PhD Science® K–5 Curriculum Correlation to Michigan Science Standards

Contents

PhD Science® Correlation to Michigan Science Standards: Level K

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

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

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

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

Key: Module (M), Lesson (L)

The *PhD Science* Level K curriculum aligns fully with the Kindergarten Michigan Science Standards. A detailed analysis of grade-level alignment appears in the table below.

Kindergarten Performance Expectations

Forces and Interactions: Pushes and Pulls			**Aligned *PhD Science* Lessons**
K-PS2-1	Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.		Level K M2 L1–23
K-PS2-2	Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.		Level K M2 L17–23

Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment			Aligned *PhD Science* Lessons
K-LS1-1	Use observations to describe patterns of what plants and animals (including humans) need to survive.		Level K M3 L4–16, 19–22, 27–29
K-ESS2-2	Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.		Level K M4 L1–10, 14–16, 26–28
K-ESS3-1	Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.		Level K M3 L1–3, 9–29 Level K M4 L1–2, 8–9, 11–13
K-ESS3-3	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

Weather and Climate			Aligned *PhD Science* Lessons
K-PS3-1	Make observations to determine the effect of sunlight on Earth's surface.		Level K M1 L8–11, 28–30
K-PS3-2	Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.		Level K M1 L12–16, 28–30
K-ESS2-1	Use and share observations of local weather conditions to describe patterns over time.		Level K M1 L1–11, 17–24, 28–30 Level K M4 L25
K-ESS3-2	Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.		Level K M1 L22–30

Engineering Design			Aligned *PhD Science* Lessons
K–2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.		Level K M1 L12–16
K–2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.		Level K M2 L17–20
K–2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.		Level K M4 L20–24

Crosscutting Concepts

1	**Patterns**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		Level K M2 L4–23 Level K M4 L3–5, 10, 14–19, 26–28

4	**Systems and System Models**	**Aligned *PhD Science* Lessons**
		Level K M3 L1–3, 9–13, 19–21, 23–25, 27–29 Level K M4 L1–9, 11–16

6	**Structure and Function**	**Aligned *PhD Science* Lessons**
		Level K M1 L10–16 Level K M4 L20–24

Disciplinary Core Ideas

Physical Science			Aligned *PhD Science* Lessons
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

Earth and Space Science			Aligned *PhD Science* Lessons
ESS2	**Earth's Systems**		Level K M1 L1–11, 17–24, 28–30 Level K M4 L1–10, 14–16, 25–28
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 Applications of Science			Aligned *PhD Science* Lessons
ETS1	**Engineering Design**		Level K M1 L4–7, 12–16 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

Science and Engineering Practices

1	**Asking Questions and Defining Problems**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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

6	**Constructing Explanations and Designing Solutions**	**Aligned *PhD Science* Lessons**
		Level K M2 L17–20 Level K M3 L4–16, 23–29

7	Engaging in Argument from Evidence		Aligned *PhD Science* Lessons
			Level K M3 L17–21, 27–29 Level K M4 L3–5, 11–13, 25

8	Obtaining, Evaluating, and Communicating Information		Aligned *PhD Science* Lessons
			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

PhD Science® Correlation to Michigan Science Standards: Level 1

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Key: Module (M), Lesson (L)

The *PhD Science* Level 1 curriculum aligns fully with the Grade 1 Michigan Science Standards. A detailed analysis of grade-level alignment appears in the table below.

Grade 1 Performance Expectations

Waves: Light and Sound			**Aligned *PhD Science* Lessons**
1-PS4-1	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
1-PS4-2	Make observations to construct an evidence-based account that objects can be seen only when illuminated.		Level 1 M2 L1–9, 21–23
1-PS4-3	Plan and conduct an 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
1-PS4-4	Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.		Level 1 M3 L18–29

Structure, Function, and Information Processing			Aligned *PhD Science* Lessons
1-LS1-1	Use materials to 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
1-LS1-2	Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.		Level 1 M1 L24–29
1-LS3-1	Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.		Level 1 M1 L22–23, 26–29

Space Systems: Patterns and Cycles			Aligned *PhD Science* Lessons
1-ESS1-1	Use observations of the sun, moon, and stars to describe patterns that can be predicted.		Level 1 M4 L1–8, 14–25
1-ESS1-2	Make observations at different times of year to relate the amount of daylight to the time of year.		Level 1 M4 L9–13, 23–25

Engineering Design			Aligned *PhD Science* Lessons
K–2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.		Level 1 M1 L11–15
K–2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.		Level 1 M3 L21–25
K–2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.		Level 1 M3 L21–25

Crosscutting Concepts

1	**Patterns**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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

