PhD Science® K–5 Curriculum Correlation to the *2018 Mississippi College- and Career-Readiness Standards (MS CCRS) for Science*

Contents

K–2 Grade Band

3–5 Grade Band

PhD Science® Correlation to the *2018 Mississippi College- and Career-Readiness Standards (MS CCRS) for Science*: Level K

The *PhD Science* K–2 curriculum mostly aligns with the Kindergarten *MS CCRS for Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Kindergarten Disciplinary Core Ideas, Standards, and Performance Objectives

Life Science

L.K.1 Hierarchical Organization

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.K.1A	Students will demonstrate an understanding of living and nonliving things.	Level K M3 L1–3, 9–29 Level K M4 L1–5, 8–9, 11–16
L.K.1A.1	With teacher guidance, conduct an investigation of living organisms and nonliving objects in various real-world environments to define characteristics of living organisms that distinguish them from nonliving things.	Level K M3 L1–3, 9–29 Level K M4 L1–5, 8–9, 11–16
L.K.1A.2	With teacher support, gain an understanding that scientists are humans who use observations to learn about the natural world. Obtain information from informational text or other media about scientists who have made important observations about living things.	Level K M3 L1–3, 8, 10, 14, 16–18, 22, 29

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.K.1B	Students will demonstrate an understanding of how animals (including humans) use their physical features and their senses to learn about their environment.	Level 1 M1 L16–17
L.K.1B.1	Develop and use models to exemplify how animals use their body parts to (a) obtain food and other resources, (b) protect themselves, and (c) move from place to place.	Level 1 M1 L1–9, 11–18, 27–29
L.K.1B.2	Identify and describe examples of how animals use their sensory body parts (eyes to detect light and movement, ears to detect sound, skin to detect temperature and touch, tongue to taste, and nose to detect smell).	Level 1 M1 L4–6, 16–18, 27–29

L.K.2 Reproduction and Heredity

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.K.2	Students will demonstrate an understanding of how living things change in form as they go through the general stages of a life cycle.	Level 3 M2 L17, 19
L.K.2.1	Use informational text or other media to make observations about plants as they change during the life cycle and use models to communicate findings.	Level 1 M1 L1–3, 7–9 Level 3 M2 L19
L.K.2.2	Construct explanations using observations to describe and model the life cycle.	Level 3 M2 L17–19
L.K.2.3	With teacher guidance, conduct a structured investigation to observe and measure (comparison of lengths) the changes in various individuals of a single plant species from seed germination to adult plant. Record observations using drawing or writing.	Level K M3 L4–8
L.K.2.4	Use observations to explain that young plants and animals are like but not exactly like their parents.	Level 1 M1 L25–29

L.K.3 Ecology and Interdependence

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.K.3A	Students will demonstrate an understanding of what animals and plants need to live and grow.	Level K M3 L1–3, 9–29 Level K M4 L1–5, 8–9, 11–16
L.K.3A.1	With teacher guidance, conduct a structured investigation to determine what plants need to live and grow (water, light, and a place to grow). Measure growth by directly comparing plants with other objects.	Level K M4 L1–10, 14–17, 25–28
L.K.3A.2	Construct explanations using observations to describe and report what animals need to live and grow (food, water, shelter, and space).	Level K M3 L4–29 Level K M4 L1–2, 6–13, 15–17, 26–28

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.K.3B	Students will demonstrate an understanding of the interdependence of living things and the environment in which they live.	Level K M3 L1–3, 9–29 Level K M4 L1–5, 8–9, 11–16
L.K.3B.1	Observe and communicate that animals get food from plants or other animals. Plants make their own food and need light to live and grow.	Level K M3 L4–16, 19–20, L22, L27–29
L.K.3B.2	Create a model habitat which demonstrates interdependence of plants and animals using an engineering design process to define the problem, design, construct, evaluate, and improve the habitat.	Level K M4 L8–16 Level 2 M3 L14–18

L.K.4 Adaptations and Diversity

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.K.4	Students will demonstrate an understanding that some groups of plants and animals are no longer living (extinct) because they were unable to meet their needs for survival.	Level K M4 L7–9 Level 3 M2 L6–8, 26–28
L.K.4.1	Obtain information from informational text or other media to document and report examples of different plants or animals that are extinct.	Level 3 M2 L6–8, 26–28
L.K.4.2	Observe and report how some present-day animals resemble extinct animals.	Level 3 M2 L2, 8, 26

Physical Science

P.K.5 Organization of Matter and Chemical Interactions

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.K.5A	Students will demonstrate an understanding of the solid and liquid states of matter.	Level 2 M1 L1–16, 19, 23, 29–31 Level 2 M2 L3–4, 14–17
P.K.5A.1	Generate questions and investigate the differences between liquids and solids and develop awareness that a liquid can become a solid and vice versa.	Level 2 M1 L4–7, 12–16
P.K.5A.2	Describe and compare the properties of different materials and classify these materials by their observable characteristics (visual, aural, or natural textural) and by their physical properties natural textural) and by their physical properties (weight, volume, solid or liquid, and sink or float).	Level 2 M1 L1–9, 12–16, 19, 23, 29–31

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.K.5B	Students will demonstrate an understanding of how solid objects can be constructed from a smaller set.	Level 2 M1 L10–11, 24–31
P.K.5B.1	Use basic shapes and spatial reasoning to model large objects in the environment using a set of small objects.	Level 1 M2 L13–14 Level 2 M1 L24–28
P.K.5B.2	Analyze a large composite structure to describe its smaller components using drawing and writing.	Level 2 M1 L1, 10–11, 24–31
P.K.5B.3	Explain why things may not work the same if some of the parts are missing.	Level 1 M2 L10–12

Earth and Space Science

E.K.8 Earth and the Universe

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.K.8A	Students will demonstrate an understanding of the pattern of seasonal changes on the Earth.	Level 1 M4 L9–13, 23–25
E.K.8A.1	Construct an explanation of the pattern of the Earth's seasonal changes in the environment using evidence from observations.	Level K M4 L25

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.K.8B	Students will demonstrate an understanding that the Sun provides the Earth with heat and light.	Level K M1 L8–11, 28–30
E.K.8B.1	With teacher guidance, generate and answer questions to develop a simple model, which describes observable patterns of sunlight on the Earth's surface (day and night).	Level K M1 L8–11, 28–30
E.K.8B.2	With teacher guidance, develop questions to conduct a structured investigation to determine how sunlight affects the temperature of the Earth's natural resources.	Level K M1 L8–9, 28–30
E.K.8B.3	Develop a device which would reduce heat from the Sun (temperature) using an engineering design process to define the problem, design, construct, evaluate, and improve the device.	Level K M1 L12–16, 28–30

E.K.10 Earth's Resources

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.K.10	Students will demonstrate an understanding of how humans use Earth's resources.	Level K M3 L1–3, 9–29 Level K M4 L1–5, 8–9, 11–16
E.K.10.1	Participate in a teacher-led activity to gather, organize, and record recyclable materials data on a chart or table using technology. Communicate results.	Level K M4 L18–19
E.K.10.2	With teacher guidance, develop questions to conduct a structured investigation to determine ways to conserve Earth's resources and communicate results.	Level K M4 L18–19
E.K.10.3	Create a product from the reused materials that will meet a human need. Use an engineering design process to define the problem, design, construct, evaluate, and improve the product.	Level K M4 L18–24

PhD Science® Correlation to the *2018 Mississippi College- and Career-Readiness Standards (MS CCRS) for Science*: Level 1

The *PhD Science* K–2 curriculum mostly aligns with the Grade 1 *MS CCRS for Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Grade 1 Disciplinary Core Ideas, Standards, and Performance Objectives

Life Science

L.1.1 Hierarchical Organization

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.1.1	Students will demonstrate an understanding of the basic needs and structures of plants.	Level 1 M1 L1–15, 27–29
L.1.1.1	Construct explanations using firsthand observations or other media to describe the structures of different plants (i.e., root, stem, leaves, flowers, and fruit). Report findings using drawings, writing, or models.	Level 1 M1 L1–3, 7–8, 10, 19–21, 27–29 Level 2 M3 L2, 8, 11, 13, 19, 24
L.1.1.2	Obtain information from informational text and other media to describe the function of each plant part (roots absorb water and anchor the plant, leaves make food, the stem transports water and food, petals attract pollinators, flowers produce seeds, and seeds produce new plants).	Level 1 M1 L1–15, 27–29 Level 2 M3 L8, 11, 13, 19, 24
L.1.1.3	Design and conduct an experiment that shows the absorption of water and how it is transported through the plant. Report observations using drawings, sketches, or models.	Level 1 M1 L7
L.1.1.4	Create a model which explains the function of each plant structure (roots, stem, leaves, petals, flowers, seeds).	Level 1 M1 L7 Level 2 M3 L2, 13, 24
L.1.1.5	With teacher support, gain an understanding that scientists are humans who use observations and experiments to learn about the natural world. Obtain information from informational text or other media about scientists who have made important observations about plants.	Level 1 M1 L1–3, 10–11

L.1.2 Reproduction and Heredity

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.1.2	Students will demonstrate an understanding of how living things change in form as they go through the general stages of a life cycle.	Level 3 M2 L16–19
L.1.2.1	Investigate, using observations and measurements (non-standard units), flowering plants (pumpkins, peas, marigolds, or sunflowers) as they change during the life cycle (i.e., germination, growth, reproduction, and seed dispersal). Use drawings, writing, or models to communicate findings.	Level 2 M3 L3–6
L.1.2.2	Obtain, evaluate, and communicate information through labeled drawings, the life cycle (egg, larva, pupa, adult) of pollinating insects.	Level 3 M2 L17–19

