 11–13

Science and Engineering Practices (P)	Aligned PhD Science Lessons
1. Asking Questions and Defining Problems	Level K M1 L1–9, 12–16, 22–26 Level K M2 L1–3, 9 Level K M3 L1–8, 14–16, 22, 27–29
2. Developing and Using Models	Level K M1 L1–2, 12–16 Level K M2 L1–3, 10–12 Level K M3 L1–3, 9–12, 19–20 Level K M4 L1–9, 11–16
3. Planning and Carrying Out Investigations	Level K M1 L4–7, 10–24, 27–30 Level K M2 L7–8, 10–23 Level K M3 L4–8, 21 Level K M4 L3–5
4. Analyzing and Interpreting Data	Level K M1 L4–7, 22–24 Level K M2 L4–8, 21–23 Level K M3 L1–20, 22–26 Level K M4 L1–2, 6–7, 10, 14–17, 20–28
5. Using Mathematics and Computational Thinking	Level K M1 L17–21, 25–30 Level K M2 L17–20
6. Constructing Explanations and Designing Solutions	Level K M2 L17–20 Level K M3 L4–16, 23–29
7. Engaging in Argument from Evidence	Level K M3 L17–21, 27–29 Level K M4 L3–5, 11–13, 25
8. Obtaining, Evaluating, and Communicating Information	Level K M1 L12–16, 28–30 Level K M2 L21–23 Level K M3 L23–29 Level K M4 L1–2, 6–10, 14–16, 18–24, 26–28

Disciplinary Core Ideas (CI)

Physical Science	Aligned *PhD Science* Lessons
PS1: Matter and Its Interactions	Level 2 M1 L1–31 Level 2 M2 L3–4, 14–17
PS2: Motion and Stability: Forces and Interactions	Level K M2 L1–23
PS3: Energy	Level K M1 L8–16, 28–30

Life Science	Aligned PhD Science Lessons
LS1: From Molecules to Organisms: Structures and Processes	Level K M3 L4–16, 19–22, 27–29
LS2: Ecosystems: Interactions, Energy, and Dynamics	Level 2 M3 L1–29
LS4: Biological Evolution: Unity and Diversity	Level 2 M4 L1–3, 7–25

Earth and Space Science	Aligned *PhD Science* Lessons
ESS2: Earth's Systems	Level K M1 L1–11, 17–24, 28–30 Level K M4 L25 Level K M4 L1–10, 14–16, 26–28
ESS3: Earth and Human Activity	Level K M1 L22–30 Level K M3 L1–3, 9–29 Level K M4 L1–2, 8–9, 11–24, 26–28

Engineering, Technology, and the Applications of Science	Aligned PhD Science Lessons
ETS1: Engineering Design	Level K M1 L12–16 Level K M2 L17–20 Level K M4 L20–24
ETS2: Links Among Engineering, Technology, Science, and Society	Level K M3 L1–3 Level K M4 L11–13, 18–19, 25

Crosscutting Concepts (CC)	Aligned *PhD Science* Lessons
1. Patterns	Level K M1 L17–30 Level K M2 L1–6, 17–20 Level K M3 L4–8, 14–20, 22, 26–29 Level K M4 L3–5
2. Cause and Effect	Level K M2 L4–23 Level K M4 L3–5, 10, 14–19, 26–28
4. Systems and System Models	Level K M3 L1–3, 9–13, 19–21, 23–25, 27–29 Level K M4 L1–9, 11–16
7. Stability and Change	Level K M1 L8–9, 17–21 Level K M4 L14–16

PhD Science® Correlation to the *Minnesota Academic Standards in Science*: Level 1

The *PhD Science* Level 1 curriculum mostly aligns with the Grade 1 *Minnesota Academic Standards in Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Grade 1 Standards and Benchmarks

Earth and Space Science (1E)

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.2: Using mathematics and computational thinking

Standards and Benchmarks	Aligned PhD Science Lessons
Standard 2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Level K M1 L17–21, 25—30 Level K M2 L17–20 Level 2 M1 L20–22 Level 2 M3 L8–11, 23–29 Level 2 M4 L7–8, 17–22
Benchmark 1E.2.2.1.1 Use quantitative data to identify and describe patterns in the amount of time it takes for Earth processes to occur and determine whether they occur quickly or slowly.	Level 2 M2 L18–24

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.1: Engaging in argument from evidence

Standards and Benchmarks	Aligned PhD Science Lessons
Standard 4.1.1 Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of others, and present counter arguments.	Level 1 M3 L4–6 Level 1 M4 L9–21
Benchmark 1E.4.1.1.1 Construct an argument based on observational evidence for how plants and animals (including humans) can change the non-living aspects of the environment to meet their needs.	Level K M4 L1–10, 14–16, 26–28
Standard 4.1.2 Students will be able to argue from evidence to justify the best solution to a problem or to compare and evaluate competing designs, ideas, or methods.	Level 1 M3 L8–9, 18–20
Benchmark 1E.4.1.2.1 Construct an argument with evidence to evaluate multiple solutions designed to slow or prevent wind or water from changing the shape of the land.	Level 2 M2 L1–17, 20, 22–24

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.2: Obtaining, evaluating, and communicating information

Standards and Benchmarks	Aligned *PhD Science* Lessons
Standard 4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	Level 1 M1 L24–25, 27–29 Level 1 M2 L21–23 Level 1 M3 L18–19, 26–29 Level 1 M4 L9–13, 23–25
Benchmark 1E.4.2.1.1 Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.	Level K M4 L14–24, 26–28

Physical Science (1P)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.2: Planning and carrying out investigations

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena.	Level 1 M1 L19–20 Level 1 M2 L4–12, 15–18, 20–23 Level 1 M3 L1–7, 11–13, 18–19 Level 1 M4 L4–6, 14–16, 19–21
Benchmark 1P.1.2.1.1 Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.	Level 1 M3 L1–17, 26–29

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.1: Analyzing and interpreting data

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	Level 1 M1 L16–21, 27–29 Level 1 M2 L1–9 Level 1 M3 L10 Level 1 M4 L4–6, 9–13
Benchmark 1P.2.1.1.1 Identify and describe patterns obtained from testing different materials and determine which materials have the properties that are best suited for producing and/or transmitting sound.	Level 1 M3 L1–17, 26–29