6	**Structure and Function**	**Aligned *PhD Science* Lessons**
		Level 1 M1 L4–15, 27–29 Level 1 M3 L8–9

Disciplinary Core Ideas

Physical Science			Aligned *PhD Science* Lessons
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

Engineering, Technology, and 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

Science and Engineering Practices

1	**Asking Questions and Defining Problems**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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

6	Constructing Explanations and Designing Solutions		Aligned *PhD Science* Lessons
			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

8	Obtaining, Evaluating, and Communicating Information		Aligned *PhD Science* Lessons
			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

PhD Science® Correlation to Michigan Science Standards: Level 2

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Key: Module (M), Lesson (L)

The *PhD Science* K–2 curriculum aligns with the Grade 2 Michigan Science Standards. A detailed analysis of grade-level alignment appears in the table below.

Grade 2 Performance Expectations

Structure and Properties of Matter			**Aligned *PhD Science* Lessons**
2-PS1-1	Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.		Level 2 M1 L1–9, 12–16, 19, 23, 29–31 Level 2 M2 L3–4, 14–17
2-PS1-2	Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.		Level 2 M1 L20–31
2-PS1-3	Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.		Level 2 M1 L10–11, 29–31
2-PS1-4	Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.		Level 2 M1 L14–19, 29–31

Interdependent Relationships in Ecosystems			Aligned *PhD Science* Lessons
2-LS2-1	Plan and conduct an investigation to determine if plants need sunlight and water to grow.		Level 2 M3 L1–7, 25–29
2-LS2-2	Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.		Level 2 M3 L8–29
2-LS4-1	Make observations of plants and animals to compare the diversity of life in different habitats.		Level 2 M4 L1–3, 7–25

Earth's Systems: Processes That Shape the Earth			Aligned *PhD Science* Lessons
2-ESS1-1	Use information from several sources to provide evidence that Earth events can occur quickly or slowly.		Level 2 M2 L18–24
2-ESS2-1	Compare 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
2-ESS2-2	Develop a model to represent the shapes and kinds of land and bodies of water in an area.		Level 2 M2 L1–2, 5–6 Level 2 M4 L1–6, 11–16, 20–21, 23–25
2-ESS2-2 MI	Develop a model to represent the state of Michigan and the Great Lakes or a more local land area and water body.		Level 2 M2 L1–2
2-ESS2-3	Obtain information to identify where water is found on Earth and that it can be solid or liquid.		Level 2 M4 L1–6, 16, 22–25
2-ESS2-3 MI	Obtain information to identify where fresh water is found on Earth, including the Great Lakes and Great Lakes Basin.		Level 2 M4 L1–6, 16, 22–25; *PhD Science* does not explicitly mention the Great Lakes.

Engineering Design			Aligned *PhD Science* Lessons
K–2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.		Level 2 M1 L24–28 Level 2 M2 L8–12
K–2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.		Level 2 M3 L14–18
K–2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.		Level 2 M2 L8–12, 14–17

Crosscutting Concepts

1	**Patterns**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		Level 2 M1 L14–19, 29–31 Level 2 M2 L8–12, 20–21 Level 2 M3 L3–11

5	**Energy and Matter**	**Aligned *PhD Science* Lessons**
		Level 2 M1 L10–11, 29–31 Level 2 M2 L3–4, 8–13, 22–24

6	**Structure and Function**	**Aligned *PhD Science* Lessons**
		Level 2 M1 L24–28 Level 2 M2 L14–17 Level 2 M3 L8–11, 14–22

7	**Stability and Change**	**Aligned *PhD Science* Lessons**
		Level 2 M2 L1–2, 18–24 Level 2 M3 L1–2, 25–29

Disciplinary Core Ideas

Physical Science			Aligned *PhD Science* Lessons
PS 1	**Matter and Its Interactions**		Level 2 M1 L1–31 Level 2 M2 L3–4, 14–17

Life Science			Aligned *PhD Science* Lessons
LS 2	**Ecosystems: Interactions, Energy, and Dynamics**		Level 2 M3 L1–29
LS 4	**Biological Evolution: Unity and Diversity**		Level 2 M4 L1–3, 7–25

Earth and Space Science			Aligned *PhD Science* Lessons
ESS 1	**Earth's Place in the Universe**		Level 2 M2 L18–24
ESS 2	**Earth's Systems**		Level 2 M2 L1–17, 20, 22–24 Level 2 M4 L1–6, 11–16, 20–25