L.1.3 Ecology and Interdependence

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.1.3A	Students will demonstrate an understanding of what plants need from the environment for growth and repair.	Level K M3 L4–13 Level 2 M3 L1–7, 25–29
L1.3A.1	Conduct structured investigations to make and test predictions about what plants need to live, grow, and repair including water, nutrients, sunlight, and space. Develop explanations, compare results, and report findings.	Level 1 M1 L19–20

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.1.3B	Students will demonstrate an understanding of the interdependence of flowering plants and pollinating insects.	Level 2 M3 L8–29
L1.3B.1	Identify the body parts of a pollinating insect and describe how insects use these parts to gather nectar or disburse pollen. Report findings using drawings, writing, or models.	Level 1 M1 L9 Level 2 M3 L9, 12, 14–18

L1.4 Adaptations and Diversity

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.1.4	Students will demonstrate an understanding of the ways plants adapt to their environment in order to survive.	Level 1 M1 L19–21
L.1.4.1	Explore the cause and effect relationship between plant adaptations and environmental changes.	Level 1 M1 L19–20
L.1.4.2	Describe how the different characteristics of plants help them to survive in distinct environments.	Level 1 M1 L19–21
L.1.4.3	Create a solution for an agricultural problem. Use an engineering design process to define the problem, design, construct, evaluate, and improve the solution.	Level 2 M3 L14–18

Physical Science

P.1.6 Motions, Forces, and Energy

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.1.6A	Students will demonstrate an understanding that light is required to make objects visible.	Level 1 M2 L1–9, 21–23
P.1.6A.1	Construct explanations using firsthand observations or other media to describe how reflected light makes an object visible.	Level 1 M2 L1–22
P.1.6A.2	Use evidence from observations to explain how shadows form and change with the position of the light source.	Level 1 M2 L10–12, 15–18, 21–22

P.1.6 Motions, Forces, and Energy

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.1.6B	Students will demonstrate an understanding of sound.	Level 1 M3 L1–17, 26–29
P.1.6B.1	Conduct an investigation to provide evidence that vibrations create sound and that sound can create vibrations.	Level 1 M3 L1–17, 26–29
P.1.6B.2	Create a device that uses light and/or sound to communicate over a distance. Use an engineering design process to define the problem, design, construct, evaluate, and improve the device.	Level 1 M3 L18–29

Earth and Space Science

E.1.9 Earth's Systems and Cycles

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.1.9A	Students will demonstrate an understanding of the patterns of weather by describing, recording, and analyzing weather data to answer questions about daily and seasonal weather patterns.	Level K M1 L1–11, 17–24, 28–30 Level K M4 L25
E.1.9A.1	Analyze and interpret data from observations and measurements to describe local weather conditions (including temperature, wind, and forms of precipitation).	Level K M1 L3–7, 11, 17–24, 28–30 Level K M4 L25
E.1.9A.2	Develop and use models to predict weather conditions associated with seasonal patterns and changes.	Level K M1 L1–11, 17–24, 28–30
E.1.9A.3	Construct an explanation for the general pattern of change in daily temperatures by measuring and calculating the difference between morning and afternoon temperatures.	Level K M1 L3–5, 9, 17–21
E.1.9A.4	Obtain and communicate information about severe weather conditions to explain why certain safety precautions are necessary.	Level K M1 L22–30

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.1.9B	Students will demonstrate an understanding of models (drawings or maps) to describe how water and land are distributed on Earth.	Level 2 M2 L1–2, 5–6 Level 2 M4 L1–6, 11–16, 20–21, 23–25
E.1.9B.1	Locate, classify, and describe bodies of water (oceans, rivers, lakes, and ponds) on the Earth's surface using maps, globes, or other media.	Level 2 M2 L1–2 Level 2 M4 L1–5, 10–16, 20–25
E.1.9B.2	Generate and answer questions to explain the patterns and location of frozen and liquid bodies of water on Earth using maps, globes, or other media.	Level 2 M4 L1–5, 10–16, 20–25
E.1.9B.3	With teacher guidance, plan and conduct a structured investigation to determine how the movement of water can change the shape of the land on Earth.	Level 2 M2 L5–17, 20, 22–24

E.1.10 Earth's Resources

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.1.10	Students will demonstrate an understanding of human dependence on clean and renewable water resources.	Level 5 M3 L4–5 L19–23 L24–27
E.1.10.1	Obtain and evaluate informational texts and other media to generate and answer questions about water sources and human uses of clean water.	Level 5 M3 L4–8
E.1.10.2	Communicate solutions that will reduce the impact of humans on the use and quality of water in the local environment.	Level 5 M3 L19–23
E.1.10.3	Create a device that will collect free water to meet a human need. Use an engineering design process to define the problem, design, construct, evaluate, and improve the device.	Level 5 M3 L19–23

PhD Science® Correlation to the *2018 Mississippi College- and Career-Readiness Standards (MS CCRS) for Science*: Level 2

The *PhD Science* K–2 curriculum mostly aligns with the Grade 2 *MS CCRS for Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Grade 2 Disciplinary Core Ideas, Standards, and Performance Objectives

Life Science

L.2.1 Hierarchical Organization

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.2.1	Students will demonstrate an understanding of the classification of animals based on physical characteristics.	Level 1 M1 L1–15, 27–29
L.2.1.1	Compare and sort groups of animals with backbones (vertebrates) from groups of animals without backbones (invertebrates).	Level 3 M2 L1
L.2.1.2	Classify vertebrates (mammals, fish, birds, amphibians, and reptiles) based on their physical characteristics.	Level 3 M3 L1–6
L.2.1.3	Compare and contrast physical characteristics that distinguish classes of vertebrates.	Level 3 M3 L16
L.2.1.4	Construct a scientific argument for classifying vertebrates that have unusual characteristics, such as bats, penguins, snakes, salamanders, dolphins, and duck-billed platypuses.	Level 5 M2 L8

L.2.2 Reproduction and Heredity

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.2.2	Students will demonstrate an understanding of how living things change in form as they go through the general stages of a life cycle.	Level 3 M2 L17, 19
L.2.2.1	Use observations through informational texts and other media to observe the different stages of the life cycle of trees to construct explanations and compare how trees change and grow over time.	Level 5 M2 L3–5
L.2.2.2	Construct explanations using firsthand observations or other media to describe the life cycle of an amphibian (birth, growth/development, reproduction, and death). Communicate findings.	Level 3 M3 L7

L.2.3 Ecology and Interdependence

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.2.3A	Students will demonstrate an understanding of the interdependence of living things and the environment in which they live.	Level K M4 L14–24, 26–28
L.2.3A.1	Evaluate and communicate findings from informational text or other media to describe how animals change and respond to rapid or slow changes in their environment (fire, pollution, changes in tide, availability of food/water).	Level 2 M3 L1–2, 24–29
L.2.3A.2	Construct scientific arguments to explain how animals can make major changes and minor changes to their environments. Communicate findings.	Level 2 M3 L1–2

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.2.3B	Students will demonstrate an understanding of the interdependence of living things.	Level 2 M3 L8–29
L.2.3B.1	Evaluate and communicate findings from informational text or other media to describe and to compare how animals interact with other animals and plants in the environment.	Level 1 M1 L21 Level 2 M3 L8–12, 19–29
L.2.3B.2	Conduct an investigation to find evidence where plants and animals compete or cooperate with other plants and animals for food or space. Present findings.	Level 2 M3 L8–12

L.2.4 Adaptations and Diversity

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.2.4	Students will demonstrate an understanding of the ways animals adapt to their environment in order to survive.	Level 3 M2 L18, 20–21
L.2.4.1	Evaluate and communicate findings from informational text or other media to describe how plants and animals use adaptations to survive in distinct environments.	Level 3 M3 L9–13
L.2.4.2	Create a solution exemplified by animal adaptations to solve a human problem in a specific environment. Use an engineering design process to define the problem, design, construct, evaluate, and improve the solution.	Level 1 M1 L10–15

Physical Science

P.2.5 Organization of Matter and Chemical Interactions

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.2.5	**Students will demonstrate an understanding of the properties of matter.**	Level 2 M1 L1–31 **Level 2 M4 L1–5**
P.2.5.1	**Conduct a structured investigation to collect, represent, and analyze categorical data to classify matter as solid, liquid, or gas. Report findings and describe a variety of materials according to observable physical properties.**	Level 2 M1 L1–31 **Level 2 M4 L1–5**
P.2.5.2	**Compare and measure the length of solid objects using technology and mathematical representations. Analyze and communicate findings.**	**Level 2 M1 L9**
P.2.5.3	**Compare the weight of solid objects and the volume of liquid objects. Analyze and communicate findings.**	Level 2 M1 L3–9 **Level 2 M2 L13, 29–31**
P.2.5.4	**Construct scientific arguments to support claims that some changes to matter caused by heating can be reversed, and some changes cannot be reversed.**	**Level 2 M1 L14–19, 29–31**

P.2.6 Motions, Forces, and Energy

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.2.6	Students will demonstrate an understanding of how the motion of objects is affected by pushes, pulls, and friction on an object.	Level K M2 L4–8 Level 3 M4 L1–18, 28–30
P.2.6.1	Conduct a structured investigation to collect, represent, and analyze data from observations and measurements to demonstrate the effects of pushes and pulls with different strengths and directions. Communicate findings.	Level K M2 L4–8 Level 3 M4 L1–18, 28–30
P.2.6.2	Generate and answer questions about the relationship between (1) friction and the motion of objects and (2) friction and the production of heat.	Level 3 M4 L15–18 Level 5 M2 L16
P.2.6.3	Develop a plan to change the force (push or pull) of friction to solve a human problem. Use an engineering design process to define the problem, design, construct, evaluate, and improve the plan.	Level 3 M4 L23–27