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.2: Constructing explanations and designing solutions

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.2.2 Students will be able to use their understanding of scientific principles and the engineering design process to design solutions that meet established criteria and constraints.	Level 1 M1 L7–8, 16–17, 22–23, 26–29 Level 1 M2 L4–7, 21–23 Level 1 M3 L4–6, 14, 26–29
Benchmark 1P.3.2.2.1 Design and build a device that uses light or sound to solve the problem of communicating over a distance.	Level 1 M3 L18–29

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.2: Obtaining, evaluating, and communicating information

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 4.2.2 Students will be able to gather information about and communicate the methods that are used by various cultures, especially those of Minnesota American Indian Tribes and communities, to develop explanations of phenomena and design solutions to problems.	Level 1 M1 L7–8, 16–17, 22–23, 26–29 Level 1 M2 L4–7, 21–23 Level 1 M3 L4–6, 14, 21–29 *PhD Science* does not cover Minnesota American Indian Tribes.
Benchmark 1P.4.2.2.1 Communicate solutions that use materials to provide shelter, food, or warmth needs for communities including Minnesota American Indian tribes and communities.	Level K M1 L1–2, 10—16 *PhD Science* does not cover Minnesota American Indian Tribes.

Life Science (1L)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.1: Asking questions and defining problems

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read.	Level 1 M1 L1–3 Level 1 M2 L1–3 Level 1 M3 L1–3 Level 1 M4 L1–3, 14–16
Benchmark 1L.1.1.1.1 Ask questions based on observations about the similarities and differences between young plants and animals and their parents.	Level 1 M1 L22–23, 26–29

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.1: Developing and using models

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions, and/or explanations, and communicate ideas to others.	Level 1 M1 L1–8, 11–15 Level 1 M2 L1–7, 10–23 Level 1 M3 L7, 11–13 Level 1 M4 L1–3, 7–8
Benchmark 1L.3.1.1.1 Develop a simple model based on evidence to represent how plants or animals use their external parts to help them survive, grow, and meet their needs.	Level 1 M1 L1–21, 27–29

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.2: Constructing explanations and designing solutions

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.2.2 Students will be able to use their understanding of scientific principles and the engineering design process to design solutions that meet established criteria and constraints.	Level 1 M1 L7–8, 11–17, 22–23, 26–29 Level 1 M2 L4–7, 21–23 Level 1 M3 L4–6, 14, 26–29
Benchmark 1L.3.2.2.2 Plan and design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.	Level 1 M1 L1–21, 27–29

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.2: Obtaining, evaluating, and communicating information

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	Level 1 M1 L24–25, 27–29 Level 1 M2 L21–23 Level 1 M3 L18–19, 26–29 Level 1 M4 L9–13, 14–18, 23–25
Benchmark 1L.4.2.1.2 Obtain information using various features of texts and other media to determine patterns in the behavior of parents and offspring that help offspring survive.	Level 1 M1 L24–29

Science and Engineering Practices	Aligned *PhD Science* Lessons
1. Asking Questions and Defining Problems	Level 1 M1 L1–3, 11–15 Level 1 M2 L1–3 Level 1 M3 L1–3 Level 1 M4 L1–3, 14–16
2. Developing and Using Models	Level 1 M1 L1–9, 11–15, 18 Level 1 M2 L1–7, 10–23 Level 1 M3 L7, 11–14 Level 1 M4 L1–3, 7–8
3. Planning and Carrying Out Investigations	Level 1 M1 L19–20 Level 1 M2 L4–12, 15–18, 20–23 Level 1 M3 L1–9, 11–13, 15–29 Level 1 M4 L1–6, 14–16, 19–21
4. Analyzing and Interpreting Data	Level 1 M1 L10, 16–21, 27–29 Level 1 M2 L1–9 Level 1 M3 L8–13, 15–16, 26–29 Level 1 M4 L4–6, 9–13
5. Using Mathematics and Computational Thinking	Level 1 M2 L15–18 Level 1 M3 L21–25
6. Constructing Explanations and Designing Solutions	Level 1 M1 L7–8, 11–17, 22–23, 26–29 Level 1 M2 L4–7, 21–23 Level 1 M3 L4–6, 14, 21–29
7. Engaging in Argument from Evidence	Level 1 M3 L4–6, 8–9, 18–20 Level 1 M4 L4–25
8. Obtaining, Evaluating, and Communicating Information	Level 1 M1 L24–25, 27–29 Level 1 M2 L21–23 Level 1 M3 L18–19, 26–29 Level 1 M4 L9–18, 23–25

Disciplinary Core Ideas

Physical Science	Aligned *PhD Science* Lessons
PS1: Matter and Its Interactions	Level 2 M1 L1–31 Level 2 M2 L3–4, 14–17
PS4: Waves and Their Applications in Technologies for Information Transfer	Level 1 M2 L1–23 Level 1 M3 L1–29

Life Science	Aligned *PhD Science* Lessons
LS1: From Molecules to Organisms: Structures and Processes	Level 1 M1 L1–21, 27–29
LS3: Heredity: Inheritance and Variation of Traits	Level 1 M1 L22–23, 26–29

Earth and Space Science	Aligned *PhD Science* Lessons
ESS1: Earth's Place in the Universe	Level 1 M4 L1–25
ESS2: Earth's Systems	Level K M1 L1–11, 17–24, 28–30 Level K M4 L25 Level K M4 L1–10, 14–16, 26–28 Level 2 M2 L1–17, 20, 22–24 Level 2 M4 L1–6, 11–16, 20–25
ESS3: Earth and Human Activity	Level K M1 L22–30 Level K M3 L1–3, 9–29 Level K M4 L1–2, 8–9, 11–24, 26–28

Engineering, Technology, and the Applications of Science	Aligned *PhD Science* Lessons
ETS1: Engineering Design	Level 1 M1 L11–15 Level 1 M3 L21–25
ETS2: Links Among Engineering, Technology, Science, and Society	Level 1 M1 L10–15 Level 1 M3 L20