Engineering, Technology, and Applications of Science			Aligned *PhD Science* Lessons
ETS 1	**Engineering Design**		Level 2 M1 L24–28 Level 2 M2 L8–12, 14–17 Level 2 M3 L14–18
ETS 2	**Links Among Engineering, Technology, Science, and Society**		Level 2 M2 L14–17 Level 2 M3 L3–6, 14–18

Science and Engineering Practices

1	**Asking Questions and Defining Problems**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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

6	Constructing Explanations and Designing Solutions		Aligned *PhD Science* Lessons
			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		Aligned *PhD Science* Lessons
			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		Aligned *PhD Science* Lessons
			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 L L4–9, 11–16, 23–25

PhD Science® Correlation to Michigan Science Standards: Level 3

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Key: Module (M), Lesson (L)

The *PhD Science* Level 3 curriculum aligns fully with the Grade 3 Michigan Science Standards. A detailed analysis of grade-level alignment appears in the table below.

Grade 3 Performance Expectations

Forces and Interactions			**Aligned *PhD Science* Lessons**
3-PS2-1	Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.		Level 3 M4 L10–18, 28–30
3-PS2-2	Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.		Level 3 M4 L1–9, 28–30
3-PS2-3	Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.		Level 3 M4 L19–21, 28–30
3-PS2-4	Define a simple design problem that can be solved by applying scientific ideas about magnets.		Level 3 M4 L22–30

Interdependent Relationships in Ecosystems: Environmental Impacts on Organisms			Aligned *PhD Science* Lessons
3-LS2-1	Construct an argument that some animals form groups that help members survive.		Level 3 M2 L13–15, 26–28
3-LS4-1	Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.		Level 3 M2 L1–8, 26–28
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 L1–2, 9–12, 16–19, 22–28
3-LS4-4	Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.		Level 3 M2 L16–28

Inheritance and Variation of Traits: Life Cycles and Traits			Aligned *PhD Science* Lessons
3-LS1-1	Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.		Level 3 M3 L7–8, 23–28
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.		Level 3 M3 L1–6, 14–18, 26–28
3-LS3-2	Use evidence to support the explanation that traits can be influenced by the environment.		Level 3 M3 L9–13, 19–20, 26–28
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 L21–28

Weather and Climate			Aligned *PhD Science* Lessons
3-ESS2-1	Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.		Level 3 M1 L1–15, 19–20, 27–29
3-ESS2-2	Obtain and combine information to describe climates in different regions of the world.		Level 3 M1 L11–15, 27–29
3-ESS3-1	Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.		Level 3 M1 L1–3, 16–29

Engineering Design			Aligned *PhD Science* Lessons
3–5-ETS1-1	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 L21–26
3–5-ETS1-2	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 3 M2 L22–25
3–5-ETS1-3	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 M4 L23–27

Crosscutting Concepts

1	**Patterns**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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

3	**Scale, Proportion, and Quantity**	**Aligned *PhD Science* Lessons**
		Level 3 M1 L4–10 Level 3 M2 L1–2, 27–28 Level 3 M3 L1–3, 14–15

4	**Systems and System Models**	**Aligned *PhD Science* Lessons**
		Level 3 M1 L1–3, 16–20 Level 3 M2 L6–15, 20–28 Level 3 M3 L9–11 Level 3 M4 L1–30

Disciplinary Core Ideas

Physical Science			Aligned *PhD Science* Lessons
PS 2	**Motion and Stability: Forces and Interactions**		Level 3 M4 L1–30

Life Science			Aligned *PhD Science* Lessons
LS 1	**From Molecules to Organisms: Structures and Processes**		Level 3 M3 L7–8, 23–28
LS 2	**Ecosystems: Interactions, Energy, and Dynamics**		Level 3 M2 L13–28
LS 3	**Heredity: Inheritance and Variation of Traits**		Level 3 M3 L1–6, 9–20, 23–28
LS 4	**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
ESS 2	**Earth's Systems**		Level 3 M1 L1–15, 19–20, 27–29
ESS 3	**Earth and Human Activity**		Level 3 M1 L1–3, 16–29

Engineering, Technology, and Applications of Science			Aligned *PhD Science* Lessons
ETS 1	**Engineering Design**		Level 3 M1 L21–26 Level 3 M2 L22–25 Level 3 M4 L23–27
ETS 2	**Links Among Engineering, Technology, Science, and Society**		Level 3 M1 L21–26 Level 3 M2 L22–25 Level 3 M4 L22–27

Science and Engineering Practices

1	Asking Questions and Defining Problems	Aligned *PhD Science* Lessons
		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	Aligned *PhD Science* Lessons
		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	Aligned *PhD Science* Lessons
		Level 3 M2 L4–5 Level 3 M3 L12–13 Level 3 M4 L7–18, 23–30

4	Analyzing and Interpreting Data	Aligned *PhD Science* Lessons
		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

6	Constructing Explanations and Designing Solutions		Aligned *PhD Science* Lessons
			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		Aligned *PhD Science* Lessons
			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		Aligned *PhD Science* Lessons
			Level 3 M1 L11–17, 28–29 Level 3 M2 L13–15, 20–21 Level 3 M4 L22

PhD Science® Correlation to Michigan Science Standards: Level 4

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

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

Key: Module (M), Lesson (L)

The *PhD Science* 3–5 curriculum aligns fully with the Grade 4 Michigan Science Standards. A detailed analysis of grade-level alignment appears in the table below.