Earth and Space Science

E.2.8 Earth and the Universe

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.2.8	Students will demonstrate an understanding of the appearance, movements, and patterns of the Sun, Moon, and stars.	Level 1 M4 L1–8, 14–25
E.2.8.1	Recognize that there are many stars that can be observed in the night sky and the Sun is the Earth's closest star.	Level 1 M4 L2–6, 14–18, 23–25
E.2.8.2	With teacher guidance, observe, describe, and predict the seasonal patterns of sunrise and sunset. Collect, represent, and interpret data from internet sources to communicate findings.	Level 1 M4 L9–13, 23–25
E.2.8.3	Observe and compare the details in images of the Moon and planets using the perspective of the naked eye, telescopes, and data from space exploration.	Level 1 M4 L19–25
E.2.8.4	With teacher support, gain an understanding that scientists are humans who use observations and experiments to learn about space. Obtain information from informational text or other media about scientists who have made important discoveries about objects in space or the development of technologies.	Level 1 M4 L3, 14–21, 23–25
E.2.8.5	Use informational text and other media to observe, describe and predict the visual patterns of motion of the Sun (sunrise, sunset) and Moon (phases).	Level 1 M4 L4–13, 19–22
E.2.8.6	Create a model that will demonstrate the observable pattern of motion of the Sun or Moon. Use an engineering design process to define the problem, design, construct, evaluate, and improve the model.	Level 1 M4 L5–8, 13, 22–25

E.2.10 Earth's Resources

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.2.10	**Students will demonstrate an understanding of how humans use Earth's resources.**	Level K M3 L1–3, 9–29 **Level K M4 L1–5, 8–9, 11–16**
E.2.10.1	**Use informational text, other media, and firsthand observations to investigate, analyze and compare the properties of Earth materials (including rocks, soils, sand, and water).**	**Level 2 M2 L5–6**
E.2.10.2	**Conduct an investigation to identify and classify everyday objects that are resources from the Earth. Classify these objects as renewable and nonrenewable resources.**	**Level 4 M1 L23–24**
E.2.10.3	**Use informational text and other media to summarize and communicate how Earth materials are used.**	**Level 4 M1 L21–27**
E.2.10.4	**Use informational text, other media, and firsthand observations to investigate and communicate the process and consequences of soil erosion.**	**Level 2 M2 L1–24**
E.2.10.5	**With teacher guidance, investigate possible solutions to prevent or repair soil erosion.**	**Level 2 M2 L14–17**

PhD Science® Correlation to the *2018 Mississippi College- and Career-Readiness Standards (MS CCRS) for Science*: K–2 Condensed Science and Engineering Practices and Crosscutting Concepts

The *PhD Science* K–2 curriculum fully aligns with the K–2 Condensed Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts that accompany the MS CCRS. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Science and Engineering Practices: K–2 Condensed Practices

Asking Questions and Defining Problems	**Aligned *PhD Science* Lessons**
Ask questions based on observations to find more information about the natural and/or designed world(s).	Level K M1 L1–3, 22–26 Level K M2 L1–3, 9 Level K M3 L1–3, 14–16, 27–29 Level 1 M1 L1–3 Level 1 M2 L1–3 Level 1 M3 L1–3 Level 1 M4 L1–3, 14–16 Level 2 M1 L1–3 Level 2 M2 L1–2 Level 2 M3 L1–2 Level 2 M4 L1–3
Ask and/or identify questions that can be answered by an investigation.	Level K M1 L8–9 Level K M3 L4–8, 22 Level 2 M3 L3–6
Define a simple problem that can be solved through the development of a new or improved object or tool.	Level K M1 L4–7, 12–16 Level 1 M1 L11–15 Level 2 M3 L14–18

Developing and Using Models	Aligned *PhD Science* Lessons
Distinguish between a model and the actual object, process, and/or events the model represents.	Level K M1 L1–2, 12–16 Level K M2 L1–3, 10–12 Level 1 M1 L4–9, 18 Level 1 M3 L14 Level 2 M4 L4–6
Compare models to identify common features and differences.	Level 1 M1 L11–15 Level 1 M2 L1–3 Level 2 M4 L1–6, 20–21, 23–25
Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).	Level K M3 L1–3, 9–12, 19–20 Level K M4 L1–9, 11–16 Level 1 M1 L1–8 Level 1 M2 L1–7, 10–23 Level 1 M3 L7, 11–13 Level 1 M4 L1–3, 7–8 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
Develop a simple model based on evidence to represent a proposed object or tool.	Level K M1 L12–16 Level 1 M1 L11–15 Level 2 M3 L14–18

Planning and Carrying Out Investigations	Aligned *PhD Science* Lessons
With guidance, plan and conduct an investigation in collaboration with peers.	Level K M2 L7–8, 10–15 Level K M3 L4–8
Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.	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
Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question.	Level K M4 L3–5 Level 2 M2 L3–4, 8–12, 22–24
Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons.	Level K M1 L4–7, 10–11, 17–24, 27–30 Level K M2 L7–8, 16–23 Level K M3 L21 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 Level 2 M1 L1–3, 29–31 Level 2 M2 L1–6, 14–19 Level 2 M3 L3–6, 8–11, 13, 21–22, 25–29 Level 2 M4 L16–19
Make observations (firsthand or from media) and/or measurements of a proposed object or tool or solution to determine if it solves a problem or meets a goal.	Level K M1 L4–7, 12–20 Level K M2 L17–20 Level 1 M3 L8–9, 20–25 Level 2 M1 L20–22, 24–28 Level 2 M2 L14–17
Make predictions based on prior experiences.	Level K M2 L13–15 Level K M3 L4–8 Level 1 M3 L11–13, 15–17, 26–29 Level 1 M4 L1–3 Level 2 M1 L17–18

Analyzing and Interpreting Data	Aligned *PhD Science* Lessons
Record information (observations, thoughts, and ideas).	Level K M1 L4–7, 22–24 Level K M2 L4–6, 21–23 Level K M3 L1–3, 9–16 Level K M4 L14–16 Level 1 M1 L10 Level 2 M1 L4–7, 10–11, 14–18
Use and share pictures, drawings, and/or writings of observations.	Level K M2 L7–8 Level K M4 L1–2, 6–7, 10, 14–17, 20–24, 26–28
Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.	Level K M3 L4–8, 14–20, 22–26 Level K M4 L25 Level 1 M1 L16–21, 27–29 Level 1 M2 L1–9 Level 1 M3 L10 Level 1 M4 L4–6, 9–13 Level 2 M1 L4–11 Level 2 M2 L5–6, 8–9 Level 2 M3 L19–20 Level 2 M4 L22–25
Compare predictions (based on prior experiences) to what occurred (observable events).	Level K M4 L14–16 Level 1 M3 L11–13, 15–16, 26–29
Analyze data from tests of an object or tool to determine if it works as intended.	Level K M4 L20–24 Level 1 M3 L8–9 Level 2 M1 L20–22, 24–28 Level 2 M3 L14–18

Using Mathematics and Computational Thinking	Aligned *PhD Science* Lessons
Use counting and numbers to identify and describe patterns in the natural and designed world(s).	Level K M1 L17–21, 25–30 Level K M2 L17–20 Level 2 M4 L7–8, 20–22
Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs.	Level 2 M1 L20–22 Level 2 M3 L8–11, 23–29 Level 2 M4 L17–19
Use quantitative data to compare two alternative solutions to a problem	Level 1 M3 L21–25 Level 2 M2 L14–17

Constructing Explanations and Designing Solutions	Aligned *PhD Science* Lessons
Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.	Level K M3 L4–16, 23–29 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 Level 2 M1 L8–9, 12–13, 17–19, 23, 29–31 Level 2 M2 L3–4, 7, 13, 22–24 Level 2 M4 L23–25
Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.	Level K M2 L17–20 Level 1 M1 L11–15 Level 2 M1 L24–28
Generate and/or compare multiple solutions to a problem.	Level 1 M3 L21–25 Level 2 M2 L8–12, 14–17

Engaging in Argument from Evidence	Aligned *PhD Science* Lessons
Identify arguments that are supported by evidence.	Level K M3 L17–18 Level 1 M4 L4–8, 23–25
Distinguish between explanations that account for all gathered evidence and those that do not.	Level 1 M3 L4–6 Level 1 M4 14–18
Analyze why some evidence is relevant to a scientific question and some is not.	Level K M4 L25 Level 1 M4 L19–25 Level 2 M4 L20–21
Distinguish between opinions and evidence in one's own explanations.	Level K M3 L17–18 Level 1 M4 L9–13
Listen actively to arguments to indicate agreement or disagreement based on evidence and/or to retell the main points of the argument.	Level K M3 L17–20 Level K M4 L3–5, 11–13 Level 2 M2 L20 Level 2 M4 L4–6, 9–13, 23–25
Construct an argument with evidence to support a claim.	Level K M3 L17–21, 27–29 Level 1 M4 L9–13, 19–21 Level 2 M2 L3–4, 10–13, 21–24 Level 2 M4 L16
Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence.	Level 1 M3 L8–9, 18–20 Level 2 M3 L14–18, 21–22

Obtaining, Evaluating, and Communicating Information	Aligned *PhD Science* Lessons
Read grade-appropriate texts and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence about the natural and designed world(s).	Level K M4 L1–2, 6–10, 14–16, 18–19 Level 1 M1 L24–25 Level 1 M3 L18–19 Level 1 M4 L9–13 Level 2 M2 L1–2, 14–17
Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea.	Level 1 M4 L14–18, 23–25 Level 2 M3 L14–18
Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question and/or supporting a scientific claim.	Level K M3 L23–26 Level 2 M2 L5–6, 18–19 Level 2 M4 L4–9, 11–16, 23–25
Communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas.	Level K M1 L12–16, 28–30 Level K M2 L21–23 Level K M3 L27–29 Level K M4 L20–24, 26–28 Level 1 M1 L27–29 Level 1 M2 L21–23 Level 1 M3 L26–29 Level 1 M4 L23–25 Level 2 M1 L29–31 Level 2 M2 L22–24 Level 2 M3 L8–12, 14–20, 25–29 Level 2 M4 L23–25