Crosscutting Concepts	Aligned *PhD Science* Lessons
1. Patterns	Level 1 M1 L1–6, 16–29 Level 1 M2 L1–9, 21–23 Level 1 M3 L1–7, 11–13, 17–20, 26–29 Level 1 M4 L1–25
2. Cause and Effect	Level 1 M2 L1–7, 10–23 Level 1 M3 L4–7, 14–17, 26–29 Level 1 M4 L4–6, 9–13, 17–21, 23–25
4. Systems and System Models	Level 1 M1 L1–8, 16–17 Level 1 M2 L1–3, 10–23 Level 1 M3 L1–3, 8–10, 14, 21–29
6. Structure and Function	Level 1 M1 L4–15, 27–29 Level 1 M3 L8–9
7. Stability and Change	Level K M1 L8–9, 17–21 Level K M4 L14–16 Level 2 M2 L1–2, 18–24 Level 2 M3 L1–2, 25–29

PhD Science® Correlation to the *Minnesota Academic Standards in Science*: Level 2

The *PhD Science* Level 2 curriculum mostly aligns with the Grade 2 *Minnesota Academic Standards in Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Grade 2 Standards and Benchmarks

Earth and Space Science (2E)

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.1: Analyzing and interpreting data

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	Level 2 M1 L4–11, 14–18 Level 2 M2 L5–6, 8–9 Level 2 M3 L19–20 Level 2 M4 L22–25
Benchmark 2E.2.1.1.1 Represent data to describe typical weather conditions expected during a particular season.	Level 3 M1 L4–12
Benchmark 2E.2.1.1.2 Analyze data from tests of objects designed to reduce the impacts of a weather-related hazards and compare the strengths and weaknesses of how each performs.	Level 3 M1 L16–25

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.2: Obtaining, evaluating, and communicating information

Standards and Benchmarks	Aligned *PhD Science* Lessons
Standard 4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	Level 2 M1 L29–31 Level 2 M2 L1–2, 14–17, 22–24 Level 2 M3 L8–12, 14–20, 25–29 Level 2 M4 L23–25
Benchmark 2E.4.2.1.1 Obtain and use information from multiple sources to identify where water is found on Earth.	Level 2 M4 L1–6, 16, 22–25
Benchmark 2E.4.2.1.2 Obtain and use information from multiple sources, including electronic sources, to describe climates in different regions of the world.	Level 3 M1 L11–15

Physical Science (2P)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.1: Asking questions and defining problems

Standards and Benchmarks	Aligned *PhD Science* Lessons
Standard 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read.	Level 2 M1 L1–3 Level 2 M2 L1–2 Level 2 M3 L1–6 Level 2 M4 L1–3
Benchmark 2P.1.1.1.1 Ask questions about an object's motion based on observation, that can be answered by an investigation.	Level 3 M4 L1–9

Strand 1: Exploring phenomena or engineering problems

Substrand 1.2: Planning and carrying out investigations

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena.	Level 2 M1 L1–3, 29–31 Level 2 M2 L1–6, 8–12, 14–19 Level 2 M3 L3–11, 13, 21–22, 25–29 Level 2 M4 L16–19
Benchmark 2P.1.2.1.1 Plan and conduct an investigation to describe how heating and cooling affects different kinds of materials based upon their observable properties.	Level 2 M1 L14–19, 29–31

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.2: Using mathematics and computational thinking

Standards and Benchmarks	**Aligned PhD Science Lessons**
Standard 2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Level 2 M2 L14–17 Level 2 M4 L7–8, 20–22
Benchmark 2P.2.2.1.1 Identify and predict quantitative patterns of the effects of balanced and unbalanced forces on the motion of an object.	Level 3 M4 L10–18

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.1: Developing and using models

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions, and/or explanations, and communicate ideas to others.	Level 2 M1 L1–3, 14–16, 19, 29–31 Level 2 M2 L1–2, 14–17, 20–24 Level 2 M3 L1–6, 8–12, 19–20, 23–29 Level 2 M4 L1–3, 7–8
Benchmark 2P.3.1.1.1 Develop a simple diagram or physical model to illustrate how some changes caused by heating or cooling can be reversed and some cannot.	Level 2 M1 L14–19, 29–31

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.2: Obtaining, evaluating, and communicating information

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 4.2.2 Students will be able to gather information about and communicate the methods that are used by various cultures, especially those of Minnesota American Indian Tribes and communities, to develop explanations of phenomena and design solutions to problems.	Level 2 M1 L8–9, 12–13, 17–19, 23, 29–31 Level 2 M2 L3–4, 8–17, 22–24 Level 2 M4 L23–25 *PhD Science* does not cover Minnesota American Indian Tribes.
Benchmark 2P.4.2.2.1 Obtain information and communicate how Minnesota American Indian Tribes and communities and other cultures apply knowledge of the natural world in determining which materials have the properties that are best suited for an intended purpose.	Level 2 M1 L20–31 *PhD Science* does not cover Minnesota American Indian Tribes.

Life Science (2L)

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.2: Constructing explanations and designing solutions

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.2.2 Students will be able to use their understanding of scientific principles and the engineering design process to design solutions that meet established criteria and constraints.	Level 2 M1 L8–9, 12–13, 17–19, 23–31 Level 2 M2 L3–4, 7–17, 22–24 Level 2 M4 L23–25
Benchmark 2L.3.2.2.1 Engineer a device that mimics the structures and functions of plants or animals in seed dispersal.	Level 2 M3 L8–29

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.1: Engaging in argument from evidence

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 4.1.1 Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of others, and present counter arguments.	Level 2 M2 L3–4, 10–13, 20, 21–24 Level 2 M4 L4–6, 9–13, 23–25
Benchmark 2L.4.1.1.1 Construct an argument with evidence that evaluates how in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.	Level 2 M4 L1–3, 7–25