Grade 4 Performance Expectations

Energy			**Aligned *PhD Science* Lessons**
4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.		Level 4 M2 L6–7, 24–26
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 L1–5, 10–11, 24–26
4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide.		Level 4 M2 L8–9, 24–26
4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.		Level 4 M2 L12–26
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 L21–27

Waves			Aligned *PhD Science* Lessons
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 L7–14, 29–31
4-PS4-3	Generate and compare multiple solutions that use patterns to transfer information.		Level 4 M4 L18–27

Structures, Function, and Information Processing			Aligned *PhD Science* Lessons
4-PS4-2	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
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 L1–6, 20, 26–31
4-LS1-2	Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.		Level 4 M3 L1–6, 15–25, 29–31

Earth's Systems: Processes That Shape the Earth			Aligned *PhD Science* Lessons
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 L1–5, 19–20, 25–27
4-ESS1-1 MI	Identify evidence from patterns in rock formations and fossils in rock layers to support possible explanations of Michigan's geological changes over time.		Level 4 M1 L1–5, 19–20, 25–27; *PhD Science* does not explicitly mention Michigan.
4-ESS2-1	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.		Level 4 M1 L6–11, 25–27
4-ESS2-2	Analyze and interpret data from maps to describe patterns of Earth's features.		Level 4 M1 L18–20, 25–27
4-ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.		Level 4 M1 L12–17, 25–27
4-ESS3-2 MI	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on Michigan's people and places.		Level 4 M1 L12–17, 25–27; *PhD Science* does not explicitly mention Michigan.

ETS1 Engineering Design			Aligned *PhD Science* Lessons
3–5-ETS1-1	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 L17–23
3–5-ETS1-2	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 L12–17 Level 4 M4 L14–17
3–5-ETS1-3	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 4 M4 L14–17

Crosscutting Concepts

1	**Patterns**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		Level 4 M2 L1–3, 8–26 Level 4 M3 L10–19, 30–31

Disciplinary Core Ideas

Physical Science			Aligned *PhD Science* Lessons
PS 3	**Energy**		Level 4 M2 L1–26
PS 4	**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
LS 1	**From Molecules to Organisms: Structures and Processes**		Level 4 M3 L1–6, 15–31

Earth and Space Science			Aligned *PhD Science* Lessons
ESS 1	**Earth's Place in the Universe**		Level 4 M1 L1–5, 19–20, 25–27
ESS 2	**Earth's Systems**		Level 4 M1 L6–11, 18–20, 25–27
ESS 3	**Earth and Human Activity**		Level 4 M1 L12–17, 21–27

Engineering, Technology, and Applications of Science			Aligned *PhD Science* Lessons
ETS 1	**Engineering Design**		Level 4 M1 L12–17 Level 4 M2 L17–23 Level 4 M4 L14–17
ETS 2	**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

Science and Engineering Practices

1	**Asking Questions and Defining Problems**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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

4	**Analyzing and Interpreting Data**	**Aligned *PhD Science* Lessons**
		Level 4 M1 L12–20, 23–24, 26–27 Level 4 M2 L25–26 Level 4 M4 L10–17

6	Constructing Explanations and Designing Solutions		Aligned *PhD Science* Lessons
			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		Aligned *PhD Science* Lessons
			Level 4 M3 L21–23, 26–28, 30–31 Level 4 M4 L7–8

8	Obtaining, Evaluating, and Communicating Information		Aligned *PhD Science* Lessons
			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
PS 3	**Energy**		Level 4 M2 L1–26
PS 4	**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
LS 1	**From Molecules to Organisms: Structures and Processes**		Level 4 M3 L1–6, 15–31

Earth and Space Science			Aligned *PhD Science* Lessons
ESS 1	**Earth's Place in the Universe**		Level 4 M1 L1–5, 19–20, 25–27
ESS 2	**Earth's Systems**		Level 4 M1 L6–11, 18–20, 25–27
ESS 3	**Earth and Human Activity**		Level 4 M1 L12–17, 21–27

Engineering, Technology, and Applications of Science			Aligned *PhD Science* Lessons
ETS 1	**Engineering Design**		Level 4 M1 L12–17 Level 4 M2 L17–23 Level 4 M4 L14–17
ETS 2	**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

PhD Science® Correlation to Michigan Science Standards: Level 5

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Key: Module (M), Lesson (L)

The *PhD Science* 3–5 curriculum aligns fully with the Grade 5 Michigan Science Standards. A detailed analysis of grade-level alignment appears in the table below.