Crosscutting Concepts: K–2

Patterns	**Aligned *PhD Science* Lessons**
Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence	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 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 Level 2 M1 L4–9 Level 2 M2 L1–2, 5–6 Level 2 M4 L1–8, 11–15, 20–21, 23–25

Cause and Effect: Mechanism and Explanation	**Aligned *PhD Science* Lessons**
Events have causes that generate observable patterns.	Level K M2 L4–16, 17–23 Level K M4 L3–5, 10, 14–19, 26–28 Level 1 M2 L1–7, 10–12, 15–23 Level 1 M3 L4–6, 14, 17, 26–29 Level 1 M4 L4–6, 9–13, 17–21, 23–25 Level 2 M1 L14–19, 29–31 Level 2 M2 L20–21 Level 2 M3 L8–11
Simple tests can be designed to gather evidence to support or refute student ideas about causes.	Level K M2 L10–12, 17–20 Level 1 M2 L13–14 Level 1 M3 L7, 15–16 Level 2 M1 L14–18 Level 2 M2 L8–12 Level 2 M3 L3–7

Scale, Proportion, and Quantity	Aligned *PhD Science* Lessons
Relative scales allow objects and events to be compared and described (e.g., bigger and smaller, hotter and colder, faster and slower).	Level K M1 L1–7, 10–24, 28–30 Level K M2 L7–9, 13–15, 21–23 Level K M3 L1–3 Level K M4 L25 Level 2 M1 L8–9 Level 2 M2 L18–21 Level 2 M3 L25–29 Level 2 M4 L1–6, 17–19, 22–25
Standard units are used to measure length.	Level 2 M3 L3–6, 14–18, 25–29

Systems and System Models	Aligned *PhD Science* Lessons
Objects and organisms can be described in terms of their parts.	Level 1 M1 L1–6, 16–17 Level 1 M3 L1–3, 8–10, 14, 21–29 Level 2 M1 L1–7, 12–13, 20–23, 29–31 Level 2 M2 L3–4, 7 Level 2 M3 L8–13, 19–24
Systems in the natural and designed world have parts that work together.	Level K M3 L1–3, 9–13, 19–21, 23–25, 27–29 Level K M4 L1–9, 11–16 Level 1 M1 L7–8 Level 1 M2 L1–3, 10–23 Level 1 M3 L21–25 Level 2 M2 L8–12, 14–17 Level 2 M4 L7–16, 23–25

Energy and Matter: Flows, Cycles, and Conservation	Aligned *PhD Science* Lessons
Objects may break into smaller pieces, be put together into larger pieces, or change shapes.	Level 2 M1 L10–11, 29–31 Level 2 M2 L3–4, 8–13, 22–24

Structure and Function	Aligned *PhD Science* Lessons
The shape and stability of structures of natural and designed objects are related to their function(s).	Level K M1 L10–16 Level K M4 L20–24 Level 1 M1 L4–15, 27–29 Level 1 M3 L8–9 Level 2 M1 L24–28 Level 2 M2 L14–17 Level 2 M3 L8–11, 14–22

Stability and Change	Aligned *PhD Science* Lessons
Some things stay the same while other things change.	Level K M1 L8–9, 17–21 Level 2 M2 L1–2, 22–24 Level 2 M3 L1–2, 25–29
Things may change slowly or rapidly.	Level K M4 L14–16 Level 2 M2 L18–24

PhD Science® Correlation to the *2018 Mississippi College- and Career-Readiness Standards (MS CCRS) for Science*: Level 3

The *PhD Science* 3–5 curriculum mostly aligns with the Grade 3 *MS CCRS for Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Grade 3 Disciplinary Core Ideas, Standards, and Performance Objectives

Life Science

L.3.1 Hierarchical Organization

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.3.1	Students will demonstrate an understanding of internal and external structures in plants and animals and how they relate to their growth, survival, behavior, and reproduction within an environment.	Level 4 M3 L1–6, 20, 26–31
L.3.1.1	Examine evidence to communicate information that the internal and external structures of animals function to support survival, growth, and behavior.	Level 4 M3 L1–6, 15–25
L.3.1.2	Examine evidence to communicate information that the internal and external structures of plant[s] function to support survival, growth, behavior, and reproduction.	Level 4 M3 L26–28
L.3.1.3	Obtain and communicate examples of physical features or behaviors of vertebrates and invertebrates and how these characteristics help them survive in particular environments.	Level 3 M2 L16–19 Level 3 M3 L11 Level 5 M2 L15–17

L.3.2 Reproduction and Heredity

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.3.2	Students will demonstrate an understanding that through reproduction, the survival and physical features of plants and animals are inherited traits from parent organisms but can also be influenced by the environment.	Level 3 M3 L1–6, 9–20, 26–28
L.3.2.1	Identify traits and describe how traits are passed from parent organism(s) to offspring in plants and animals.	Level 3 M3 L1–6, 14–18, 26–28
L.3.2.2	Describe and provide examples of plant and animal offspring from a single parent organism as being an exact replica with identical traits as the parent organism.	The *PhD Science* K–5 curriculum does not address single-parent organisms.
L.3.2.3	Describe and provide examples of offspring from two parent organisms as containing a combination of inherited traits from both parent organisms.	Level 3 M3 L1–6, 14–18, 26–28
L.3.2.4	Obtain and communicate data to provide evidence that plants and animals have traits inherited from both parent organisms and that variations of these traits exist in groups of similar organisms.	Level 3 M3 L1–6, 14–18, 26–28
L.3.2.5	Research to justify the concept that traits can be influenced by the environment.	Level 3 M3 L9–13, 19–20, 26–28

L.3.4 Adaptations and Diversity

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.3.4	Students will demonstrate an understanding of how adaptations allow animals to satisfy life needs and respond both physically and behaviorally to their environment.	Level 3 M2 L16–28
L.3.4.1	Obtain data from informational text to explain how changes in habitats (both those that occur naturally and those caused by organisms) can be beneficial or harmful to the organisms that live there.	Level 3 M2 L16–28
L.3.4.2	Ask questions to predict how natural or man-made changes in a habitat cause plants and animals to respond in different ways, including hibernating, migrating, responding to light, death, or extinction.	Level 3 M2 L16–28
L.3.4.3	Analyze and interpret data to explain how variations in characteristics among organisms of the same species may provide advantages in surviving, finding mates, and reproducing.	Level 3 M3 L21–28
L.3.4.4	Define and improve a solution to a problem created by environmental changes and any resulting impacts on the types of density and distribution of plant and animal populations living in the environment. Use an engineering design process to define the problem, design, construct, evaluate, and improve the environment.	Level 3 M2 L22–25
L.3.4.5	Construct scientific argument using evidence from fossils of plants and animals that lived long ago to infer the characteristics of early environments.	Level 3 M2 L1–8, 26–28

Physical Science

P.3.5 Organization of Matter and Chemical Interactions

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.3.5	Students will demonstrate an understanding of the physical properties of matter to explain why matter can change states between a solid, liquid, or gas dependent upon the addition or removal of heat.	Level 5 M1 L9–17, 23–26
P.3.5.1	Plan and conduct scientific investigations to determine how changes in heat (i.e., an increase or decrease) change matter from one state to another.	Level 5 M1 L9–17, 23–26
P.3.5.2	Develop and use models to communicate the concept that matter is made of particles too small to be seen that move freely around in space.	Level 5 M1 L5–10, 23–26
P.3.5.3	Plan and conduct investigations that particles speed up or slow down with addition or removal of heat.	Level 5 M1 L9–12

P.3.6 Motions, Forces, and Energy

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.3.6	Students will demonstrate an understanding of magnets and the effects of pushes, pulls, and friction on the motion of objects.	Level 3 M4 L1–9, 19–22, 28–30
P.3.6.1	Compare and contrast the effects of different strengths and directions of forces on the motion of an object.	Level 3 M4 L1–9, 28–30
P.3.6.2	Plan an experiment to investigate the relationship between a force applied to an object and resulting motion of the object.	Level 3 M4 L10–18, 28–30
P.3.6.3	Research and communicate information to explain how magnets are used in everyday life.	Level 3 M4 L19–22
P.3.6.4	Define and solve a simple design problem by applying scientific ideas about magnets. Use an engineering design process to define the problem, design, construct, evaluate, and improve the magnet.	Level 3 M4 L22–30

Earth and Space Science

E.3.7 Earth's Structure and History

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.3.7	Students will demonstrate an understanding of the various processes involved in the rock cycle, superposition of rock layers, and fossil formation.	Level 4 M1 L3–5
E.3.7A.1	Plan and conduct controlled scientific investigations to identify the processes involved in forming the three major types of rock, and investigate common techniques used to identify them.	Level 4 M1 L19
E.3.7A.2	Develop and use models to demonstrate the processes involved in the development of various rock formations, including superposition, and how those formations can fracture and move over time.	Level 4 M1 L1–5, 19–20, 25–27
E.3.7A.3	Ask questions to generate testable hypotheses regarding the formation and location of fossil types, including their presence in some sedimentary rock.	Level 4 M1 L1–5, 19–20

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.3.7B	Students will demonstrate an understanding of the composition of Earth and the processes which change Earth's landforms.	Level 4 M1 L18–20, 25–27
E.3.7B.1	Obtain and evaluate scientific information to describe the four major layers of Earth and the varying compositions of each layer.	Level 2 M2 L3 Level 5 M3 L10 *PhD Science* does not address Earth's Layers.
E.3.7B.2	Develop and use models to describe the characteristics of Earth's continental landforms and classify landforms as volcanoes, mountains, valleys, canyons, planes, and islands.	Level 4 M1 L18–20, 25–27
E.3.7B.3	Develop and use models of weathering, erosion, and deposition processes which explain the appearance of various Earth features.	Level 4 M1 L6–11, 25–27
E.3.7B.4	Compare and contrast constructive and destructive processes of the Earth.	Level 4 M1 L6–11, 25–27