Science and Engineering Practices	Aligned *PhD Science* Lessons
1. Asking Questions and Defining Problems	Level 2 M1 L1–3 Level 2 M2 L1–2 Level 2 M3 L1–6, 14–18 Level 2 M4 L1–3
2. Developing and Using Models	Level 2 M1 L1–3, 14–16, 19, 29–31 Level 2 M2 L1–2, 14–17, 20–24 Level 2 M3 L1–6, 8–12, 14–20, 23–29 Level 2 M4 L1–8, 20–21, 23–25
3. Planning and Carrying Out Investigations	Level 2 M1 L1–3, 17–18, 20–22, 24–31 Level 2 M2 L1–6, 8–12, 14–19, 22–24 Level 2 M3 L3–11, 13, 21–22, 25–29 Level 2 M4 L16–19
4. Analyzing and Interpreting Data	Level 2 M1 L4–11, 14–18, 20–22, 24–28 Level 2 M2 L5–6, 8–9 Level 2 M3 L14–20 Level 2 M4 L22–25
5. Using Mathematics and Computational Thinking	Level 2 M1 L20–22 Level 2 M2 L14–17 Level 2 M3 L8–11, 23–29 Level 2 M4 L7–8, 17–22
6. Constructing Explanations and Designing Solutions	Level 2 M1 L8–9, 12–13, 17–19, 23–31 Level 2 M2 L3–4, 7–17, 22–24 Level 2 M4 L23–25
7. Engaging in Argument from Evidence	Level 2 M2 L3–4, 10–13, 20–24 Level 2 M3 L14–18, 21–22 Level 2 M4 L4–6, 9–13, 16, 20–21, 23–25
8. Obtaining, Evaluating, and Communicating Information	Level 2 M1 L29–31 Level 2 M2 L1–2, 5–6, 14–19, 22–24 Level 2 M3 L8–12, 14–20, 25–29 Level 2 M4 L4–9, 11–16, 23–25

Disciplinary Core Ideas

Physical Science	Aligned *PhD Science* Lessons
PS1: Matter and Its Interactions	Level 2 M1 L1–31 Level 2 M2 L3–4, 14–17
PS2: Motion and Stability: Forces and Interactions	Level K M2 L1–23
PS3: Energy	Level K M1 L8–16, 28–30

Life Science	Aligned *PhD Science* Lessons
LS2: Ecosystems: Interactions, Energy, and Dynamics	Level 2 M3 L1–29
LS4: Biological Evolution: Unity and Diversity	Level 2 M4 L1–3, 7–25

Earth and Space Science	Aligned *PhD Science* Lessons
ESS2: Earth's Systems	Level 2 M2 L1–17, 20, 22–24 Level 2 M4 L1–6, 11–16, 20–25
ESS3: Earth and Human Activity	Level K M1 L22–30 Level K M3 L1–3, 9–29 Level K M4 L1–2, 8–9, 11–24, 26–28

Engineering, Technology, and the Applications of Science	Aligned *PhD Science* Lessons
ETS1: Engineering Design	Level 2 M1 L24–28 Level 2 M2 L8–12, 14–17 Level 2 M3 L14–18
ETS2: Links Among Engineering, Technology, Science, and Society	Level 2 M2 L14–17 Level 2 M3 L3–6, 14–18

Crosscutting Concepts	Aligned *PhD Science* Lessons
1. Patterns	Level 2 M1 L4–9 Level 2 M2 L1–2, 5–6 Level 2 M4 L1–8, 11–15, 20–21, 23–25
2. Cause and Effect	Level 2 M1 L14–19, 29–31 Level 2 M2 L8–12, 20–21 Level 2 M3 L3–11
6. Structure and Function	Level 2 M1 L24–28 Level 2 M2 L14–17 Level 2 M3 L8–11, 14–22

PhD Science® Correlation to the *Minnesota Academic Standards in Science*: Level 3

The *PhD Science* Level 3 curriculum mostly aligns with the Grade 3 *Minnesota Academic Standards in Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Grade 3 Standards and Benchmarks

Earth and Space Science (3E)

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.1 Analyzing and interpreting data

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	Level 3 M1 L4–12 Level 3 M3 L7–8, 27–28 Level 3 M4 L4–9
Benchmark 3E.2.1.1.1 Record observations of the Sun, moon, and stars and use them to describe patterns that can be predicted.	Level 5 M4 L1–2, 5–17, 20–26

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.2 Using mathematics and computational thinking

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Level 2 M1 L20–22 Level 2 M3 L8–11, 23–29 Level 2 M4 L7–8, 17–22
Benchmark 3E.2.2.1.1 Organize and electronically present collected data to identify and describe patterns in the amount of daylight in different times of the year.	Level 1 M4 L9–13, 23–25

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.2: Obtaining, evaluating, and communicating information

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 4.2.2 Students will be able to gather information about and communicate the methods that are used by various cultures, especially those of Minnesota American Indian Tribes and communities, to develop explanations of phenomena and design solutions to problems.	Level 3 M1 L11–17, 28–29 *PhD Science* does not cover Minnesota American Indian Tribes.
Benchmark 3E.4.2.2.1 Gather information and communicate how Minnesota American Indian Tribes and communities and other cultures use patterns in stars to make predictions and plans.	Level 1 M4 L1–8, 14–25 Level 5 M4 L1–2, 5–17, 20–26 *PhD Science* does not cover Minnesota American Indian Tribes.

Physical Science (3P)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.1: Asking questions and defining problems

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read.	Level 3 M1 L1–3, 10, 15, 20 Level 3 M2 L1–2, 8, 13, 15, 27 Level 3 M3 L1–3, 6, 11, 16, 18, 21, 25, 27 Level 3 M4 L1–3, 6, 9, 12, 14, 16–18, 21, 29
Benchmark 3P.1.1.1.1 Ask questions based on observations about why objects in darkness can be seen only when illuminated.	Level 1 M2 L1–9, 21–23

Strand 1: Exploring phenomena or engineering problems

Substrand 1.2: Planning and carrying out investigations

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena.	Level 3 M2 L4–5 Level 3 M4 L7–18, 23–30
Benchmark 3P.1.2.1.1 Plan and conduct a controlled investigation to determine the effect of placing objects made with different materials in the path of a beam of light.	Level 1 M2 L1–3, 10–23

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.1: Developing and using models

Standards and Benchmarks	Aligned PhD Science Lessons
Standard 3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions, and/or explanations, and communicate ideas to others.	Level 3 M1 L1–3, 19–20 Level 3 M2 L9–12, 27–28 Level 3 M3 L7–11, 21–25, 27–28 Level 3 M4 L1–3, 17–18, 28–30
Benchmark 3P.3.1.1.1 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.	Level 4 M4 L1–17, 25–27

Life Science (3L)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.2: Planning and carrying out investigations