Grade 5 Performance Expectations

Structure and Properties of Matter			**Aligned *PhD Science* Lessons**
5-PS1-1	Develop a model to describe that matter is made of particles too small to be seen.		Level 5 M1 L5–10, 23–26
5-PS1-2	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
5-PS1-3	Make observations and measurements to identify materials based on their properties.		Level 5 M1 L1–4, 11–17, 23–26
5-PS1-4	Conduct an investigation to determine whether the mixing of two or more substances results in new substances.		Level 5 M1 L1–2, 13–26

Matter and Energy in Organisms and Ecosystems			
5-PS3-1	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
5-LS1-1	Support an argument that plants get the materials they need for growth chiefly from air and water.		Level 5 M2 L3–5, 24–26
5-LS2-1	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.		Level 5 M2 L1–2, 6–14, 20, 24–26

Earth's Systems			Aligned *PhD Science* Lessons
5-ESS2-1	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.		Level 5 M3 L1–3, 6–13, 19–27
5-ESS2-1 MI	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact in Michigan and the Great Lakes basin.		Level 5 M3 L1–3, 6–13, 19–27; *PhD Science* does not explicitly mention Michigan or the Great Lakes.
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 L4–5, 19–27
5-ESS2-2 MI	Describe and graph the amounts and percentages of [salt] water and fresh water in the Great Lakes to provide evidence about the distribution of water on Earth.		Level 5 M3 L4–5, 19–27; *PhD Science* does not explicitly mention the Great Lakes.
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 L14–18, 24–27

Space Systems: Stars and the Solar System			Aligned *PhD Science* Lessons
5-PS2-1	Support an argument that the gravitational force exerted by Earth on objects is directed down.		Level 5 M4 L3–4, 24–26
5-ESS1-1	Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.		Level 5 M4 L18–19, 24–26
5-ESS1-2	Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.		Level 5 M4 L1–2, 5–17, 20–26

Engineering Design			Aligned *PhD Science* Lessons
3–5-ETS1-1	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 5 M2 L21–23
3–5-ETS1-2	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 L19–23
3–5-ETS1-3	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 L18–22

Crosscutting Concepts

1	**Patterns**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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

Disciplinary Core Ideas

Physical Science			Aligned *PhD Science* Lessons
PS 1	**Matter and Its Interactions**		Level 5 M1 L1–26
PS 2	**Motion and Stability: Forces and Interactions**		Level 5 M4 L3–4, 24–26
PS 3	**Energy**		Level 5 M2 L6–7, 15–19, 24–26

Life Science			Aligned *PhD Science* Lessons
LS 1	**From Molecules to Organisms: Structures and Processes**		Level 5 M2 L3–5, 8–9, 15–19, 24–26
LS 2	**Ecosystems: Interactions, Energy, and Dynamics**		Level 5 M2 L1–2, 6–14, 20, 24–26

Earth and Space Science			Aligned *PhD Science* Lessons
ESS 1	**Earth's Place in the Universe**		Level 5 M4 L1–2, 5–26
ESS 2	**Earth's Systems**		Level 5 M3 L1–13, 24–27
ESS 3	**Earth and Human Activity**		Level 5 M3 L14–27

Engineering, Technology, and Applications of Science			Aligned *PhD Science* Lessons
ETS 1	**Engineering Design**		Level 5 M1 L18–22 Level 5 M2 L21–23 Level 5 M3 L19–23
ETS 2	**Links Among Engineering, Technology, Science, and Society**		Level 5 M2 L21–23 Level 5 M3 L19–23 Level 5 M4 L7–8

Science and Engineering Practices

1	**Asking Questions and Defining Problems**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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**	**Aligned *PhD Science* Lessons**
		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		Aligned *PhD Science* Lessons
			Level 5 M1 L 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		Aligned *PhD Science* Lessons
			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

8	Obtaining, Evaluating, and Communicating Information		Aligned *PhD Science* Lessons
			Level 5 M2 L6–7, 10–11, 18–20, 25–26 Level 5 M3 L9, 14–16, 19–27 Level 5 M4 L18–19