E.3.9 Earth's Systems and Cycles

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.3.9	**Students will demonstrate an understanding of how the Earth's systems (i.e., geosphere, hydrosphere, atmosphere, and biosphere) interact in multiple ways to affect Earth's surface materials and processes.**	**Level 5 M3 L1–13, 19–27**
E.3.9.1	**Develop models to communicate the characteristics of the Earth's major systems, including the geosphere, hydrosphere, atmosphere, and biosphere.**	**Level 5 M3 L1–3, 6–13, 19–27**
E.3.9.2	**Construct explanations of how different landforms and surface features result from the location and movement of water on Earth's surface.**	**Level 5 M3 L1–13, 24–27**
E.3.9.3	**Use graphical representations to communicate the distribution of fresh water and salt water on Earth.**	**Level 5 M3 L4–5, 24–27**

E.3.10 Earth's Resources

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.3.10	Students will demonstrate an understanding that all materials, energy, and fuels that humans use are derived from natural sources.	Level 4 M1 L21–27
E.3.10.1	Identify some of Earth's resources that are used in everyday life such as water, wind, soil, forests, oil, natural gas, and minerals and classify as renewable or nonrenewable.	Level 4 M1 L21–27
E.3.10.2	Obtain and communicate information to exemplify how humans attain, use, and protect renewable and nonrenewable Earth resources.	Level 4 M1 L21–27
E.3.10.3	Use maps and historical information to identify natural resources in the state connecting (a) how resources are used for human needs and (b) how the use of those resources impacts the environment.	Level 5 M3 L17 *PhD Science* does not address Mississippi specifically.
E.3.10.4	Design a process for cleaning a polluted environment. Use an engineering design process to define the problem, design, construct, evaluate, and improve the environment.	Level 5 M3 L19–23.

PhD Science® Correlation to the *2018 Mississippi College- and Career-Readiness Standards (MS CCRS) for Science*: Level 4

The *PhD Science* 3–5 curriculum mostly aligns with the Grade 4 *MS CCRS for Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Grade 4 Disciplinary Core Ideas, Standards, and Performance Objectives

Life Science

L.4.1 Hierarchical Organization

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.4.1	Students will demonstrate an understanding of the organization, functions, and interconnections of the major human body systems.	The *PhD Science* K–5 curriculum does not address human body systems.
L.4.1.1	Use technology or other resources to research and discover general system function as they relate to human organ systems and identify organs that work together to create organ systems.	*PhD Science* does not cover this topic.
L.4.1.2	Obtain and communicate data to describe patterns that indicate the nature of relationships between human organ systems, which interact with one another to control digestion, respiration, circulation, excretion, movement, coordination, and protection from infection.	*PhD Science* does not cover this topic.
L.4.1.3	Construct models of organ systems to demonstrate both the unique function of the system and how multiple organs and organ systems work together to accomplish more complex functions.	*PhD Science* does not cover this topic.
L.4.1.4	Research and communicate how noninfectious diseases and infectious diseases serve to disrupt the function of the body system.	*PhD Science* does not cover this topic.
L.4.1.5	Using informational text, investigate how scientific fields, medical specialties, and research methods help us find new ways to maintain a healthy body and lifestyle.	*PhD Science* does not cover this topic.

L.4.2 Reproduction and Heredity

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.4.2	Students will demonstrate an understanding of life cycles, including familiar plants and animals.	Level 3 M3 L7–8, 23–28
L.4.2.1	Compare and contrast life cycles of familiar plants and animals.	Level 3 M3 L7–8
L.4.2.2	Develop and use models to explain the unique and diverse life cycles of organisms other than humans including commonalities.	Level 3 M3 L7–8, 23–28

Physical Science

P.4.6 Motions, Forces, and Energy

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.4.6	Students will demonstrate an understanding of the common sources and uses of heat and electric energy and the materials used to transfer heat and electricity.	Level 4 M2 L10–16
P.4.6A.1	Obtain and communicate information to compare how different processes (including burning, friction, and electricity) serve as sources of heat energy.	Level 4 M2 L10–11 Level 5 M2 L16
P.4.6A.2	Plan and conduct scientific investigations to classify different materials as either an insulator or conductor of electricity.	The *PhD Science* K–5 curriculum does not explicitly address conductors or insulators.
P.4.6A.3	Develop models demonstrating how heat and electrical energy can be transformed into other forms of energy.	Level 4 M2 L10–16
P.4.6A.4	Develop models that demonstrate the path of an electric current in a complete, simple circuit.	Level 4 M2 L1–3
P.4.6A.5	Use informational text and technology resources to communicate technological breakthroughs made by historical figures in electricity.	Level 4 M2 L1–3, 15–23
P.4.6A.6	Design a device that converts any form of energy from one form to another form. Use an engineering design process to define the problem, design, construct, evaluate, and improve the device.	Level 4 M2 L12–26

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.4.6B	Students will demonstrate an understanding of the properties of light as forms of energy.	Level 4 M2 L4–11, 15–16, 24–26
P.4.6B.1	Construct scientific evidence to support the claim that white light is made up of different colors. Include the work of Sir Isaac Newton to communicate results.	Level 4 M4 L9
P.4.6B.2	Obtain and communicate information to explain how the visibility of an object is related to light.	Level 4 M4 L10–13
P.4.6B.3	Develop and use models to communicate how light travels and behaves when it strikes an object, including reflection, refraction, and absorption.	Level 4 M4 L3–4, 7–8 Level 5 M4 L3
P.4.6B.4	Plan and conduct scientific investigations to explain how light behaves when it strikes transparent, translucent, and opaque materials.	Level 1 M2 L1–3, 10–23 Level 5 M4 L3

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.4.6C	Students will demonstrate an understanding of the properties of sound as a form of energy.	Level 4 M3 L10–14
P.4.6C.1	Plan and conduct scientific investigations to test how different variables affect the properties of sound (i.e., pitch and volume).	Level 4 M3 L12–4
P.4.6C.2	In relation to how sound is perceived by humans, analyze and interpret data from observations and measurements to report how changes in vibration affect the pitch and volume of sound.	Level 4 M3 L12–19
P.4.6C.3	Obtain and communicate information about scientists who pioneered in the science of sound.	The *PhD Science* K–5 curriculum does not explicitly address scientists who pioneered in the science of sound.

Earth and Space Science

E.4.9 Earth's Systems and Cycles

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.4.9A	Students will demonstrate an understanding of how the water cycle is propelled by the Sun's energy.	Level 5 M3 L6–8, 10–11
E.4.9A.1	Develop and use models to explain how the Sun's energy drives the water cycle.	Level 5 M3 L6–8, 10–11

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.4.9B	Students will demonstrate an understanding of weather and climate patterns.	Level 3 M1 L1–15, 19–20, 27–29
E.4.9B.1	Analyze and interpret data to predict changes in weather over time.	Level 3 M1 L1–15, 19–20, 27–29
E.4.9B.2	Construct explanations about regional climate differences using maps and long-term data from various regions.	Level 3 M1 L11–15, 27–29
E.4.9B.3	Design weather instruments utilized to measure weather conditions. Use an engineering design process to define the problem, design, construct, evaluate, and improve the weather instrument.	Level 3 M1 L5–7

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.4.9C	Students will demonstrate an understanding of how natural processes and human activities affect the features of Earth's landforms and oceans.	Level 4 M1 L6–11, 18–20, 25–27
E.4.9C.1	Analyze and interpret data to describe and predict how natural processes affect Earth's surface.	Level 3 M1 L21–16 Level 4 M1 L6–11, 18–20, 25–27
E.4.9C.2	Develop and use models of natural processes to explain the effect of the movement of water on the ocean shore zone, including beaches, barrier islands, estuaries, and inlets.	Level 2 M2 L8–9, 13–17 Level 3 M1 L21–16 Level 4 M3 L10–11
E.4.9C.3	Construct scientific arguments from evidence to support claims that human activities, such as conservation efforts or pollution, affect the land, oceans, and atmosphere of Earth.	Level 5 M3 L14–27
E.4.9C.4	Research and explain how systems (i.e., the atmosphere, geosphere, and/or hydrosphere), interact and support life in the biosphere.	Level 5 M3 L1–3, 6–13, 19–27
E.4.9C.5	Obtain and communicate information about severe weather phenomena to explain steps humans can take to reduce the impact of severe weather events.	Level 3 M1 L1–3, 10, 16–29

E.4.10 Earth's Resources

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.4.10	Students will demonstrate an understanding of the various sources of energy used for human needs along with their effectiveness and possible impacts.	Level 4 M1 L21–27 Level 4 M2 L1–5
E.4.10.1	Organize simple data sets to compare energy and pollution output of various traditional, nonrenewable resources (e.g. coal, crude oil, wood).	Level 4 M1 L23–24
E.4.10.2	Use technology or informational text to investigate, evaluate, and communicate various forms of clean energy generation.	Level 4 M1 L21–27 Level 4 M2 L1–5

PhD Science® Correlation to the *2018 Mississippi College- and Career-Readiness Standards (MS CCRS) for Science*: Level 5

The *PhD Science* 3–5 curriculum mostly aligns with the Grade 5 *MS CCRS for Science*. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Grade 5 Disciplinary Core Ideas, Standards, and Performance Objectives