Standards and Benchmarks	Aligned PhD Science Lessons
Standard 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena.	Level 3 M2 L4–5 Level 3 M4 L7–18, 23–30
Benchmark 3L.1.2.1.2 Plan and conduct an investigation to determine how amounts of sunlight and water impact the growth of a plant.	Level 2 M3 L1–7, 25–29

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.1: Developing and using models

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions, and/or explanations and communicate ideas to others.	Level 3 M1 L1–3, 19–20 Level 3 M2 L9–12, 27–28 Level 3 M3 L7–11, 21–25, 27–28 Level 3 M4 L1–3, 17–18, 28–30
Benchmark 3L.3.1.1.2 Develop multiple models to describe how organisms have unique and diverse life cycles but all have birth, growth, reproduction, and death in common.	Level 3 M3 L7–8, 23–28

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.2: Constructing explanations and designing solutions

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.2.1 Students will be able to apply scientific principles and empirical evidence (primary or secondary) to explain the causes of phenomena or identify weaknesses in explanations developed by the students or others.	Level 3 M1 L16–18, 21–26, 28–29 Level 3 M2 L9–12, 16–28 Level 3 M3 L9–13, 19–25–28 Level 3 M4 L1–3, 10–30
Benchmark 3L.3.2.1.1 Construct an explanation using evidence from various sources for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.	Level 3 M3 L21–28

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.1: Engaging in argument from evidence

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 4.1.1 Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of others, and present counterarguments.	Level 3 M2 L9–15, 27–28 Level 3 M3 L16–18
Benchmark 3L.4.1.1.1 Construct an argument about strategies animals use to survive.	Level 3 M2 L13–15, 26–28

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.2: Obtaining, evaluating, and communicating information

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	Level 3 M1 L21–26, 28–29 Level 3 M2 L20–21
Benchmark 3L.4.2.1.1 Obtain information from various types of media to support an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	Level 1 M1 L1–21, 24–29

Science and Engineering Practices	Aligned *PhD Science* Lessons
1. Asking Questions and Defining Problems	Level 3 M1 L1–3, 21–26, 28–29 Level 3 M2 L1–2 Level 3 M3 L1–3, 12–13 Level 3 M4 L1–3, 7–9, 15–16, 19–30
2. Developing and Using Models	Level 3 M1 L1–3, 19–20 Level 3 M2 L1–3, 6–12, 22–25, 27–28 Level 3 M3 L7–11, 21–25, 27–28 Level 3 M4 L1–3, 17–18, 23–30
3. Planning and Carrying Out Investigations	Level 3 M2 L4–5 Level 3 M3 L12–13 Level 3 M4 L7–18, 23–30
4. Analyzing and Interpreting Data	Level 3 M1 L4–15, 19–20, 27–29 Level 3 M2 L3–8, 16–19, 27–28 Level 3 M3 L4–9, 14–20, 27–28 Level 3 M4 L7–9
5. Using Mathematics and Computational Thinking	Level 3 M1 L4–12 Level 3 M2 L3, 16–19 Level 3 M3 L7–8 Level 3 M4 L23–27
6. Constructing Explanations and Designing Solutions	Level 3 M1 L13–15, 18, 21–29 Level 3 M2 L6–8, 22–28 Level 3 M3 L9–11, 14–15, 21–28 Level 3 M4 L10–14, 19–21, 28–30
7. Engaging in Argument from Evidence	Level 3 M1 L21–26, 28–29 Level 3 M2 L9–15, 20–21, 27–28 Level 3 M3 L16–20 Level 3 M4 L12–14
8. Obtaining, Evaluating, and Communicating Information	Level 3 M1 L11–17, 28–29 Level 3 M2 L13–15, 20–21 Level 3 M4 L22

Disciplinary Core Ideas

Physical Science	Aligned *PhD Science* Lessons
PS4: Waves and Their Applications in Technologies for Information Transfer	Level 4 M3 L7–14, 29–31 Level 4 M4 L1–27

Life Science	Aligned *PhD Science* Lessons
LS1: From Molecules to Organisms: Structures and Processes	Level 3 M3 L7–8, 23–28
LS2: Ecosystems: Interactions, Energy, and Dynamics	Level 3 M2 L13–28
LS4: Biological Evolution: Unity and Diversity	Level 3 M2 L1–12, 16–28 Level 3 M3 L21–28

Earth and Space Science	Aligned *PhD Science* Lessons
ESS1: Earth's Place in the Universe	Level 4 M1 L1–5, 19–20, 25–27 Level 5 M4 L1–2, 5–26

Crosscutting Concepts	Aligned *PhD Science* Lessons
1. Patterns	Level 3 M1 L11–15, 19–20, 27–29 Level 3 M2 L3–8, 13–15, 27–28 Level 3 M3 L1–8, 14–18, 26–28 Level 3 M4 L1–9, 28–30
2. Cause and Effect	Level 3 M1 L1–3, 16–18, 21–29 Level 3 M2 L9–12, 16–28 Level 3 M3 L9–13, 19–25, 27–28 Level 3 M4 L1–3, 10–30
4. Systems and System Models	Level 3 M1 L1–3, 16–20 Level 3 M2 L6–15, 20–28 Level 3 M3 L9–11 Level 3 M4 L1–30

PhD Science® Correlation to the *Minnesota Academic Standards in Science*: Level 4

The *PhD Science* Level 4 curriculum mostly aligns with the Grade 4 *Minnesota Academic Standards in Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Grade 4 Standards and Benchmarks

Earth and Space Science (4E)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.1: Asking questions and defining problems

Standards and Benchmarks	Aligned PhD Science Lessons
Standard 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read.	Level 4 M1 L2, 5, 9, 22–23, 26 Level 4 M2 L3, 8, 9, 11, 16, 23, 25 Level 4 M3 L3, 6, 9, 25, 30 Level 4 M4 L2, 13, 24, 26
Benchmark 4E.1.1.1.2 Ask questions about how water moves through the Earth system and identify the type of question.	Level 5 M3 L6–8