Life Science

L.5.3 Ecology and Interdependence

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.5.3A	Students will demonstrate an understanding of photosynthesis and the transfer of energy from the Sun into chemical energy necessary for plant growth and survival.	Level 5 M2 L6–7, 18–19
L.5.3A.1	Research and communicate the basic process of photosynthesis that is used by plants to convert light energy into chemical energy that can be stored and released to fuel an organism's activities.	Level 5 M2 L6–7, 18–19
L.5.3A.2	Analyze environments that do not receive direct sunlight and devise explanations as to how photosynthesis occurs, either naturally or artificially.	Level 5 M2 L6–7, 18–19

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
L.5.3B	Students will demonstrate an understanding of a healthy ecosystem with a stable web of life and the roles of living things within a food chain and/or food web, including producers, primary and secondary consumers, and decomposers.	Level 5 M2 L1–2, 8–14, 20, 24–26
L.5.3B.1	Obtain and evaluate scientific information regarding the characteristics of different ecosystems and the organisms they support.	Level 2 M4 L7–22
L.5.3B.2	Develop and use a food chain model to classify organisms as producers, consumers, or decomposers. Trace the energy flow to explain how each group of organisms obtains energy.	Level 5 M2 L1–2, 8–14, 20, 24–26
L.5.3B.3	Design and interpret models of food webs to justify what effects the removal or the addition of a species (i.e., introduced or invasive) would have on a specific population and/or the ecosystem as a whole.	Level 5 M2 L1–2, 8–14, 20, 24–26
L.5.3B.4	Communicate scientific or technical information that explains human positions in food webs and our potential impacts on these systems.	Level 5 M2 L1–2

Physical Science

P.5.5 Organization of Matter and Chemical Interactions

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.5.5A	Students will demonstrate an understanding of the physical properties of matter.	Level 5 M1 L1–8
P.5.5A.1	Obtain and evaluate scientific information to describe basic physical properties of atoms and molecules.	The *PhD Science* K–5 curriculum does not explicitly address atoms and molecules.
P.5.5A.2	Collect, analyze, and interpret data from measurements of the physical properties of solids, liquids, and gases.	Level 5 M1 L3–4, 15–17
P.5.5A.3	Analyze matter through observations and measurements to classify materials based on their properties.	Level 5 M1 L3–4
P.5.5A.4	Make and test predictions about how the density of an object affects whether the object sinks or floats when placed in a liquid.	The *PhD Science* K–5 curriculum does not explicitly address density.
P.5.5A.5	Design a vessel that can safely transport a dense substance through water at various distances and under variable conditions. Use an engineering design process to define the problem, design, construct, evaluate, and improve the vessel.	The *PhD Science* K–5 curriculum does not explicitly address density.

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.5.5B	Students will demonstrate an understanding of mixtures and solutions.	Level 5 M1 L1–26
P.5.5B.1	Obtain and evaluate scientific information to describe what happens to the properties of substances in mixtures and solutions.	Level 5 M1 L1–2, 13–26
P.5.5B.2	Analyze and interpret data to communicate that the concentration of a solution is determined by the relative amount of solute versus solvent in various mixtures.	Level 5 M1 L13–14
P.5.5B.3	Investigate how different variables affect the rate at which a solute will dissolve.	Level 5 M1 L13–14
P.5.5B.4	Design an effective system for separating various mixtures. Use an engineering design process to define the problem, design, construct, evaluate, and improve the system.	Level 5 M1 L13–14

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.5.5C	Students will demonstrate an understanding of the difference between physical and chemical changes.	Level 5 M1 L1–2, 13–26
P.5.5C.1	Analyze and communicate the results of chemical changes that result in the formation of new materials.	Level 5 M1 L1–2, 13–26
P.5.5C.2	Analyze and communicate the results of physical changes to a substance that results in a reversible change.	Level 5 M1 L13–17,
P.5.5C.3	Analyze and interpret data to support claims that when two substances are mixed, the total weight of matter is conserved.	Level 5 M1 L15–17

P.5.6 Motions, Forces, and Energy

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
P.5.6	Students will demonstrate an understanding of the factors that affect the motion of an object through a study of Newton's Laws of Motion.	Level 3 M4 L10–14
P.5.6.1	Obtain and communicate information describing gravity's effect on an object.	Level 3 M4 L12–14 Level 5 M4 L4, 24–26
P.5.6.2	Predict the future motion of various objects based on past observation and measurement of position, direction, and speed.	Level 3 M4 L1–9, 28–30
P.5.6.3	Develop and use models to explain how the amount or type of force, both contact and noncontact, affects the motion of an object.	Level 3 M4 L10–18, 28–30
P.5.6.4	Plan and conduct scientific investigations to test the effects of balanced and unbalanced forces on the speed and/or direction of objects in motion.	Level 3 M4 L10–18, 28–30
P.5.6.5	Predict how a change of force, mass, and/or friction affects the motion of an object to convert potential energy into kinetic energy.	Level 3 M4 L7–14

Earth and Space Science

E.5.8 Earth and the Universe

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.5.8A	Students will demonstrate an understanding of the locations of objects in the universe.	Level 5 M4 L1–2, 13, 16–23
E.5.8A.1	Develop and use scaled models of Earth's solar system to demonstrate the size, composition (i.e., rock or gas), location, and order of the planets as they orbit the Sun.	Level 5 M4 L7 The *PhD Science* K–5 curriculum does not directly address planets in Earth's solar system.
E.5.8A.2	Use evidence to argue why the Sun appears brighter than other stars.	Level 5 M4 L18–19, 24–26
E.5.8A.3	Describe how constellations appear to move from Earth's perspective throughout the seasons.	Level 5 M4 L1–2, 5–17, 20–26
E.5.8A.4	Construct scientific arguments to support claims about the importance of astronomy in navigation and exploration, including the use of telescopes, compasses, and star charts.	Level 5 M4 L1–2, 7–8, 18–23

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.5.8B	Students will demonstrate an understanding of the principles that govern Moon phases, day and night, appearance of objects in the sky, and seasonal changes.	Level 5 M4 L13–23
E.5.8B.1	Analyze and interpret data from observations and research to explain patterns in the location, movement, and appearance of the Moon throughout a month and over the course of a year.	Level 5 M4 L13–17
E.5.8B.2	Develop and use a model of the Earth-Sun-Moon system to analyze the cyclic patterns of lunar phases, solar and lunar eclipses, and seasons.	Level 5 M4 L5–17
E.5.8B.3	Develop and use models to explain the factors that result in Earth's seasonal changes.	Level 5 M4 L5–12
E.5.8B.4	Obtain information and analyze how our understanding of the solar system has evolved over time.	Level 5 M4 L7–8

E.5.10 Earth's Resources

Code	Standard and Performance Objectives	Aligned *PhD Science* Lessons
E.5.10	Students will demonstrate an understanding of the effects of human interaction with Earth and how Earth's natural resources can be protected and conserved.	Level 5 M3 L14–27
E.5.10.1	Collect and organize scientific ideas that individuals and communities can use to conserve Earth's natural resources and systems.	Level 5 M3 L19–23
E.5.10.2	Design a process for better preparing communities to withstand manmade or natural disasters. Use an engineering design process to define the problem, design, construct, evaluate, and improve the disaster plan.	Level 3 M1 L21–26 Level 4 M1 L12–17

PhD Science® Correlation to the Missouri Learning Standards in Science: 3–5 Condensed Science and Engineering Practices, Progressions of Disciplinary Core Ideas, and Crosscutting Concepts

The *PhD Science* 3–5 curriculum fully aligns with the 3–5 Condensed Science and Engineering Practices, Progressions of Disciplinary Core Ideas, and Crosscutting Concepts that accompany the Missouri Learning Standards in Science. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Science and Engineering Practices: 3–5 Condensed Practices

Asking Questions and Defining Problems	**Aligned *PhD Science* Lessons**
Ask questions about what would happen if a variable is changed.	Level 4 M3 L15–19
Identify scientific (testable) and non-scientific (non-testable) questions.	Level 3 M3 L12–13 Level 3 M4 L15–16, 19–21
Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.	Level 3 M1 L1–3 Level 3 M2 L1–2 Level 3 M3 L1–3 Level 3 M4 L1–3, 7–9, 28–30 Level 4 M1 L1–2, 23 Level 4 M2 L1–3, 8–9, 11, 25–26 Level 4 M3 L1–3, 6 Level 4 M4 L1–2
Use prior knowledge to describe problems that can be solved.	Level 3 M4 L22, 29–30 Level 5 M3 L19–23
Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.	Level 3 M1 L21–26, 28–29 Level 3 M4 L23–27 Level 4 M1 L12–17 Level 4 M2 L17–23 Level 4 M4 L14–17

Developing and Using Models	Aligned *PhD Science* Lessons
Identify limitations of models.	Level 4 M4 L14–17, 26–27 Level 5 M1 L5–6 Level 5 M2 L14 Level 5 M3 L6–8, 25–27
Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.	Level 4 M2 L15–16 Level 4 M4 L3–8, 10–13 Level 5 M1 L5–6 Level 5 M2 L1–2, 6–7 Level 5 M4 L1–2, 7–8, 14–17
Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.	Level 3 M1 L1–3 Level 3 M2 L1–3, 6–8, 27–28 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 L1–2
Develop and/or use models to describe and/or predict phenomena.	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 Level 4 M1 L1–2, 26–27 Level 4 M2 L1–3, 8–9, 25–26 Level 4 M3 L1–3 Level 4 M4 L1–6
Develop a diagram or simple physical prototype to convey a proposed object, tool, or process.	Level 3 M2 L22–25 Level 3 M4 L23–27 Level 4 M4 L26–27
Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.	Level 4 M3 L7–11 Level 4 M4 L10–13, 18–24 Level 5 M3 L12–13 Level 5 M4 L9–12