Strand 1: Exploring phenomena or engineering problems

Substrand 1.2: Planning and carrying out investigations

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena.	Level 4 M1 L8–11 Level 4 M2 L6–7 Level 4 M3 L15–19 Level 4 M4 L7–8, 18–21
Benchmark 4E.1.2.1.1 Make observations and measurements to provide evidence of the effects of weathering or the rate of erosion by the forces of water, ice, wind, or vegetation.	Level 4 M1 L6–11, 25–27
Benchmark 4E.1.2.1.2 Plan and carry out fair tests in which variables are controlled and failure points are considered to improve a model or prototype to prevent erosion.	Level 4 M1 L12–17

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.2: Using mathematics and computational thinking

Standards and Benchmarks	**Aligned PhD Science Lessons**
Standard 2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Level 4 M2 L8–9 Level 4 M4 L14–17
Benchmark 4E.2.2.1.1 Interpret charts, maps, and/or graphs of the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.	Level 5 M3 L4–5, 19–27

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.1: Developing and using models

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions, and/or explanations, and communicate ideas to others.	Level 4 M1 L1–2, 26–27 Level 4 M2 L1–3, 8–11, 25–26 Level 4 M3 L1–3, 7–14, 30–31 Level 4 M4 L1–6
Benchmark 4E.3.1.1.1 Develop a model based in part on student observations or data to describe ways the geosphere, biosphere, hydrosphere, and atmosphere interact.	Level 5 M3 L1–3, 6–13, 19–27

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.2: Constructing explanations and designing solutions

Standards and Benchmarks	**Aligned PhD Science Lessons**
Standard 3.2.1 Students will be able to apply scientific principles and empirical evidence (primary or secondary) to explain the causes of phenomena or identify weaknesses in explanations developed by the students or others.	Level 4 M1 L3–5, 10, 18, 21–22, 25–27
Benchmark 4E.3.2.1.1 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 L1–5, 19–20, 25–27
Standard 3.2.2 Students will be able to use their understanding of scientific principles and the engineering design process to design solutions that meet established criteria and constraints.	Level 4 M1 L12–17 Level 4 M2 L17–23 Level 4 M4 L14–17
Benchmark 4E.3.2.2.1 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	Level 4 M1 L12–17, 25–27

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.2: Obtaining, evaluating, and communicating information

Standards and Benchmarks	Aligned PhD Science Lessons
Standard 4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	Level 4 M1 L3–5 Level 4 M3 L30–31 Level 4 M4 L22–24
Benchmark 4E.4.2.1.1 Read and comprehend grade appropriate complex texts and/or other reliable media to describe that energy and fuels are derived from natural resources and their uses affect the environment.	Level 4 M1 L21–27
Standard 4.2.2 Students will be able to gather information about and communicate the methods that are used by various cultures, especially those of Minnesota American Indian Tribes and communities, to develop explanations of phenomena and design solutions to problems.	Level 4 M1 L6–7, 26–27 Level 4 M2 L25–26 Level 4 M3 L30–31 Level 4 M4 L18–21, 26–27 *PhD Science* does not cover Minnesota American Indian Tribes.
Benchmark 4E.4.2.2.1 Obtain and combine multiple sources of information about ways individual communities, including Minnesota American Indian Tribes and communities and other cultures, use evidence and scientific principles to make decisions about the uses of Earth's resources.	Level 5 M3 L14–18, 24–27 *PhD Science* does not cover Minnesota American Indian Tribes.

Physical Science (4P)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.1: Asking questions and defining problems

Standards and Benchmarks	Aligned PhD Science Lessons
Standard 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read.	Level 4 M1 L2, 5, 9, 22–23, 26 Level 4 M2 L3, 8, 9, 11, 16, 23, 25 Level 4 M3 L3, 6, 9, 25, 30 Level 4 M4 L2, 13, 24, 26
Benchmark 4P.1.1.1.1 Ask questions to determine cause and effect relationships of electric and magnetic interactions between two objects not in contact with each other.	Level 3 M4 L19–21, 28–30
Standard 1.1.2 Students will be able to ask questions about a problem to be solved so they can define constraints and specifications for possible solutions.	Level 4 M1 L12–17 Level 4 M2 L17–23 Level 4 M4 L14–17
Benchmark 4P.1.1.2.1 Define a simple design problem that can be solved by applying scientific ideas about magnets.	Level 3 M4 L22–30

Life Science (4L)

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.1: Engaging in argument from evidence

Standards and Benchmarks	Aligned PhD Science Lessons
Standard 4.1.1 Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of others, and present counterarguments.	Level 4 M3 L21–23, 26–28, 30–31
Benchmark 4L.4.1.1.1 Construct or support an argument that traits can be influenced by different environments.	Level 3 M3 L9–13, 19–20, 26–28

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.2: Obtaining, evaluating, and communicating information

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	Level 4 M1 L3–5 Level 4 M3 L30–31 Level 4 M4 L22–24
Benchmark 4L.4.2.1.2 Obtain information from various media sources to determine 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 L1–6, 14–18, 26–28

Science and Engineering Practices	Aligned *PhD Science* Lessons
1. Asking Questions and Defining Problems	Level 4 M1 L1–2, 12–17, 23 Level 4 M2 L1–3, 8–9, 11, 17–23, 25–26 Level 4 M3 L1–3, 6, 15–19 Level 4 M4 L1–2, 14–17
2. Developing and Using Models	Level 4 M1 L1–2, 26–27 Level 4 M2 L1–3, 8–11, 15–16, 25–26 Level 4 M3 L1–3, 7–14, 30–31 Level 4 M4 L1–8, 10–24, 26–27
3. Planning and Carrying Out Investigations	Level 4 M1 L8–11, 21–22 Level 4 M2 L6–7, 10–14 Level 4 M3 L15–19 Level 4 M4 L7–9, 14–21, 26–27
5. Using Mathematics and Computational Thinking	Level 4 M2 L8–9 Level 4 M4 L14–17
6. Constructing Explanations and Designing Solutions	Level 4 M1 L3–7, 10, 12–18, 21–22, 25–27 Level 4 M2 L4–5, 15–26 Level 4 M3 L4–5, 24–25, 29–31 Level 4 M4 L14–27
7. Engaging in Argument from Evidence	Level 4 M3 L21–23, 26–28, 30–31 Level 4 M4 L7–8
8. Obtaining, Evaluating, and Communicating Information	Level 4 M1 L3–5, 23–24 Level 4 M3 L4–6, 10–11, 20–23, 26–28, 30–31 Level 4 M4 L22–24