Planning and Carrying Out Investigations	Aligned *PhD Science* Lessons
Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	Level 3 M4 L7–9, 15–16, 23–27, 29–30 Level 4 M1 L8–11 Level 4 M2 L6–7 Level 4 M3 L15–19 Level 4 M4 L7–8, 18–21
Evaluate appropriate methods and/or tools for collecting data.	Level 3 M3 L12–13 Level 4 M4 L7–8
Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.	Level 3 M2 L4–5 Level 3 M4 L7–18, 29–30 Level 4 M1 L6–11, 21–22 Level 4 M2 L10–14 Level 4 M3 L15–19 Level 4 M4 L9, 26–27
Make predictions about what would happen if a variable changes.	Level 3 M3 L12–13 Level 3 M4 L7–9, 15–16, 28–30 Level 5 M4 L5–6
Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.	Level 4 M4 L14–17

Analyzing and Interpreting Data	Aligned *PhD Science* Lessons
Represent data in tables and/or various graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships.	Level 3 M1 L4–12 Level 3 M3 L7–8, 27–28 Level 3 M4 L4–9 Level 5 M2 L3–5, 10–11 Level 5 M3 L4–5, 14–16 Level 5 M4 L14–15
Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.	Level 3 M1 L11–15, 19–20, 27–29 Level 3 M2 L3–8, 16–19, 27–28 Level 3 M3 L4–6, 14–18, 27–28 Level 4 M1 L12–20, 23–24, 26–27 Level 4 M2 L25–26 Level 4 M4 L10–13
Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.	Level 3 M3 L14–15, 19–20 Level 3 M4 L7–9 Level 5 M3 L14–16
Analyze data to refine a problem statement or the design of a proposed object, tool, or process.	Level 4 M4 L14–17
Use data to evaluate and refine design solutions.	Level 4 M4 L14–17

Using Mathematics and Computational Thinking	Aligned *PhD Science* Lessons
Organize simple data sets to reveal patterns that suggest relationships.	Level 3 M1 L4–12 Level 3 M2 L3, 16–19 Level 3 M3 L7–8 Level 5 M4 L25–26
Describe, measure, estimate, and/or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems.	Level 3 M3 L7–8 Level 4 M2 L8–9
Create and/or use graphs and/or charts generated from simple algorithms to compare alternative solutions to an engineering problem.	Level 4 M4 L14–17

Constructing Explanations and Designing Solutions	Aligned *PhD Science* Lessons
Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard).	Level 3 M2 L6–8 Level 3 M3 L26–28 Level 3 M4 L10–14 Level 4 M1 L6–7, 26–27 Level 4 M2 L25–26 Level 4 M3 L30–31 Level 4 M4 L18–21, 26–27
Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.	Level 3 M1 L13–15, 18 Level 3 M2 L6–8, 26–28 Level 3 M3 L9–11, 14–15, 21–28 Level 3 M4 L10–14, 19–21, 28–30 Level 4 M1 L3–5, 25–27 Level 4 M2 L4–5, 15–16, 24–26 Level 4 M3 L4–5, 24–25, 29–31 Level 4 M4 L25–27
Identify the evidence that supports particular points in an explanation.	Level 3 M2 L26–28 Level 3 M3 L26–28 Level 3 M4 L28–30 Level 4 M1 L3–5, 10, 18, 21–22, 25–27
Apply scientific ideas to solve design problems.	Level 3 M2 L22–25 Level 3 M4 L28–30 Level 4 M2 L17–23 Level 4 M4 L14–17, 26–27
Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.	Level 3 M1 L21–29 Level 3 M2 L22–25 Level 4 M1 L12–17 Level 4 M4 L14–17, 22–24

Engaging in Argument from Evidence	Aligned *PhD Science* Lessons
Compare and refine arguments based on an evaluation of the evidence presented.	Level 3 M3 L16–18 Level 4 M3 L21–23 Level 4 M4 L7–8
Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation.	Level 5 M4 L5–6
Respectfully provide and receive critiques from peers about a proposed procedure, explanation, or model by citing relevant evidence and posing specific questions.	Level 4 M3 L21–23 Level 5 M2 L3–5, 21–23, 25–26
Construct and/or support an argument with evidence, data, and/or a model.	Level 3 M2 L9–15, 27–28 Level 3 M3 L16–18 Level 4 M3 L21–23, 26–28, 30–31 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
Use data to evaluate claims about cause and effect.	Level 3 M3 L19–20 Level 3 M4 L12–14 Level 5 M4 L24–26
Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.	Level 3 M1 L21–26, 28–29 Level 3 M2 L20–21 Level 5 M3 L19–23

Obtaining, Evaluating, and Communicating Information	Aligned *PhD Science* Lessons
Read and comprehend grade-appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas and describe how they are supported by evidence.	Level 3 M2 L13–15 Level 3 M4 L22 Level 4 M1 L3–5 Level 4 M3 L30–31 Level 4 M4 L22–24 Level 5 M2 L10–11, 18–19, 25–26
Combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices.	Level 3 M2 L13–15 Level 5 M2 L6–7, 20 Level 5 M3 L25–27
Combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices.	Level 5 M4 L18–19
Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.	Level 3 M1 L11–17, 28–29 Level 4 M1 L3–5, 23–24 Level 4 M3 L4–6, 10–11, 20–23, 26–28 Level 5 M3 L9, 14–16, 19–27
Communicate scientific and/or technical information orally and/or in written formats, including various forms of media and may include tables, diagrams, and charts.	Level 3 M2 L20–21 Level 4 M1 L23–24

Disciplinary Core Ideas: 3–5 Progressions

Life Science

LS1 From Molecules to Organisms: Structures and Processes

LS1.A Structure and Function	**Aligned *PhD Science* Lessons**
Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.	Level 4 M3 L1–6, 20, 26–31
Organisms have both internal and external macroscopic structures that allow for growth, survival, behavior, and reproduction with organs that are specialized for particular body functions.	Level 4 M3 L1–6, 20, 26–31

LS1.B Growth and Development of Organisms	**Aligned *PhD Science* Lessons**
Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.	Level 3 M3 L7–8, 23–28

LS1.C Organization for Matter and Energy Flow in Organisms	**Aligned *PhD Science* Lessons**
Food provides animals with the materials they need for body repair, growth and the energy they need to maintain body warmth and for motion.	Level 5 M2 L8–9, 15–19, 24–26
Plants acquire their material for growth chiefly from air and water.	Level 5 M2 L3–5, 24–26

LS1.D Information Processing	**Aligned *PhD Science* Lessons**
Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.	Level 4 M3 L1–6, 15–25, 29–31

LS2 Ecosystems: Interactions, Energy, and Dynamics

LS2.A Interdependent Relationships in Ecosystems	**Aligned *PhD Science* Lessons**
The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants' parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.	Level 5 M2 L1–2, 8–14, 20, 24–26

LS2.B Cycles of Matter and Energy Transfer in Ecosystems	**Aligned *PhD Science* Lessons**
Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment and release waste matter (gas, liquid, or solid) back into the environment.	Level 5 M2 L6–7, 10–14, 24–26

LS2.C Ecosystem Dynamics, Functioning, and Resilience	**Aligned *PhD Science* Lessons**
When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.	Level 3 M2 L16–28

LS3 Heredity: Inheritance and Variation of Traits

LS3.A Inheritance of Traits	**Aligned *PhD Science* Lessons**
Many characteristics of organisms are inherited from their parents.	Level 3 M3 L14–18, 26–28
Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.	Level 3 M3 L9–13, 19–20, 26–28

LS3.B Variation of Traits	**Aligned *PhD Science* Lessons**
Different organisms vary in how they look and function because they have different inherited information.	Level 3 M3 L1–6, 14–18, 23–28
The environment also affects the traits that an organism develops.	Level 3 M3 L9–13, 19–20

LS4 Biological Evolution: Unity and Diversity

LS4.B Natural Selection	**Aligned *PhD Science* Lessons**
Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.	Level 3 M3 L21–28

LS4.C Adaptation	**Aligned *PhD Science* Lessons**
For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.	Level 3 M2 L1–2, 9–12, 16–19, 22–28

LS4.D Biodiversity and Humans	**Aligned *PhD Science* Lessons**
Populations live in a variety of habitats, and change in those habitats affects the organisms living there.	Level 3 M2 L16–28

Earth and Space Science

ESS1 Earth's Place in the Universe

ESS1.A The Universe and Its Stars	Aligned *PhD Science* Lessons
The Sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.	Level 5 M4 L18–19, 24–26

ESS1.B Earth and the Solar System	Aligned *PhD Science* Lessons
Patterns of seasons can be observed, described, and predicted.	Level 1 M4 L9–13, 23–25 Level 5 M4 L22–23
The orbits of Earth around the Sun and of the Moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the Sun, Moon, and stars at different times of the day, month, and year.	Level 5 M4 L1–2, 5–17, 20–26

ESS1.C The History of Planet Earth	Aligned *PhD Science* Lessons
Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.	Level 4 M1 L1–5, 19–20, 25–27

ESS2 Earth's Systems

ESS2.A Earth Materials and Systems	Aligned *PhD Science* Lessons
Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.	Level 4 M1 L6–11, 25–27
Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.	Level 5 M3 L1–13, 24–27

ESS2.B Plate Tectonics and Large-Scale System Interactions	Aligned *PhD Science* Lessons
The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth.	Level 4 M1 L18–20, 25–27

ESS2.C The Roles of Water in Earth's Surface Processes	Aligned *PhD Science* Lessons
Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.	Level 5 M3 L4–5, 24–27

ESS2.D Weather and Climate	Aligned *PhD Science* Lessons
Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.	Level 3 M1 L1–15, 19–20, 27–29
Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.	Level 3 M1 L11–15, 27–29

ESS2.E Biogeology	Aligned *PhD Science* Lessons
Living things affect the physical characteristics of their regions.	Level 4 M1 L6–11, 25–27