Disciplinary Core Ideas

Physical Science	**Aligned *PhD Science* Lessons**
PS2: Motion and Stability: Forces and Interactions	Level 3 M4 L1–30 Level 5 M4 L3–4, 24–26

Life Science	**Aligned *PhD Science* Lessons**
LS3: Heredity: Inheritance and Variation of Traits	Level 3 M3 L1–6, 9–20, 23–28

Earth and Space Science	**Aligned *PhD Science* Lessons**
ESS1: Earth's Place in the Universe	Level 4 M1 L1–5, 19–20, 25–27
ESS2: Earth's Systems	Level 4 M1 L6–11, 18–20, 25–27
ESS3: Earth and Human Activity	Level 4 M1 L12–17, 21–27

Engineering, Technology, and the Applications of Science	**Aligned *PhD Science* Lessons**
ETS1: Engineering Design	Level 4 M1 L12–17 Level 4 M2 L17–23 Level 4 M4 L14–17
ETS2: Links Among Engineering, Technology, Science and Society	Level 4 M1 L12–17, 23–24 Level 4 M2 L15–23 Level 4 M4 L14–17, 22–24

Crosscutting Concepts	Aligned *PhD Science* Lessons
1. Patterns	Level 4 M1 L1–5, 18–20, 26–27 Level 4 M2 L4–5, 8–11, 24–26 Level 4 M3 L1–3, 7–11, 20, 24–31 Level 4 M4 L1–4, 7–8, 14–17, 22–27
2. Cause and Effect	Level 4 M1 L6–17, 21–27 Level 4 M2 L1–7, 10–14, 24–26 Level 4 M3 L6–23, 30–31 Level 4 M4 L3–13, 18–21, 25–27
4. Systems and System Models	Level 4 M1 L1–2, 12–17, 21–24 Level 4 M2 L1–11, 15–26 Level 4 M3 L7–9, 15–19, 21–23, 26–28, 30–31 Level 4 M4 L1–6, 10–27
5. Energy and Matter	Level 4 M2 L1–3, 8–26 Level 4 M3 L10–19, 30–31

PhD Science® Correlation to the *Minnesota Academic Standards in Science*: Level 5

The *PhD Science* Level 5 curriculum mostly aligns with the Grade 5 *Minnesota Academic Standards in Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Grade 5 Standards and Benchmarks

Earth and Space Science (5E)

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.2 : Using mathematics and computational thinking

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Level 5 M1 L15–17, 24–26 Level 5 M2 L8–9, 12–13, 15–17, 25–26 Level 5 M3 L4–5, 25–27 Level 5 M4 L25–26
Benchmark 5E.2.2.1.2 Use data to describe patterns in the 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 L1–2, 5–17, 20–26

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.1: Engaging in argument from evidence

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 4.1.1 Students will be able to engage in argument from evidence for the explanations the students construct, defend and revise their interpretations when presented with new evidence, critically evaluate the scientific arguments of others, and present counterarguments.	Level 5 M1 L3–4, 24–26 Level 5 M2 L3–5, 8–11, 25–26 Level 5 M3 L25–27 Level 5 M4 L13–17, 20–21, 24–26
Benchmark 5E.4.1.1.1 Use evidence to support an argument that the apparent brightness of the Sun and stars is due to their relative distances from Earth.	Level 5 M4 L18–19, 24–26

Physical Science (5P)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.1: Asking questions and defining problems

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read.	Level 5 M1 L2, 10, 12, 24 Level 5 M2 L2, 7, 14, 25 Level 5 M3 L4, 8, 13, 18, 25 Level 5 M4 L2, 13– 16, 21, 25
Benchmark 5P.1.1.1.1 Ask investigatable questions and predict reasonable outcomes about the changes in energy, related to speed, that occur when objects interact.	Level 4 M2 L6–9, 12–16, 24–26

Strand 1: Exploring phenomena or engineering problems

Substrand 1.2: Planning and carrying out investigations

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena.	Level 5 M1 L13–14, 18–22, 24–26 Level 5 M2 L3–5, 8 Level 5 M3 L10–12 Level 5 M4 L7–8, 18–19, 25–26
Benchmark 5P.1.2.1.1 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.	Level 5 M1 L1–2, 13–26
Benchmark 5P.1.2.1.2 Evaluate appropriate methods and tools to identify materials based on their properties prior to investigation.	Level 5 M1 L1–4, 11–17, 23–26

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.1: Analyzing and interpreting data

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	Level 5 M2 L3–5, 10–11 Level 5 M3 L4–5, 14–16 Level 5 M4 L14–15
Benchmark 5P.2.1.1.1 Analyze and interpret data to show that energy can be transferred from place to place by sound, light, heat, and electric currents.	Level 4 M2 L1–5, 10–11, 24–26

Strand 2: Looking at data and empirical evidence to understand phenomena or solve problems

Substrand 2.2: Using mathematics and computational thinking

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Level 5 M1 L15–17, 24–26 Level 5 M2 L8–9, 12–13, 15–17, 25–26 Level 5 M3 L4–5, 21, 25–27 Level 5 M4 L25–26
Benchmark 5P.2.2.1.1 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 L9–17, 23–26

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.1: Developing and using models

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions, and/or explanations, and communicate ideas to others.	Level 5 M1 L1–2, 7–10, 13–14, 23–26 Level 5 M2 L1–2, 6–7, 14, 20, 25–26 Level 5 M3 L1–3, 6–16, 24–27 Level 5 M4 L3–4, 13, 20–26
Benchmark 5P.3.1.1.1 Develop and refine a model to describe that matter is made of particles too small to be seen.	Level 5 M1 L5–10, 23–26
Benchmark 5P.3.1.1.2 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 L15–19, 24–26

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.2: Constructing explanations and designing solutions

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.2.1 Students will be able to apply scientific principles and empirical evidence (primary or secondary) to explain the causes of phenomena or identify weaknesses in explanations developed by the students or others.	Level 5 M1 L5–6, 11–12, 23–26 Level 5 M2 L15–17, 24–26 Level 5 M3 L17–18, 25–27 Level 5 M4 L20–21, 24–26
Benchmark 5P.3.2.1.1 Construct an explanation based on evidence relating the speed of an object to the energy of that object.	Level 4 M2 L6–9, 12–16, 24–26
Standard 3.2.2 Students will be able to use their understanding of scientific principles and the engineering design process to design solutions that meet established criteria and constraints.	Level 5 M1 L18–22 Level 5 M2 L20–23 Level 5 M3 L19–23
Benchmark 5P.3.2.2.1 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	Level 4 M2 L12–26

Life Science (5L)

Strand 1: Exploring phenomena or engineering problems

Substrand 1.2: Planning and carrying out investigations

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena.	Level 5 M1 L13–14, 18–22, 24–26 Level 5 M2 L3–5 Level 5 M3 L10–11 Level 5 M4 L18–19, 25–26
Benchmark 5L.1.2.1.3 Plan and conduct an investigation to obtain evidence that plants get the materials they need for growth chiefly from air and water.	Level 5 M2 L3–5, 24–26

Strand 3: Developing possible explanations of phenomena or designing solutions to engineering problems

Substrand 3.1: Developing and using models

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions, and/or explanations, and communicate ideas to others.	Level 5 M1 L1–2, 7–10, 13–14, 23–26 Level 5 M2 L1–2, 6–7, 14, 20, 25–26 Level 5 M3 L1–3, 6–16, 24–27 Level 5 M4 L3–4, 13, 20–26
Benchmark 5L.3.1.1.3 Create an electronic visualization of the movement of matter among plants, animals, decomposers, and the environment.	Level 5 M2 L1–2, 8–14, 20, 24–26

Strand 4: Communicating reasons, arguments, and ideas to others

Substrand 4.1: Engaging in argument from evidence

Standards and Benchmarks	**Aligned *PhD Science* Lessons**
Standard 4.1.2 Students will be able to argue from evidence to justify the best solution to a problem or to compare and evaluate competing designs, ideas, or methods.	Level 5 M2 L3–5, 21–23, 25–26 Level 5 M3 L19–23
Benchmark 5L.4.1.2.1 Evaluate the merit of a solution to a problem caused by changes in plant and animal populations as a result of environmental changes.	Level 3 M2 L16–28

Science and Engineering Practices	Aligned *PhD Science* Lessons
1. Asking Questions and Defining Problems	Level 5 M1 L1–2 Level 5 M2 L1–2, 21–23 Level 5 M3 L1–3, 19–23 Level 5 M4 L1–2, 13
2. Developing and Using Models	Level 5 M1 L1–2, 5–10, 13–14, 23–26 Level 5 M2 L1–2, 6–7, 14, 20, 25–26 Level 5 M3 L1–3, 6–16, 24–27 Level 5 M4 L1–4, 7–17, 19–26
3. Planning and Carrying Out Investigations	Level 5 M1 L13–14, 18–22, 24–26 Level 5 M2 L3–5 Level 5 M3 L10–11 Level 5 M4 L5–6, 18–19, 25–26
4. Analyzing and Interpreting Data	Level 5 M1 L15–17, 24–26 Level 5 M2 L3–5, 8–13, 15–17, 25–26 Level 5 M3 L4–5, 14–16, 25–27 Level 5 M4 L14–15
5. Using Mathematics and Computational Thinking	Level 5 M1 L3–4, 15–17 Level 5 M3 L10–11, 24–27 Level 5 M4 L5–6, 25–26
6. Constructing Explanations and Designing Solutions	Level 5 M1 L5–6, 11–12, 18–26 Level 5 M2 L12–13, 15–17, 21–26 Level 5 M3 L17–23, 25–27 Level 5 M4 L3–4, 9–12, 20–21, 22–26
7. Engaging in Argument from Evidence	Level 5 M1 L3–4, 24–26 Level 5 M2 L3–5, 8–11, 21–23, 25–26 Level 5 M3 L19–23, 25–27 Level 5 M4 L5–6, 13–17, 20–21, 24–26

Disciplinary Core Ideas

Physical Science	**Aligned PhD Science Lessons**
PS1: Matter and Its Interactions	Level 5 M1 L1–26
PS3: Energy	Level 5 M2 L6–7, 15–19, 24–26

Life Science	**Aligned *PhD Science* Lessons**
LS1: From Molecules to Organisms: Structures and Processes	Level 5 M2 L3–5, 8–9, 15–19, 24–26
LS2: Ecosystems: Interactions, Energy, and Dynamics	Level 5 M2 L1–2, 6–14, 20, 24–26

Earth and Space Science	**Aligned *PhD Science* Lessons**
ESS1: Earth's Place in the Universe	Level 5 M4 L1–2, 5–26

Engineering, Technology, and the Applications of Science	**Aligned *PhD Science* Lessons**
ETS1: Engineering Design	Level 5 M1 L18–22 Level 5 M2 L21–23 Level 5 M3 L19–23
ETS2: Links Among Engineering, Technology, Science and Society	Level 5 M2 L21–23 Level 5 M3 L19–23 Level 5 M4 L7–8

cs

Crosscutting Concepts	Aligned *PhD Science* Lessons
1. Patterns	Level 5 M1 L7–8 Level 5 M2 L1–5, 8–9, 15–17, 25–26 Level 5 M3 L6–9 Level 5 M4 L1–17, 20–26
2. Cause and Effect	Level 5 M1 L1–2, 5–6, 9–10, 18–22, 24–26 Level 5 M2 L3–7, 12–13, 18–23, 25–26 Level 5 M3 L6–8, 12–18, 25–27 Level 5 M4 L5–6, 24–26
3. Scale, Proportion, and Quantity	Level 5 M1 L3–4, 13–17, 23–26 Level 5 M2 L10–11 Level 5 M3 L1–5, 10–11, 24–27 Level 5 M4 L18–19, 24–26
4. Systems and System Models	Level 5 M1 L3–4, 15–17 Level 5 M2 L1–2, 6–11, 14, 18–19, 24–26 Level 5 M3 L1–9, 12–13, 19–27 Level 5 M4 L1–2, 7–26
5. Energy and Matter	Level 5 M1 L5–8, 13–14, 23–26 Level 5 M2 L6–11, 14–19, 24–26 Level 5 M3 L10–11 Level 5 M4 L3–4