ESS3 Earth and Human Activity

ESS3.B Natural Hazards	**Aligned *PhD Science* Lessons**
A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.	Level 3 M1 L1–3, 16–29 Level 4 M1 L12–17, 25–27

ESS3.C Human Impacts on Earth Systems	**Aligned *PhD Science* Lessons**
Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean[s], air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.	Level 5 M3 L14–27

Physical Science

PS1 Matter and Its Interactions

PS1.A Structure and Properties of Matter	**Aligned *PhD Science* Lessons**
Predict and investigate that water can change from a liquid to a solid (freeze), and back again (melt), or from a liquid to a gas (evaporation), and back again (condensation) as the result of temperature changes.	Level 2 M1 L14–16 Level 5 M1 L9–12
Matter of any type can be subdivided into particles that are too small to see.	Level 5 M1 L5–10, 23–26
The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.	Level 5 M1 L9–17, 23–26
Measurements of a variety of properties can be used to identify materials.	Level 5 M1 L1–4, 11–17, 23–26

PS1.B Chemical Reactions	**Aligned *PhD Science* Lessons**
Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.	Level 2 M1 L14–19, 29–31
When two or more different substances are mixed, a new substance with different properties may be formed.	Level 5 M1 L1–2, 15–26
No matter what reaction or change in properties occurs, the total weight of the substances does not change.	Level 5 M1 L9–17, 23–26

PS2 Motion and Stability: Forces and Interactions

PS2.A Forces and Motion	**Aligned *PhD Science* Lessons**
Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.	Level 3 M4 L10–18, 28–30
The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.	Level 3 M4 L1–9, 28–30

PS2.B Types of Interactions	**Aligned *PhD Science* Lessons**
Objects in contact exert forces on each other.	Level 3 M4 L10–18, 28–30
The effect of unbalanced forces on an object results in a change of motion. Patterns of motion can be used to predict future motion. Some forces act through contact; some forces act even when the objects are not in contact. The gravitational force of Earth acting on an object near Earth's surface pulls that object toward Earth's center.	Level 3 M4 L10–18, 28–30 Level 5 M4 L3–4, 24–26
Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.	Level 3 M4 L19–30
The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.	Level 5 M4 L3–4, 24–26

PS3: Energy

PS3.A Definitions of Energy	Aligned *PhD Science* Lessons
The faster a given object is moving, the more energy it possesses.	Level 4 M2 L6–9, 12–16, 24–26
Energy can be moved from place to place by moving objects or through sound, light, or electric currents.	Level 4 M2 L1–3, 10–11, 15–16, 24–26

PS3.B Conservation of Energy and Energy Transfer	Aligned *PhD Science* Lessons
Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.	Level 4 M2 L1–5, 8–9, 24–26
Light also transfers energy from place to place.	Level 4 M2 L10–11, 24–26
Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.	Level 4 M2 L1–3, 10–26

PS3.C Relationships Between Energy and Forces	Aligned *PhD Science* Lessons
A simple machine can change the amount of force or distance necessary to do work.	Level 4 M2 L8–9, 24–26

PS3.D Energy in Chemical Processes and Everyday Life	Aligned *PhD Science* Lessons
The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use.	Level 4 M2 L12–14, 24–26
The energy released from food was once energy from the Sun that was captured by plants in the chemical process that forms plant matter (from air and water).	Level 5 M2 L6–7, 15–19, 24–26

PS4: Waves and Their Applications in Technologies for Information Transfer

PS4.A Wave Properties	**Aligned *PhD Science* Lessons**
Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; it does not move in the direction of the wave except when the water meets the beach.	Level 4 M3 L7–14, 29–31
Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).	Level 4 M3 L7–14, 29–31

PS4.B Electromagnetic Radiation	**Aligned *PhD Science* Lessons**
An object can be seen when light reflected from its surface enters the eyes.	Level 4 M4 L1–17, 25–27

Engineering, Technology, and the Applications of Science

ETS1: Engineering Design

ETS1.A Defining and Delimiting an Engineering Problem	**Aligned *PhD Science* Lessons**
Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.	Level 3 M1 L21–26 Level 4 M2 L17–23 Level 5 M2 L21–23

ETS1.B Developing Possible Solutions	**Aligned *PhD Science* Lessons**
Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.	Level 3 M2 L22–25 Level 4 M1 L12–17 Level 4 M4 L14–17 Level 5 M2 L21–23 Level 5 M3 L19–23
At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.	Level 3 M2 L22–25 Level 4 M1 L12–17 Level 4 M4 L14–17 Level 5 M2 L21–23 Level 5 M3 L19–23
Tests are often designed to identify failure points or difficulties, which suggest the elements of a design that need to be improved.	Level 3 M2 L22–25 Level 4 M1 L12–17 Level 4 M4 L14–17 Level 5 M2 L21–23 Level 5 M3 L19–23

ETS1.C Optimizing the Design Solution	**Aligned *PhD Science* Lessons**
Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.	Level 3 M4 L23–27 Level 4 M4 L14–17 Level 5 M1 L18–22

Crosscutting Concepts: 3–5

Patterns	Aligned *PhD Science* Lessons
Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena and designed products.	Level 3 M3 L1–8, 14–15, 27–28 Level 3 M4 L29–30 Level 4 M3 L7–9, 30–31 Level 4 M4 L22–27 Level 5 M4 L5–6, 13–17, 22–23
Patterns of change can be used to make predictions.	Level 3 M1 L11–15, 19–20, 27–29 Level 3 M3 L7–8 Level 3 M4 L1–9, 28–30 Level 4 M4 L1–2 Level 5 M4 L9–12, 20–21, 24–26
Patterns can be used as evidence to support an explanation.	Level 3 M1 L11–15, 28–29 Level 3 M2 L3–8, 13–15, 27–28 Level 3 M3 L16–18, 26–28 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 L3–4, 7–8, 14–17 Level 5 M1 L7–8 Level 5 M2 L1–5, 8–9, 15–17, 25–26 Level 5 M3 L6–9 Level 5 M4 L1–4, 7–8, 24–26

Cause and Effect	Aligned *PhD Science* Lessons
Cause and effect relationships are routinely identified, tested, and used to explain change.	Level 3 M1 L16–18, 21–26, 28–29 Level 3 M2 L9–12, 16–28 Level 3 M3 L9–13, 19–25, 27–28 Level 3 M4 L1–3, 10–30 Level 4 M1 L6–17, 19–27 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 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
Events that occur together with regularity might or might not be a cause and effect relationship.	Level 3 M1 L1–3, 27–29 Level 3 M2 L9–12 Level 4 M1 L19–20, 25–27 Level 5 M2 L20 Level 5 M3 L14–16

Scale, Proportion, and Quantity	Aligned *PhD Science* Lessons
Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods.	Level 3 M2 L1–2, 27–28 Level 3 M3 L1–3 Level 4 M1 L3–5 Level 5 M1 L23–26 Level 5 M2 L10–11 Level 5 M3 L4–5, 24–27 Level 5 M4 L18–19, 24–26
Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.	Level 3 M1 L4–10 Level 3 M3 L1–3, 14–15 Level 3 M1 L4–10 Level 3 M3 L1–3, 14–15 Level 5 M1 L3–4, 13–17, 23–26 Level 5 M3 L1–3, 10–11, 25–27

Systems and System Models	Aligned *PhD Science* Lessons
A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.	Level 4 M1 L21–24 Level 4 M2 L15–23 Level 4 M4 L14–17, 26–27 Level 5 M2 L14, 18–19, 24–26 Level 5 M3 L6–8, 19–27
A system can be described in terms of its components and their interactions.	Level 3 M1 L1–3, 16–20 Level 3 M2 L6–15, 20–28 Level 3 M3 L9–11 Level 3 M4 L1–30 Level 4 M1 L1–2, 12–17 Level 4 M2 L1–11, 24–26 Level 4 M3 L7–9, 15–19, 21–23, 26–28, 30–31 Level 4 M4 L1–6, 10–13, 18–27 Level 5 M1 L3–4, 15–17 Level 5 M2 L1–2, 6–11, 24–26 Level 5 M3 L1–9, 12–13, 19–27 Level 5 M4 L1–2, 7–26

Energy and Matter	Aligned *PhD Science* Lessons
Matter is made of particles.	Level 5 M1 L5–8, 23–26 Level 5 M2 L6–9, 14, 25–26 Level 5 M4 L3–4
Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems.	Level 5 M2 L10–11, 25–26
Energy can be transferred in various ways and between objects.	Level 4 M2 L1–3, 8–26 Level 4 M3 L10–19, 30–31 Level 5 M1 L13–14 Level 5 M2 L15–19, 24–26 Level 5 M3 L10–11

Structure and Function	Aligned *PhD Science* Lessons
Different materials have different substructures, which can sometimes be observed.	Level 3 M2 L1–3 Level 4 M3 L4–5, 20, 24–25 Level 4 M4 L7–9, 25–27
Substructures have shapes and parts that serve functions.	Level 3 M2 L9–12 Level 3 M3 L4–6, 21–28 Level 4 M3 L4–6, 29–31

Stability and Change	Aligned *PhD Science* Lessons
Change is measured in terms of differences over time and may occur at different rates.	Level 3 M1 L4–15, 27–29 Level 3 M2 L16–19 Level 3 M3 L7–8, 12–13, 19–20, 26–28 Level 4 M1 L3–11, 18–20, 25–27 Level 5 M1 L1–2, 9–12, 18–26 Level 5 M2 L12–13, 20, 25–26 Level 5 M3 L17–18 Level 5 M4 L5–6, 9–12, 24–26
Some systems appear stable, but over long periods of time will eventually change.	Level 3 M1 L8–10 Level 5 M2 L24–26 Level 5 M3 L14–16